COOPER ORNITHOLOGICAL CLUB

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Black-billed Magpie

Yellow-billed Magpie

EDITED BY

JOSEPH GRINNELL

JEAN M. LINSDALE

AND

ALDEN H. MILLER

AT THE

Museum of Vertebrate Zoology
University of California

NOTE

The publications of the Cooper Ornithological Club consist of two series— *The Condor*, which is the bi-monthly official organ, and the *Pacific Coast Avifauna*, for the accommodation of papers whose length prohibits their appearance in *The Condor*. The present publication is the twenty-fifth in the *Avifauna* series.

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INTRODUCTION

The magpies are peculiarly suitable for an intensive study because they comprise a group which possesses many distinctive features of behavior and of structure. Many races have developed, and these inhabit extensive areas in the northern hemisphere. Since the magpie, wherever it occurs, prefers to live close to man, and since it is of large size, for a passerine species, a great many detailed facts have been observed in its natural history. Much of this information has been published, but it is available only in scattered places and in several different languages. No previous attempt has been made to gather together and summarize this information.

In central California, I have had opportunity over a period of several years to make first-hand observations in the field upon the well-marked yellow-billed form, *Pica nuttallii,* and to study it in practically its entire range. An opportunity has also been afforded me to make field studies on the black-billed race, *Pica pica hudsonia,* in various localities in its range in the western United States. Availability of both these birds for natural history study has been excellent.

Natural history studies as applied to birds have many phases, and any person who undertakes them may have many aims or only one. Often the aim is merely the satisfaction of a natural curiosity or, possibly, a well-marked collector's instinct. Far too much work with birds has been only imitative or emulative. We make elaborate migration charts and locality lists primarily because other persons have done the same sort of thing.

One of the principal objectives in the present undertaking has been to assemble a picture, as complete as possible, of the life of the magpie as an avian type. Few kinds of birds, possibly none, have been observed so often or under such widely different conditions of habitat. In spite of the many observations that have been made and published concerning the magpie, this bird is actually almost unknown to present-day ornithologists, especially in America.

The factor of most weight in selecting the magpie for intensive study was the promise of opportunity to correlate general habits with structure and to contrast differing habits with structural differences of the geographic forms. It seems especially worth while to pay attention to relationships between the two American forms as they are revealed in structure and in contrasting behavior.

Concentrated attention to a few closely-related forms may lead to an improved understanding of principles of biology of birds in general. This viewpoint merits more attention than it has been given in most recent natural-history monographs. In other words the aim is not alone to give a résumé of all that is known about magpies, but in addition it is to see if this information answers any of the broader questions in avian distribution, migration, food relationships, and sociology.

A great many printed facts relating to magpies are contained in faunal lists of birds. The custom of publishing all sorts of miscellaneous information on natural history in an annotated list is nearly universal among field naturalists. Reading the resulting papers gives the impression that the writers expect the facts which they present to have considerable importance for general biology. However, there is seldom any definite expression as to just how it is expected this information will be used by future workers. Is there sufficient value in this type of faunal paper to warrant its publication? In the present undertaking it seems desirable to keep this question in mind when going over the many faunal reports with the hope of making a definite judgment as to their merit. Suggestions will be made as to what sorts of facts are most desirable in these reports.

A necessary requisite for an advance in the biology of birds is the discovery of additional methods of observation or of recording the results of watching. A favorable occasion for testing the usual practices of field work and of widening their scope is in an application of them to some one kind of bird. One product of such a study might be suggestion of new types of procedure in field observation or in handling its results.

In this study particular effort has been expended to evaluate the many phases of the life history of the magpie and the factors concerned in them, to pick out the more critical of these, and to emphasize them. In this procedure details are given because of conviction that they have more value and greater significance than would abridged and too concise statements of conclusions. If the latter proved to be unsound, then the usefulness of the whole work would be lost. Then, too, if the details are clearly and coherently stated, it seems that the proper conclusions will follow naturally, but the converse is not true.

Precaution is taken to avoid the danger of sacrificing detail of circumstances surrounding an observation in the attempt to improve readability. We have not reached a stage where the place of each item in the whole life story can be determined. Items which formerly were considered inconsequential have come to have significance because of certain discoveries in the physiology of birds. Therefore, it seems best to give references fully and to give details of some observations at the risk of making duller reading than might result from some other plan.

Another problem which demands consideration is the relative dependence to be put on quantitative and qualitative observations. It may be true that an ultimate aim may be the expression of the processes of natural history in quantitative form, but it also seems evident that such expression must rest on sound qualitative analysis. Little good can come from merely accumulating facts expressible in quantitative form because they are available, *unless* some value can be anticipated for them in interpreting the general problems of the life cycle of the animal.

Materials drawn upon for the present study belong to the following general classes, here listed in the order of my dependence upon them. (1) First-hand observations upon magpies in the field; (2) published notes on the genus *Pica*; (3) museum specimens, including skins, skeletons, eggs, and specimens in alcohol; (4) observations on captive birds.

Throughout the main report, a comparative form of presentation is followed. Under each major topic, the form *nuttallii* is treated first because my observations dealt with it more completely than with any other form. Next, as indicated by side-heads, the form *hudsonia* is considered, followed then by discussions of other kinds. This procedure seems decidedly preferable to the practice, sometimes followed, of taking up closely related races in such a manner that each account is a unit. My aim is to develop a single story of the magpie, with comparisons emphasized in their natural order.

This volume may in one sense be considered a centennial summary of our knowledge of the yellow-billed magpie and its near relatives. That bird was first formally described and named by Audubon a hundred years ago, from specimens obtained near Santa Barbara, California, by Thomas Nuttall, and ever since then it has attracted special interest from naturalists. Part of this interest has been aroused by the distinguishing yellow bill and part by the small range and supposed rarity of the bird. My own concern with magpies has extended over only the past ten years and has involved only a few aspects of their lives. The results are now presented not as a completed study but as materials of probable significance, the assembling of which

would require much time and effort by any other person who might undertake a yet more extended study of this bird. The deficiencies and imperfections in presentation will be more or less obvious, and they require no excuses.

I am indebted to many persons and institutions for information and for the privilege of studying materials. Miss Annie M. Alexander and Dr. Joseph Grinnell have made it possible to carry on studies of the nature of the present one at the California Museum of Vertebrate Zoology with a maximum of essential help and equipment and a minimum of interruption. Authorities at the Field Museum of Natural History, the Museum of Zoology of the University of Michigan, the United States National Museum, the Museum of Comparative Zoology, and the United States Bureau of Biological Survey have given me free access to specimens, records, and libraries. Bird students and others who gave me suggestions and materials are so numerous that I will not attempt to list them here. Acknowledgment is given at appropriate places in the text, and the personal names are listed in the index. Lawrence V. Compton made many photographs for me. Finally, I appreciate the approval of all those officers and members of the Cooper Ornithological Club who are responsible for the publication of this material in the Pacific Coast Avifauna series.

JEAN M. LINSDALE

March 1, 1937

TAXONOMY OF PICA

RELATION OF THE GROUP TO OTHER BIRDS

The magpies (genus *Pica*) belong to the large family of crows (Corvidae). This family contains the largest species of the order Passeriformes to which belong most of the familiar, small species of birds. The most recent attempts to arrange the families of this order place the Corvidae between the Oriolidae and the Ptilinorhynchidae. However, for a long time workers have been puzzled by the intricate relationships in this the most highly developed order of birds. For example, Ridgway (1904, p. 253) thought it was necessary to frame a diagnosis that would be applicable to American forms of Corvidae only. Among the birds of America it seems likely that the Paridae are most closely related to the Corvidae, or at least to that division of the family (Garrulinae) which includes the magpies. Ridgway was able to discover no satisfactory external character by which these two families could be separated.

Magpies form a sort of connecting link between the crows and the jays. Magpies differ from crows most in the possession of the extremely lengthened tail and shortened, rounded wings. The most distinctive structural character, setting off the genus, is the sickle-shaped, outermost primary. According to Ridgway "the genus *Pica* is most nearly related to the Palaearctic genus *Cyanopolius* Bonaparte, but differs conspicuously in the falcate first primary and style of coloration; *Cyanopolius* having only the pileum, sides of head and hindneck black, the underparts being whitish or pale vinaceous-gray, the back, scapulars, and rump light gray or vinaceous-gray, the wings and tail light grayish blue.

"The only other American genus of jays with a very long and graduated tail is *Calocitta,* of Mexico and Central America, which has uncovered nostrils, a conspicuous recurved crest, and the plumage chiefly blue."

In a general discussion of the Corvidae, Lönnberg has pointed out (1927, p. 13) that that family is represented in America by fifteen genera. About twenty-five genera represent the family in the eastern hemisphere. Four of the American genera (*Corvus, Pica, Nucifraga* and *Cractes*) are also found in the Palaearctic region. He called attention to the fact that *Pica* has two species in western North America and none extending farther south and considered it "quite natural" that the magpies had invaded North America from the Palaearctic region as had some other genera of the family. *Microcorax* is closely related to *Corvus*. Among the remaining ten American genera, four more are "represented in North America and remarkably enough these are chiefly western."

The magpies occupy nearly the whole of Europe, a small area in northwestern Africa, and parts of Asia and western North America. Diederich (1889, p. 280) has made an extensive study of the distribution of the genus *Pica*. Many details of distribution may be found in his report.

FOSSIL RECORDS OF MAGPIES

The paleontological history of the magpies—their characters, ranges, and true relationships—is almost entirely unknown. Nearly all opinions concerning these features of the birds in the past must be based upon observations of the birds as they are at present. However, a few bones have been found which extend our knowledge of the bird back at least into the Pleistocene.

Lambrecht (1933, p. 782) lists fossil remains of magpies found in the Pleistocene, in European localities as follows.

Ireland: Castlepook Cave, Edenvale and Newhall caves (Clare County, Bell).

France: Brenguez bone pits (Puel: Bull. Soc. Géol., 1837, p. 43, cited after Giebel), Lacombe-Thayac, Gourdan (Milne-Edwards).

Switzerland: Caverns in the Castle Cliffs of Birseck, in Basel, Azilien (Studer), Kalt-brunnental-Höhle (Stehlin and Studer), Ermitage, Azilien (Studer).

Belgium: Trou des Nutons, du Sureau and du Frontal (Dupont).

Monaco: Grottes de Menton (Rivière), Grimaldi and Grotte de l'Observatoire (Boule).

Italy: Abri of the caves d'Equi, Alpi Apuane (Del Campana), doubtful Grotta dei Colombi (Regalia), Buco della Volpe sopra. Ravenna (Portis), Verezzi, Ligurien (Milne-Edwards), caverne delle Arena candide (Finalmarino, Morelli and Issel), Buca dell Tasso, Alpi Apuane (Del Campana).

Portugal: Doubtful from Grotte de Furninha (Harlé).

Bohemia: Iudmirau, Sipka, Čertova dira (Čapek).

Austria: Schusterlucke (Woldřich), Mixnitz (Lambrecht).

Hungary: Puskaporos, Balla, Peskö, Bajót, Remetehegy, Pilisszántó (Lambrecht).

Corsica: Grotte di Brietta (Newton).

In North America magpie remains have been found in cave deposits of Shelter Cave, New Mexico (Howard and Miller, 1933, p. 16). This locality is outside the normal, present range of the black-billed magpie. It is not known definitely whether these remains are as old as Pleistocene.

Californian fossil remains of magpies have been identified as the yellow-billed form (*nuttallii*) in two localities. Three bones were reported by Miller (1932, p. 174) from the Pleistocene of Carpinteria. From the Rancho La Brea deposits, also Pleistocene, Los Angeles County, the same writer (1929, p. 6) considered this to be the most abundant passerine bird in the collection he studied. This locality is south of the southern boundary of the present range of the species.

SPECIES AND RACES

The most extensive recent paper which treats of the systematics of the magpies is that of Stegmann (1927). That worker had the advantage of having available hundreds of specimens from the collection of the Zoological Museum of the Academy of Russia and in the private collection of Professor P. Sushkin. Since there has been no opportunity in the present work to verify the findings of Stegmann or of any other of the contributors to the taxonomy of this group, the brief outline of the systematics of the group given here is merely offered to indicate roughly the nature of the geographic variation as it has been studied so far. Synonyms have not been worked out, because of lack of opportunity to examine the significant material. In the list which follows, the arrangement of forms is alphabetical.

Of the seventeen kinds of magpies considered here as probably valid the greatest number, ten, have the main parts or all of their ranges in Asia. Europe ranks next with four generally recognized kinds. In North America two kinds occur and in Africa one. See accompanying map (fig. 1) for approximate type localities of the various kinds of magpies.

Pica pica amurensis Stegmann

Pica pica amurensis Stegmann, Ann. Mus. Zool. Acad. Sci., URSS., 1927, p. 380.

Type locality.—Station Wjasemskaja, Ussuri-Bahn, not far from Chabarowsk, Coast Province, Siberia.

Characters.—Wing length, 200–214 mm. (av. 206); tail 262–285 mm.; bill from nostril, 25–30 mm. In the original description this race was characterized as differing from *P. p. jankowskii* in having somewhat greener color in the primaries. The tail is supposed to be pure green, without a bluish reflection, somewhat as in *P. p. bactriana,* and with the dark terminal borders on the primaries somewhat smaller than in *jankowskii.*

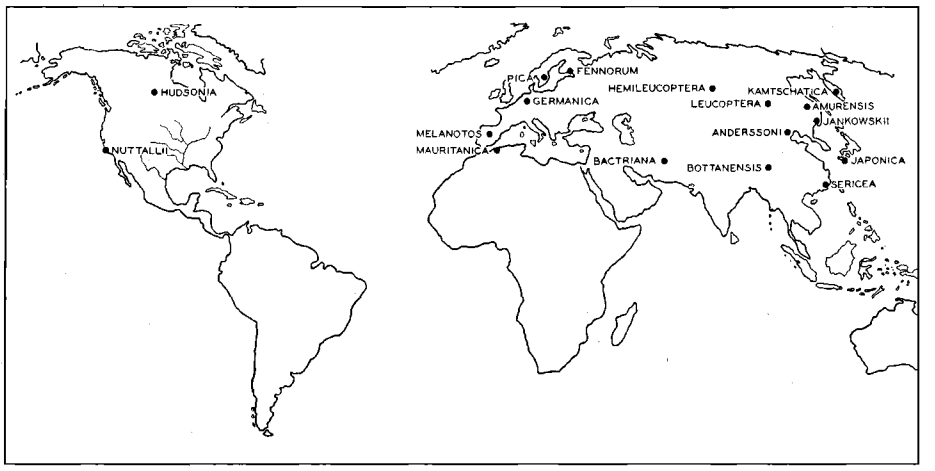


Fig. 1. Map showing approximate type localities for the kinds of magpies recognized by recent workers. Drawn by Tom Rodgers.

Range.—Near the Amur River in northern Manchuria and in the Coast Province of Siberia. Localities shown on map by Stegmann (1927) are all on south and east sides of the river.

Pica pica anderssoni Lönnberg

Pica p. anderssoni Lönnberg, Fauna och Flora, vol. 18, 1923, p. 264.

Type locality.—Huai-Lai-Hsien, Hain-Pao-an, Chihli Province, China.

Characters.—Wing length (type), 200 mm.; tail 281 mm.; culmen 30 mm.; tarsus 47 mm. This race is characterized by having a small bill and slender tarsi as well as distinctive coloration (Lönnberg, 1931, p. 8). Stegmann (1927), when he worked with the magpies, did not see representatives of this form, or rather he did not recognize them as such.

Range.—Northern China and adjoining parts of southern Mongolia westwards to the Alashan district, eastern parts of the Nan-Shan Mountains and the Etsingol district (Lönnberg, 1931, p. 8).

Pica pica bactriana Bonaparte

Pica bactriana Bonaparte, Consp. av. I, 1850, p. 383.

Type locality.—"Kandahar, Afghanistan (not 'eastern Persia', as stated by Bonaparte)." Hellmayr (1929, p. 34).

Characters.—Wing length, 188–212 mm. (av. 196); tail 260–288 mm.; tarsus, 47–50 mm. (Stegmann, 1927, p. 171). According to Stegmann this form compared with *P. p. pica* has the color on the primaries less purely blue; the last primary especially has a strongly green appearance. The tail feathers are always without bluish sheen, rather tending towards bronze color. The dark end spot on the inner web of the first primary is often lacking entirely. The dark terminal borders on the inner webs of the rest of the primaries are much smaller than in *P. p. pica.*

Color of soft parts.—"Iris dark brown; bill and legs black" (Baker, 1922, p. 38).

Range.—Molineux (1930, p. 81) outlines the range of this race as follows: eastern Russia (west to about Viatka, Kazan, and Don Cossacks Govs.), Kirghiz Steppes, Aral-Caspian region, Aral Sea, Transcaspia, western Turkestan, northern India, Afghanistan, Baluchistan, eastern and southern Persia, and Mesopotamia. Of rare occurrence in southern Russia (west to Poltava Gov.). Occurring in winter in Kizil-Kum.

Pica bottanensis Delessert

Pica bottanensis Delessert, Rev. Zool. 1840, p. 100.

Type locality.—"Bottan ou Boutan, au nord du Bengale.".

Characters.—Wing length, 239–259 mm.; tail, 270–300 mm.; tarsus, 52–59 mm. (Stegmann, 1927, p. 382). This form is the largest of all the magpies and it has a relatively short tail which is also the least sharply pointed among magpies. In several characters it is one of the most sharply set off of the whole group. No white band across the rump is found in this bird.

Stegmann considered this the most primitive of the kinds of magpies. He pointed out that the range occupied by this bird is also occupied by other primitive bird forms.

Color of soft parts.—"Iris dark brown, bill and legs black" (Baker, 1922, p. 39).

Range.—From Sikkim and Bhutan over Eastern Tibet. Toward the northeast it reaches to the Burchan-Budda Mountains, to northeastern Zaidam (Kurlyk) and the eastern Nan-Schan Mountains (Stegmann, 1927, p. 383).

Pica pica fennorum Lönnberg

Pica pica fennorum Lönnberg, Fauna och Flora, 1927, p. 109.

Type locality.—Viborg district in southeastern Finland.

Characters.—Wing length; largest male, 221 mm., largest female, 210 mm.

Range.—Molineux (1930, p. 81) gives the range of this race as northern Sweden, Finland, and possibly northern Norway and northwestern Russia.

Pica pica germanica Brehm

Pica Germanica Brehm, Handbuch Naturgesch. Vögel Deutschl., 1831, p. 177.

Type locality.—"in vielen Gegenden Mitteldeutschlands" = central Germany.

Characters.—Wing length, 175–193 mm.; tail about 222–240 mm. (Stegmann, 1927, p. 370). This form differs from the birds in northern Europe (*P. p. pica*) in having shorter wings and darker color on the rump (Gengler, 1925, p. 39). Stegmann (1927, p. 377) characterized this race as small, short-tailed, with blue primaries, the tail often with a bluish reflection. It has broad terminal borders on the primaries, and in the folded wing the tip is dark.

Range.—According to Molineux (1930, p. 81) this is the magpie found in the Channel Islands, Holland, Belgium, France, Germany, Switzerland, Austria, Czecho-Slovakia, western Poland, western Rumania, Hungary, Yugo-Slavia, western Bulgaria, Albania, Greece, Italy, and Sicily. Of accidental occurrence in Corsica.

Pica pica hemileucoptera Stegmann

Pica pica hemileucoptera Stegmann, Ann. Mus. Zool. Acad. Sci., URSS., 1927, p. 372.

Type locality.—Nishneudinsk, Siberia.

Characters.—Wing length, 192–224 mm. (av. 210); tail, 293–305 mm.; tarsus, 46–52 mm. (Stegmann, 1927, p. 372). This is a large, long-tailed form. The dark border of the primaries is always absent at the end of the first primary; it is usually broken at the end on the second and often even on the third. Toward the point of the closed wing almost equal amounts of black and white are to be seen.

Range.—Western and middle Siberia, the Altai, the Ssajan Mountains, northwestern Mongolia, eastern Turkestan.

Pica pica hudsonia (Sabine)

Corvus Hudsonius Sabine, App. Franklin, Narr. Jour. Polar Sea, 1823, p. 671.

Type locality.—Cumberland House, Saskatchewan.

Characters.—Ridgway (1904, p. 287) pointed out that this form differed from *P. p. pica* in "averaging decidedly larger; feathers of throat with setaceous shafts less developed, and with more or less concealed white spotting; white spot on inner web of first (innermost) primary averaging much smaller, rarely, if ever, occupying the edge of the web; secondaries averaging more greenish blue."

Color of soft parts.—Iris has a grayish-blue outer ring (Baird, Brewer, and Ridgway, 1874, p. 266). Ridgway (1877, p. 519) remarked that the "leaden-blue outer ring to the iris" was a constant feature of this form. Iris "brown with a conspicuous outer ring of milky white" (Brooks, 1931, p. 272).

Range.—From the Alaska Peninsula, middle Yukon, central Alberta, central Saskatchewan, and southern Manitoba south to northern Arizona and New Mexico, and from eastern Washington and the eastern slope of the Sierra Nevada to western North Dakota and New Mexico.

Pica pica jankowskii Stegmann

Pica pica jankowskii Stegmann, Ann. Mus. Zool. Acad. Sci., URSS., 1927, p. 380.

Type locality.—Sidemi near Vladivostok.

Characters.—Wing length, 194–208 mm. (av. 199); tail, 225–265 mm.; bill from nostril, 23–27 mm.; tarsus 45–54 mm. According to the describer this bird has the primaries more purely blue, with less violet reflection, than *P. p. sericea*. The tail is brighter with somewhat more green, but always with much blue.

Range.—As indicated by Stegmann this form occupies the southern tip of the Coast Province of Siberia.

Pica pica japonica Schlegel

Pica varia japonica Schlegel, Fauna Japonica, Aves, 1848, p. 81.

Type locality.—Island of Kiushu, Japan.

Characters.—Stegmann (1927, p. 380) examined five specimens from southern Japan which he considered as belonging to this race. They had a stronger violet tinge on the primaries than *P. p. sericea.* Also the wing coverts had a clearly violet tinge. The dark terminal borders of the primaries were smaller than in *P. p. sericea,* about as in *P. p. jankowskii.* The bill length, 25 to 28 mm., was between those two forms.

Range.—The Japanese island of Kiushu.

Pica pica kamtschatica Stejneger

Pica camtschatica Stejneger, Proc. Biol. Soc. Wash., vol. 2, 1884, p. 97.

Type locality.—Kamtschatka.

Characters.—Wing length, 199–219 mm. (av. 210); tail 254–288 mm. (Stegmann, 1927, p. 376). Allen (1905, p. 247) wrote of this form that it differed from the American representative "through its larger size, shorter and much thicker bill, absence of blackish apically on the primaries, and the very broad, pure white rump band . . .". He considered this bird as a full species. Stegmann (1927, p. 377) characterized it as of small size, about as in *P. p. hemileucoptera,* short tailed as *P. p. bactriana,* and very green. The dark borders on the primaries are always interrupted at the ends and they are often entirely lacking.

Range.—Eastern part of Kamtschatka and the edge of the tundra in the Anadyr River region.

Pica pica leucoptera Gould

Pica leucoptera Gould, Birds of Asia, vol. 5, 1862, pl. 55.

Type locality.—"from East Sibiria."

Characters.—Wing length, 208–230 mm. (av. 220); tail 295–331 mm.; tarsus 49–51 mm. This is the largest of all the forms of *Pica* except *bottanensis* which is often considered as a distinct species (Stegmann, 1927, p. 374). He pointed out that dark borders of the primaries were broken at least to the fifth and this feature was usually lacking entirely on the last primary.

Range.—From the southern part of Transbaikal to northeastern Mongolia and part of Manchuria.

Pica mauritanica Malherbe

Pica mauritanica Malherbe, Mém. Soc. d'Hist. Nat. Mus. de Metz, 1843, p. 7.

Type locality.—Algeria.

Characters.—Wing length, about 175 mm.; tarsus, about 45 mm. (Whitaker, 1905, p. 11). This form is markedly smaller than the one which occupies western Europe. Mayaud (1933, p. 364) has pointed out that the tail is longer relative to size of body than in the European races. This bird is characterized by having a bare patch behind the eye which is colored cobalt blue. This colored patch is present, according to Whitaker, even in young birds not yet able to fly. Also this form apparently never shows the gray on the rump, which is present in birds from Europe. The white on the remiges is least extensive on this one of any of the kinds of magpie (Mayaud, 1933, p. 372).

Color of soft parts.—Iris dark brown; bill and feet black (Whitaker, 1905, p. 11).

Range.—This bird has a limited range in northwestern Africa and is locally distributed in Tunisia, Algeria and Morocco.

Pica pica melanotos Brehm

Pica melanotos Brehm, Jour. für Ornith., vol. 6, 1858, p. 174.

Type locality.—Vicinity of Madrid and Toledo, Spain.

Characters.—Uniform black rump, occasionally with a pale patch, constitutes the main distinguishing character of this form (Witherby, 1920, p. 22).

Range.—This form occupies Spain and Portugal (Molineux, 1930, p. 81).

Pica nuttallii (Audubon)

Corvus Nutallii Audubon, Birds Amer. (folio), vol. IV, 1836 [1837?], pl. 362, fig. 1 (*C. Nuttallii* Orn. Biog., vol. IV, 1838, 450).

Type locality.—Santa Barbara, Santa Barbara County, California.

Characters.—The yellow-billed magpie resembles the black-billed race in North America in color except for its bright yellow bill and the yellow coloring on the skin, especially about the head

and the soles of the feet. In size it is considerably smaller than *P. p. hudsonia,* being almost exactly the same size as the bird in Europe according to Ridgway (1904, p. 291). Coues (1903, p. 494) calls this form "a perpetuated accident" of *hudsonia.*

Range.—California west of the Sierra Nevada, from Shasta County to Ventura and Kern counties, chiefly in the Sacramento and San Joaquin valleys and the coastal valleys south of San Francisco Bay.

Pica pica pica (Linnaeus)

Corvus Pica Linnaeus, Syst. Nat., ed. 10, 1758, p. 106.

Type locality.—"in Europa" = Sweden (Witherby, 1920, p. 21).

Characters.—Wing length (male) 187–200 mm., (female) 173–190 mm.; tail (male) 215–260 mm., (female) 205–240 mm.; tarsus (male) 47–53 mm.

Range.—Molineux (1930, p. 81) gives the range of this race as including southern Sweden, southern Norway, Denmark, eastern Prussia, Baltic Provinces, eastern Poland, central and southern Russia, eastern Rumania, Bulgaria, Asia Minor, Crimea, Caucasus, Transcaucasia, northern Persia, Cyprus, and British Isles.

Pica pica sericea Gould

Pica sericea Gould, Proc. Zool. Soc. London, 1845, p. 2.

Type locality.—Amoy, China.

Characters.—Wing length, 200–213 mm.; tail 228–244 mm.; bill from anterior border of nostril, 26–30 mm.; tarsus, 49–53 mm. (Stegmann, 1927, p. 379). This race has a relatively longer tail than the larger, more northern birds. The author cited above points out that it is of average size and is very dark. The rump band is brownish white and little expanded. The primaries are violet blue, when held in the light, reflecting purple. The tail is dark blue green. On the first primary there is always a broad terminal border and on the rest the borders are always broad, broader than in *P. p. germanica.*

Color of soft parts.—"Iris dark brown, bill and legs black" (Baker, 1922, p. 39).

Range.—Eastern China and the nearby island of Formosa. Stegmann (1927) shows records of occurrence in Fukien.

The general procedure of not tracing the history of synonyms is followed throughout this discussion, with exceptions for the two recently proposed names listed below which have raised objections from systematic workers, as indicated.

Pica pica alashanica Stegmann

Pica pica alashanica Stegmann, Ann. Mus. Zool. Acad. Sci., URSS., 1927, p. 381.

Type locality.—"der nördliche Ala-Schan" = Alashan, China.

Size.—Wing length, 197–214 mm. (av. 205); tail, 250–280 mm.; bill from nostril, 23–27 mm.

Lönnberg (1931, p. 8) has expressed his opinion that the name *alashanica* is a synonym of *anderssoni,* the latter previously described by himself.

Pica pica laubmanni Stresemann

Pica pica laubmanni Stresemann, Jour. für Ornith., vol. 76, 1928, p. 342.

Type locality.—Kelat, Baluchistan ("Balutschistan").

An opinion has been expressed by Hellmayr (1929, p. 35) that this name cannot be maintained on account of mistaken identification of some of the material used in drawing up the original description. If this analysis proves to be correct, this name becomes a synonym of *bactriana.* Ticehurst (1928, p. 118) had already arrived at the same conclusion.

DISTRIBUTION

OCCURRENCE OF THE YELLOW-BILLED MAGPIE

The yellow-billed magpie is one of the few species of North American birds whose range is entirely within the state of California. In this bird the large size and conspicuous markings make identification a simple task so that the area occupied by it can be determined with assurance and with comparatively little waste of effort. The sedentary habits of the form are helpful in classifying localities of observation; fewer detailed records of presence are needed to show residence in any neighborhood than would be required of a bird which roamed more widely or which exhibited a marked

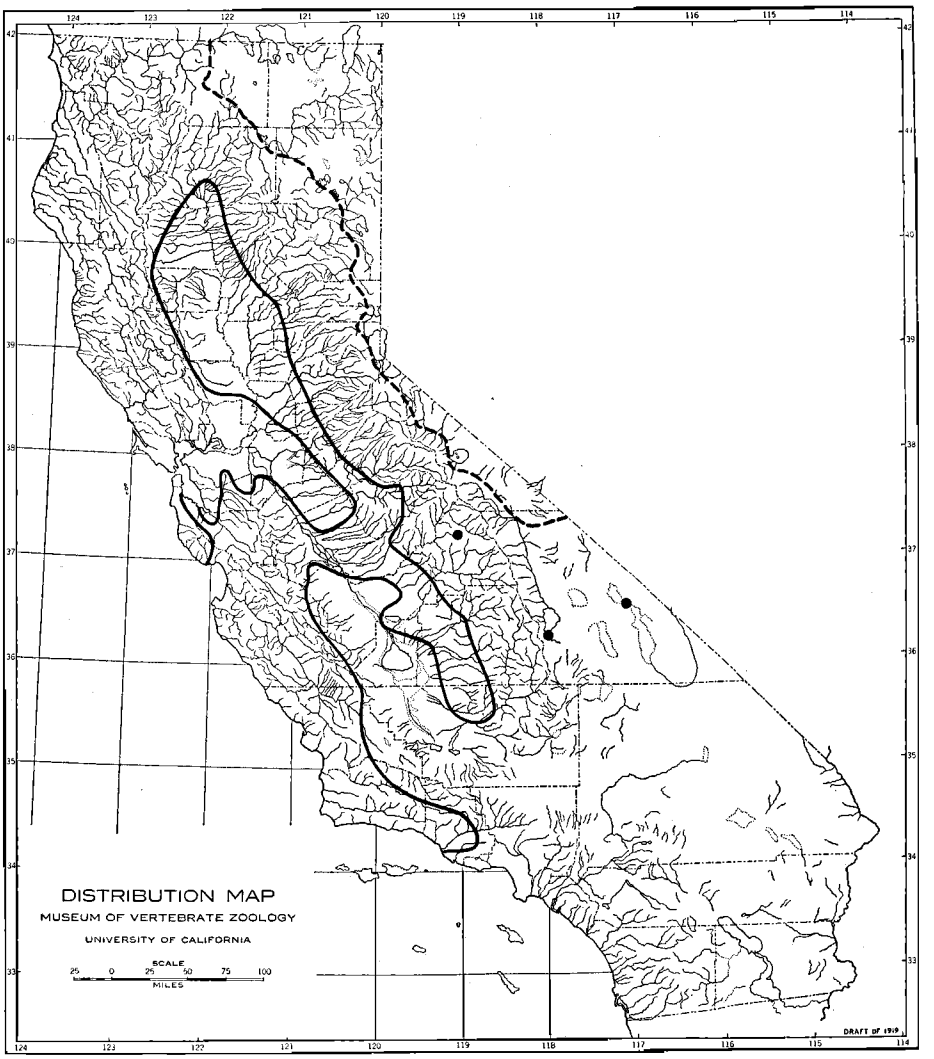


Fig. 2. Map showing extent of occurrence of the magpie in California. In general, the yellow-billed magpie occurs wherever suitable habitat occurs within the area enclosed by the heavy line. Broken line shows westward limit of black-billed magpie in California; spots represent vagrant occurrences.

migration. The small size of the total area inhabited makes it practicable to compile and to give here a rather complete definition of present day distribution and a more complete account of the bird's status within recent years than could be given for a more wide-ranging species. (See fig. 2.)

The accompanying tabulation of records shows localities known to me that are or have been inhabited by yellow-billed magpies. In certain areas where the birds occur almost continuously over a stretch of a good many miles these records fail to indicate the true distribution, but in the main they show adequately the status of this bird in California. The following supplementary remarks may be useful as aids in interpreting the table.

Beginning at the north, magpies are present in small numbers in Shasta County, at the head of the Sacramento Valley, eight miles east of Redding being the northernmost locality on record. Beginning near the northern border of Tehama County, apparently, the birds inhabit the immediate vicinity of the Sacramento River, south at least to Sacramento. West of the river, colonies are found along a few of the streams up to the base of the hills. Most of these localities are in the northern part of the valley. Over most of the west side of the valley the absence of trees prevents occurrence of this bird except as an infrequent straggler. East of the river, trees and permanent streams are more plentiful and magpies are correspondingly more numerous. In fact, for much of the area the records are too sparse to indicate the true numbers of the birds. However, there seems to be no good reason for adding more to the many record stations in the region.

It should be mentioned that there is no authentic record of a magpie in the North Coast Ranges. The mention of the species by Fisher (1900, p. 137) in a list of birds observed on Mt. St. Helena has been cited often as a record for that vicinity. (See Grinnell and Wythe, 1927, p. 100.) However, reference to the original publication reveals that the bird was not observed; its presence was only suspected.

South of the latitude of San Francisco Bay, magpies are less numerous, in the San Joaquin Valley, than north of it in the Sacramento Valley although they occur at scattered localities for the full length of the whole valley. They occur at a good many places in the Sierra Nevada foothills eastward from the San Joaquin Valley. The species is widespread through the southern Coast Ranges, reaching the coast at several places between Santa Cruz and Santa Barbara. In parts of this area, as in the Sacramento Valley, magpies are much more numerous than the records given here will indicate. In this southern part of the state marked changes have occurred in the status of magpies within the last century. The birds are now absent from many localities, mainly peripheral ones, where they formerly occurred, and they occur, sometimes commonly, in many places where they were absent or scarce when the country was first settled. Changes in agricultural practices seem to have been more important than the direct influences of man in thus changing the status of the bird in this region.

Early records for the yellow-billed magpie as far south as San Diego were possibly erroneous (see Grinnell, 1915, p. 96). The southernmost authenticated records for recent times in the coastal districts were near the southern line of Ventura County, and the species does not occur there even now. In the interior the southernmost recent record is for the vicinity of Breckenridge Mountain in northern Kern County.

One conspicuous hindrance to advance in the study of bird populations is the absence of detailed records to show the nature of former occurrence of any given kind. It would be advantageous to know for magpies just where they occurred and in how great numbers for some time in the past. Present indications are that such information

will have even greater value in the future. The usefulness of the items in this section will be realized most fully when comparison is made with similar facts after a lapse of years.

Only the Californian yellow-billed form is given extensive treatment, because it is the only one known to me in sufficient detail. Although the records assembled below do not account for all the individuals of yellow-billed magpies, they are satisfactory in showing the limits and extent of the present range. They indicate where the colonies are continuous in distribution and where discontinuous and insofar as possible numbers that have been observed at each locality. More exact determination of numbers must await some organized project for cooperative observation.

SHASTA COUNTY

Redding, 8 miles east of, on road to Pittville: 4; April 28, 1931 (D. D. McLean, verbal).
Anderson, north of: small flocks; September 13, 1898 (C. H. Merriam, Biol. Surv. notes).
Anderson: July 4, 1916 (Dawson, 1923, p. 39); 1929 (W. B. Davis, MS); 9, April 28, 1931 (D. D. McLean, verbal).

TEHAMA COUNTY

Cottonwood, north of: 15 seen; Oct. 3, 1899 (C. H. Merriam, Biol. Surv. notes).
Cottonwood: 5 eating figs from trees; September 19, 1921 (J. Dixon, MS, p. 1395).
Bloody Island (Grinnell, *et al.*, 1930, p. 299).
Jelly's Ferry (Grinnell, *et al.*, 1930, p. 299).
Red Bluff: always to be found (Townsend, 1887, p. 211); May 14, 1931 (D. D. McLean, MS).
Red Bluff, 7½ miles east of: May 14, 1931 (D. D. McLean, MS).
Paynes Creek P. O., 8 miles west of: 1 seen; December, 1905 (Gaut, Biol. Surv. notes).
Silva's (Grinnell, *et al.*, 1930, p. 299).
Cone Ranch, 4 miles southeast of Red Bluff: 6 skins in Mus. Vert. Zool.; April 22 and 23, 1911 (A. M. Alexander and L. Kellogg, MS).
Red Bluff, 10 miles south of: 15±; April 2, 1932 (J. M. Linsdale, MS).
Tehama (Grinnell, *et al.*, 1930, p. 299).
Flournoy: killed by poison, 1929 (J. M. Duncan, MS).

BUTTE COUNTY

Chico, within 4 miles south of: quite a number; January, 1929 (J. Grinnell, MS).
Chico, 5½ miles southeast of: 2; April 3, 1932 (J. M. Linsdale, MS).
Dry Creek: specimen in Mus. Vert. Zool.; June 5, 1912 (W. P. Taylor, MS).
Oroville, 1 mile south of: 15 or 20 pairs; April, 1931 (W. B. Davis, MS).
Oroville, 2½ miles south of (near Round House): 6 ±; April 3, 1932 (J. M. Linsdale, MS).
Oroville, south of: quite a number; January, 1929 (J. Grinnell, MS).
Oroville, 10 miles northwest on road to Paradise: 2, April 3, 1932 (J. M. Linsdale, MS).
Oroville, to county line on south on 99E: 60–75; April 3, 1932 (P. DuMont, MS).
Central House School, 12 miles south of Oroville: about 30 nests; April, 1931 (W. B. Davis, MS).
Palermo, ½ mile north of: about 30 nests; April, 1931 (W. B. Davis, MS).
Palermo, 5 miles south of: 50 nests; April, 1931 (W. B. Davis, MS).
Palermo, near school: 8 or 10 nests; April, 1931 (W. B. Davis, MS).
Honcut, 1½ miles east of: many; April 3, 1932 (J. M. Linsdale, MS).
Honcut, 4 miles east of: 11, April 3, 1932 (J. M. Linsdale, MS).
Honcut, 4.4 miles east of: 9; April 3, 1932 (J. M. Linsdale, MS).
Honcut, 4.7 miles east of: 17; April 3, 1932 (J. M. Linsdale, MS).
Honcut, 5.5 miles east of: 1; April 3, 1932 (J. M. Linsdale, MS).
Honcut Creek, where crossed by highway south of Oroville: 20; April 3, 1932 (P. DuMont, MS).

GLENN COUNTY

Orland, 11 miles northwest on Stony Creek: nesting colony; 1914 to 1924 (R. T. Orr, MS).
Orland, 2 miles north of: 6 or 8; March 30, 1932 (P. DuMont, MS).
Fruto: numerous killed by squirrel poison; fall, 1927.
Willows: common; January, 1894 (C. P. Streator, Biol. Surv. notes).
Glenn, 2 miles west of: several; April 1, 1932 (J. M. Linsdale, MS).

COLUSA COUNTY

Princeton: 1 specimen in Mus. Vert. Zool.; February 22, 1929 (R. Ellis, Jr.).
Princeton, ¾ mile west of: 7±; one family; May 30, 1931 (J. M. Linsdale, MS).
Princeton, 5½ miles south of: 12±; October 4, 1929 (J. M. Linsdale, MS).
Colusa, 10 miles north of: several; October 6, 1929 (J. M. Linsdale, MS).
Maxwell, 8 miles east of: 15 to 20; October 6, 1929 (J. M. Linsdale, MS).
Colusa, 3 miles northwest of: 1 specimen in Mus. Vert. Zool.; November 28, 1926 (R. Ellis, Jr.).
Colusa, ½ mile north of: several; October 6, 1929 (J. M. Linsdale, MS).
Colusa, 2 miles northeast of: 50±; October 6, 1929 (J. M. Linsdale, MS).
Colusa, 3 miles east of (east side of river): 30±; November 11, 1930 (J. M. Linsdale, MS).
Colusa, 1 mile southeast of: few; October 7, 1929 (J. M. Linsdale, MS).
Colusa, 6 miles southeast of: 15–20; October 7, 1929 (J. M. Linsdale, MS).
Sites, 1 mile west of: several nesting; June 20, 1903 (C. H. Merriam, Biol. Surv. notes).
Arbuckle, 1 mile south of: 1 on telegraph pole; May 1, 1924 (Grinnell, MS).
Arbuckle, 2 miles south of: 1 near highway; November 29, 1934 (W. I. Follett, letter, Dec. 10, 1934).
Grimes, 3½, 4½, 6½, 11, 11½, and 20 miles southeast of: October 7, 1929 (J. M. Linsdale, MS).

SUTTER COUNTY

Pennington: 3 specimens in Mus. Vert. Zool.; May 25, 1914 (H. C. Bryant).
West Butte, 3 miles north of: 1 specimen in Mus. Vert. Zool.; November 17, 1929 (J. Moffitt).
West Butte, 1 mile west of: 1 specimen in Mus. Vert. Zool.; April 15, 1912 (F. H. Holden).
West Butte, 1 mile east of: 15; July 13, 1930 (J. M. Linsdale, MS).
Meridian, 1 mile south of: 25±; November 11, 1930 (J. M. Linsdale, MS).
Meridian, 2 miles south of: 7; November 11, 1930 (J. M. Linsdale, MS).
Meridian, 3 miles south of: 25±; November 11, 1930 (J. M. Linsdale, MS).
Meridian, 4 miles south of: 30±; November 11, 1930 (J. M. Linsdale, MS).
Yuba City, 13 miles south of: 11±; February 7, 1931 (J. M. Linsdale, MS).
Tudor: observed (W. P. Hespen, verbal, April 17, 1932).
Verona, 1 mile south of: 25; April 3, 1932 (P. DuMont, MS).

YUBA COUNTY

Marysville: common, constant resident (Belding, 1879, p. 422).
Sheep dip, near Hammon City: eggs in Mus. Vert. Zool.; May 13, 1906.
Honcut Creek, to Marysville on highway 99E: 10 to 12; April 3, 1932 (P. DuMont, MS).
Browns Valley, 5 miles north of: 2; April 3, 1932 (J. M. Linsdale, MS).
Browns Valley, 4.2 miles north of: 2; April 3, 1932 (J. M. Linsdale, MS).
Browns Valley, 3.4 miles north of: 3; April 3, 1932 (J. M. Linsdale, MS).
Browns Valley, 1.3 miles north of: 2; April 3, 1932 (J. M. Linsdale, MS).
Browns Valley, 1 mile north of: 2; April 3, 1932 (J. M. Linsdale, MS).
Browns Valley, 0.4 mile south of: 1; April 3, 1932 (J. M. Linsdale, MS).
Smartsville, 6.3 miles south of: 3; April 3, 1932 (J. M. Linsdale, MS).
Smartsville, 6.6 miles south of: 5; April 3, 1932 (J. M. Linsdale, MS).
Wheatland: large flock; March, 1898 (C. P. Streator, Biol. Surv. notes).
Wheatland, 1 mile northeast of: 3; April 3, 1932 (J. M. Linsdale, MS).
Wheatland, 0.6 mile northeast of: 2; April 3, 1932 (J. M. Linsdale, MS).

YOLO COUNTY

Dunnigan, 3½ and 4 miles north: single birds; November 29, 1934 (W. I. Follett, letter, Dec. 10, 1934).
Dunnigan: 2; October 24, 1923 (Stoner, 1924, p. 23).
Knights Landing, Grand Island, 2 miles north of: 12 or 15; May 21, 1912 (Taylor, MS, p. 1496).
Woodland, 10 miles northeast of: 4; February 7, 1931 (J. M. Linsdale, MS).
Woodland, 5½ miles north of: 2; February 7, 1931 (J. M. Linsdale, MS).
Woodland, 4 miles north of: July 12, 1930 (J. M. Linsdale, MS).
Woodland, 3½ miles north of: 2; February 16, 1930 (J. M. Linsdale, MS).
Woodland, 6½ miles east of: 3; April 1, 1932 (J. M. Linsdale, MS).

SACRAMENTO COUNTY

Elk Grove, 3½ miles from: common in small flocks; November 8, 1907 (C. H. Merriam, Biol. Surv. notes).

Sacramento, 8 miles northwest on Sacramento River: April 3, 1932 (P. DuMont, MS, 1932).
Sacramento, 7.7 miles northeast on Auburn Road; 1 on golf course; May 15, 1933 (J. M. Linsdale, MS).
Sacramento, Haggins Ranch, 5 miles north of: 29 sets eggs in Mus. Vert. Zool.; about 1890.
Benali, 2 to 10 miles east of: seen at intervals; August 20, 1907 (C. H. Merriam, Biol. Surv. notes).
Sacramento, outskirts of city (Ridgway, 1877, p. 519).
Sacramento: seen from train (Wheelock, 1904, p. 388).
Perkins, 1 to 3 miles east of: 2 near highway; June 28, 1930 (J. M. Linsdale, MS).
Folsom City: 1 specimen in Field Museum; April 27, 1897 (E. M. Nutting).
Slough House: several; February 28, 1931 (J. M. Linsdale, MS).
Folsom, Willow Creek near: 1; October 22, 1904 (C. H. Merriam, Biol. Surv. notes).
Folsom, Alder Creek 2 miles above: 12 to 15; December 4, 1904 (C. H. Merriam, Biol. Surv. notes).
Slough House, 1 mile southeast of: 2; February 28, 1931 (J. M. Linsdale, MS).
Bridgehouse: 12 or more seen; October 24, 1906 (C. H. Merriam, Biol. Surv. notes); poisoned on ranch; April, 1925 (J. D. Granless, MS).
Franklin, and 2 miles south: 3 seen; November 21, 1936 (J. M. Linsdale, MS).

SAN JOAQUIN COUNTY

Woodbridge, 2 miles west of: heard in oaks; November 28, 1929 (A. H. Miller, MS).
Tracy, 6 miles northwest of: 3 or 4 in vineyard; May 16, 1931 (R. T. Orr, MS).
Banta: formerly common, now absent (Bryant, 1890, p. 290).
Ellis: formerly common, now absent (Bryant, 1890, p. 290).
Clements: flock of 20; August 26, 1903 (C. H. Merriam, Biol, Surv. notes); 1; September 14, 1905 (C. H. Merriam, Biol. Surv. notes).
Wallace, 2 miles west of: 4; July 25, 1935 (C. H. Feltes, letter August 21, 1935).
Lockeford, Mokelumne River: 1; September 14, 1905 (C. H. Merriam, Biol. Surv. notes).
Bellota, 1 and 6 miles east of: 10 and 8; July 23 and 24, 1935 (C. H. Feltes, letter August 21, 1935).

STANISLAUS COUNTY

La Grange, 1½ to 2 miles southeast of: colony; April, 1931 (D. D. McLean, verbal).
Tuolumne River, 4 miles southwest of La Grange: 2 in oak by road; March 1, 1921 (J. Dixon, MS).
Grayson: common in 1878, nearly exterminated by 1890 (Bryant, 1890, p. 290).
Crow's Landing, along road to San Joaquin River: many; February 23, 1930 (J. M. Linsdale, MS).
Crow's Landing, east of on San Joaquin River: common; November 29, 1929 (A. H. Miller, MS).
Crow's Landing, southeast on Orestimba Creek: 20±; March 9, 1930 (J. M. Linsdale, MS).
Newman, 5 miles northeast of, mouth Merced River: 2, March 9, 1930 (J. M. Linsdale, MS).
Newman, 4 miles northeast of: several; April 18, 1932 (J. M. Linsdale, MS).
Newman, 2 miles north of: 2; April 18, 1932 (J. M. Linsdale, MS).
Newman, just north of city limits: 10±; February 23, 1930 (J. M. Linsdale, MS).
Newman, 2 miles south of: 2; March 8, 1930 (J. M. Linsdale, MS).

SAN MATEO COUNTY

San Bruno: June, 1850 (Bryant, 1890, p. 290); none since 1870 (Bryant, 1890, p. 290).
Redwood City, near slaughter house: nesting colony; 1860 to 1868 (C. Littlejohn, verbal, March 5, 1931).

ALAMEDA COUNTY

Oakland: 1 in winter, probably an escaped one (Belding, 1890, p. 108).
Pleasanton, hills near: 40±; 1920 and 1921 (Grinnell and Wythe, 1927, p. 100).
Sunolglen, Niles Cañon: 1 specimen in Mus. Vert. Zool.; June 6, 1901 (M. P. Anderson).
Calaveras Creek, 3½ miles southwest Sunol: 25±; March 29 1930 (J. M. Linsdale, MS).
Mocho: eggs in Mus. Vert. Zool.; June 2, 1904.
Tesla Cañon, at foot of Tesla Pass: 4; June 16, 1929 (H. de Fremery, MS).
Tesla Pass, in hills 1 mile south summit: 2; February 16, 1930 (H. de Fremery, MS).
Indian Creek, 6 miles southwest Sunol: 25±; November 13, 1932 (J. M. Linsdale, MS).

SANTA CLARA COUNTY

Mission Peak, Wool Ranch on south side: colony; February, 1931 (C. C. Cummings, verbal, February 21, 1931).
Calaveras Valley: regularly (Grinnell and Wythe, 1927, p. 100); single occupied nest; April 3, 1910 (Carriger and Ray, 1911, p. 73).
Berryessa: eggs in Mus. Vert. Zool.; April 7 and 20, 1896 (R. H. Beck).

Hall's Valley: nests; February 21, 1931 (J. M. Linsdale, MS).
San Jose: previous to 1858 (Grinnell and Wythe, 1927, p. 100).
San Jose, 5 miles southeast of: 8; 1920 (Grinnell and Wythe, 1927, p. 100).
Silver Creek Hills, southeast of San Jose: noted frequently; 1928 (G. Pickwell, MS).
San Jose, 15 miles southeast of: 8, many nests; May 10, 1929 (J. M. Linsdale, MS).
Arroyo Calero: 34; July 12, 1930 (G. Pickwell, MS).
Coyote, 2½ miles southwest of: 50±; March 23, 1930 (J. M. Linsdale, MS).
Coyote, 4½ miles southwest of: 2; March 23, 1930 (J. M. Linsdale, MS).
Llagas School, 2 miles north of: 3; March 23, 1930 (J. M. Linsdale, MS).
Llagas School, on stream below school-house: large colony; May 11, 1929 (J. M. Linsdale, MS).
Madrone, 3 miles east on Coyote Creek: 20±; April 13, 1930 (J. M. Linsdale, MS).
Morgan Hill: 2, skins in Mus. Vert. Zool.; March 16, 1925 (G. W. Lane).
Gilroy: formerly common, now absent (Bryant, 1890, p. 290).
Gilroy, 3 miles south on Sargent lease: 50; March, 1932 (E. E. Horn, verbal, March 7, 1932).
Sargent: (Barlow, 1895, p. 20); November 28, 1930 (A. H. Miller, MS).
Gilroy, 5 miles southeast on M. L. Reis farm: 8; February 23, 1930 (J. M. Linsdale, MS).
Gilroy, 8 miles southeast of: 10±; February 23, 1930 (J. M. Linsdale, MS).
Gilroy, 9 miles southeast of: several; February 23, 1930 (J. M. Linsdale, MS).
Gilroy, 16 miles southeast of: 4; February 23, 1930 (J. M. Linsdale, MS).

SANTA CRUZ COUNTY

Santa Cruz: few, seen by C. L. Anderson; about 1870 (McGregor, 1901, p. 11).
Watsonville: 1 shot; September 27, 1903 (Hunter, 1904, p. 24).
Chittenden: 5 or 6; February 16, 1928 (W. E. Unglish, MS).

SAN BENITO COUNTY

San Juan Rocks: colony near (W. E. Unglish, MS).
San Benito Store, San Benito Valley: 1; September, 1902 (L. J. Goldman, Biol. Surv. notes).
San Benito River (W. E. Unglish, MS).
Pinnacles P. O., 4 or 5 miles north of: colony; November 29, 1932 (D. D. McLean, verbal, 1932).
Paicines: formerly very abundant, now limited to a few pairs (Mailliard, 1901, p. 124).
Paicines, O. P. Hodges Ranch: killed by squirrel poison (O. P. Hodges, MS, October 24, 1930).
Paicines, ½ mile east: 25±; July 9, 1936 (J. M. Linsdale, MS).
Hernandez: 1 specimen in Mus. Vert. Zool.; September 3, 1908 (J. Rowley).
Topo Valley: pair; November, 1907 (E. A. Goldman, Biol. Surv. notes).
Tres Pinos Creek, above Emmett: February 7, 1932 (Grinnell, MS); 25±; November 30, 1929 (A. H. Miller, MS).
Quien Sabe Ranch, east of Tres Pinos: nesting colony; April, 1931 (D. D. McLean, verbal, April, 1931).
Mercy Hot Springs, 10 miles northwest of: 180±; September 14, 1932 (D. D. McLean, verbal, October 13, 1932).
Llanada: flock near road; July 9, 1936 (J. M. Linsdale, MS).
Panoche, 6 miles northwest of: colony; February, 1931 (D. D. McLean, verbal, April, 1931).
Panoche Pass, ½ mile east of divide: February 7, 1932 (J. Grinnell, MS).

MONTEREY COUNTY

San Juan Rocks: nesting colony (W. E. Unglish, MS).
Monterey, within six miles: only two or three pairs (Cooper, 1875, p. 198).
Monterey, near top of ridge south of: 4 seen along highway; November 27, 1934 (J. M. Linsdale, MS).
Carmel Mission: 1; October 10, 1904 (C. H. Merriam, Biol. Surv. notes).
Carmel Mission, 200 yards from: 1; November 29, 1930 (A. H. Miller, MS).
Point Lobos Reserve: noted 9 times; 1934–1935 (J. M. Linsdale, MS).
Notley's Landing, 1 or 2 miles north of: 1 each day, close to coast; June and August 7, 1933 (J. F. Ashley, verbal, August 15, 1933).
Big Sur River: noted in winter (Pemberton and Carriger, 1915, p. 198).
Big Sur P. O., 5 miles south of: 1; ½ mile from beach in rough brushy country (W. E. Unglish, MS).
Big Sur, 4 miles south of: common on coast (L. O. Williams, verbal, Nov. 27, 1934).
Partington Cañon, Stevens Ranch near coast: used to be common, now rarely seen; 1906 (Jenkins, 1906, p. 127).

Jamesburg, 2 miles northeast of: colony; May 14, 1933 (E. M. Fisher, verbal, July 20, 1933).
San Ardo, within 10 miles south: several; November 17, 1918 (R. Hunt, MS, p. 248).
Greenfield, near: several; December 26, 1932 (D. D. McLean, verbal, 1933).
Arroyo Seco, mouth of cañon west of Greenfield: July 21, 1919 (R. Hunt, MS, p. 336).
Soledad, by bridge on Salinas River above: 2; August 11, 1902 (C. H. Merriam, Biol. Surv. notes).
San Antonio Creek, in upper valley: common; May 18 (Pemberton and Carriger, 1915, p. 198).
Peach Tree Valley, San Lorenzo Creek, 1475 feet: 15±; November, 1918 (R. Hunt, MS, p. 259).
Jolon: 6; October 19, 1918 (J. Grinnell, MS, p. 1682).
Milpitas, 20 miles north of Jolon: flock of 30±; August 25, 1902 (C. H. Merriam, Biol. Surv. notes).
Parkfield, 1 mile north of: 6; April 30, 1935 (C. H. Feltes, letter August 21, 1935).
Bryson, within 5 miles north: scattered groups; early September, 1936 (W. C. Russell, MS).

SAN LUIS OBISPO COUNTY

San Miguel: 1 specimen coll. San Diego Soc. Nat. Hist.; March 15, 1894 (F. Stephens).
Cholame, 5 or 6 miles south of: nesting colony; 1932 (F. Truesdale, verbal, April 26, 1932).
Shandon, 10 miles northeast near Cholame: 20 killed by squirrel poison; March, 1928 (F. Truesdale, MS, October 27, 1930).
Paso Robles: nest and seven eggs taken; March 15, 1894 (F. Stephens, Biol. Surv. notes).
Paso Robles, 6 miles west of: colony nesting; 1932 (F. Truesdale, verbal, April 26, 1932).
Creston, about 10 miles south of: flock; August 8, 1931 (S. B. Benson, MS).
Atascadero, 10 miles west of: colony nesting; 1932 (F. Truesdale, verbal, April 26, 1932).
Santa Margarita, east of on road to Pozo: largest colony in vicinity; 1932 (F. Truesdale, verbal, April 26, 1932).
Santa Margarita, 5 miles east of: 24 to 36 seen in 15 mile stretch; May 14, 1932 (L. Huey, MS, June 1, 1932).
Santa Margarita, in hills south of town: abundant; 1911 (H. S. Swarth, MS).
San Luis Obispo, La Panza to: October 28 and November 3 (Fisher, 1893, p. 68).
San Luis Obispo: 5 specimens in Dickey coll.; April 26, 1913 (A. B. Howell) and December 16, 1921 (A. J. van Rossem).

SANTA BARBARA COUNTY

Los Alamos: specimen in Dickey coll.; July 29, 1913 (C. C. Lamb).
Santa Ynez River, south to but not beyond (Fisher, 1893, p. 68).
Alamo Pintado Valley, 2 to 6 miles above Los Olivos: flock; September-October, 1911 (V. Bailey, Biol. Surv. notes).
Road between Zaca Station and Los Alamos: young seen August 3, 1936 (E. Rett, MS, 1936).
Los Olivos: April 8, 1913 and August 8, 1915 (A. B. Howell).
La Laguna, 5 miles northeast of Los Olivos: large colony breeds; seen annually since 1923 (E. Rett, MS, 1936).
Santa Ynez Valley, San Marcos Ranch, 10 miles west of Los Prietos: flock, 12±; July, 1911 (N. Dearborn, Biol. Surv. notes).
Santa Ynez: November 1, 1922 (H. H. Sheldon).
Happy Cañon, northeast of Santa Ynez: breeding colony, birds collected May, August, and September, 1934 (E. Rett).
Buellton, 4 miles north on highway at divide: large flock; September, 1932 (D. D. McLean, verbal, October 13, 1932).
Buellton, 5 miles south Nojoqui Creek at Gaviota Pass: 3 skins in A. H. Miller coll.; November 27, 28 and 29, 1924 (A. H. Miller).
Zaca Creek, near Buellton: 5 eggs; April 11, 1925 (Peyton Bros., MS).
Alisal Ranch, Solvang: breeding colony; seen annually (E. Rett, MS, 1936).
Nojoqui, at foot of Las Cruces Grade: 2; May 14 and 27, 1932 (L. Huey, letter June 1, 1932).
San Marcos Ranch, 15 miles northwest of Santa Barbara: nesting colony; seen annually (E. Rett, MS, 1936).
Gaviota, near: 2 or 3; spring 1935 and Feb. 7, 1937 (R. Bond, verbal, Feb. 22, 1937).
Santa Barbara, immediate neighborhood: abundant; before 1847 (Gambel, 1847, p. 46).
Santa Barbara: numerous in April and May (Cooper, 1870, p. 295).
Santa Barbara, near: 6 eggs; April 10, 1887 (Davie, 1889, p. 258).

VENTURA COUNTY

Cañada Larga, between Ventura and Ojai: reported by ranch hands and cowboys (M. C. Badger, MS).

Aliso Cañon: 8 eggs, April 9, 1911, no birds since; 1915 (Peyton Bros., April 25, 1932); 1 skin in Dickey coll.; November 28, 1915 (A. J. van Rossem); 1 many times from 1915 to 1919 (Badger, MS, May 22, 1932).
Santa Paula, Wheeler Cañon: always abundant (Evermann, 1886, p. 181).
Aliso Cañon, near Wheeler Cañon: small colony; 1908 (Willett, 1908, p. 67).
Fillmore, on Peyton Ranch: one seen many years ago (S. Peyton, verbal, April 25, 1932).
Santa Susana, at Eddie Maier Ranch: 2 nests; April 18, 1914 (J. S. Appleton, MS, 1931).
Simi Valley, 7 miles north of Los Angeles County line: 1; 1908 (Willett, 1908, p. 67).

LOS ANGELES COUNTY

Conejo Valley, on Los Angeles County line, Los Angeles County: common in early 80's, none in 1908 (Willett, 1908, p. 67).
Chatsworth Lake: 1; October 26, 1925 (Schneider, 1926, p. 69).

NEVADA COUNTY

Penn Valley: rarely found above, common in lower valleys (Richards, 1924, p. 101).

PLACER COUNTY

Lincoln, Auburn Ravine and Coon Creek: breeding (Adams, 1909, p. 9).
Lincoln, 4.1 miles northwest of: 2; April 3, 1932 (J. M. Linsdale, MS).
Lincoln, 3.7 miles northwest of: 8; April 3, 1932 (J. M. Linsdale, MS).
Clipper Gap: single birds noted; April and September (Adams, 1909, p. 9).

ELDORADO COUNTY

Folsom, toward Placerville: very abundant, many nests (Ray, 1905, p. 364).
Latrobe, short distance west: noted from train (Barlow and Price, 1901, p. 167).

AMADOR COUNTY

Plymouth, slaughter house 1 mile from: favorite feeding ground (N. E. Sharp, verbal, December 13, 1930).
Drytown: 1 skin in Mus. Vert. Zool.; May 4, 1896 (C. D. Kaeding).
Drytown, 7 miles below: 1 skin in Mus. Vert. Zool.; February 8, 1895 (C. D. Kaeding).
Drytown, 3 miles below: 1 skin in Mus. Vert. Zool.; March 15, 1896 (C. D. Kaeding).
Jackson Valley: common among oaks; August 21, 1907 (C. H. Merriam, Biol. Surv. notes).
Carbondale, 1½ miles southeast of: 2; December 13, 1930 (J. M. Linsdale, MS).
Buena Vista, ½ mile south of: 1; September 14, 1905 (C. H. Merriam, Biol. Surv. notes).
Carbondale, 0.8 mile southeast of: 7; December 13, 1930 (J. M. Linsdale, MS).
Carbondale, 4.8 miles east of: 1; December 13, 1930 (J. M. Linsdale, MS).
Ione: several; September 30, 1905 and October 22–23, 1906 (C. H. Merriam, Biol. Surv. notes).
Ione, 2.6 to 2.9 miles northwest of: 25±; December 13, 1930 (J. M. Linsdale, MS).
Ione, 1.6 miles northwest of: 1; December 13, 1930 (J. M. Linsdale, MS).
Ione, 4 miles southwest of: 4; December 13, 1930 (J. M. Linsdale, MS).
Ione, 5.9 miles southwest of: 3; December 13, 1930 (J. M. Linsdale, MS).
Ione, 7 miles southwest of: 2; December 13, 1930 (J. M. Linsdale, MS).
Martell, 2 miles west of: 1; September 30, 1905 (C. H. Merriam, Biol. Surv. notes).

CALAVERAS COUNTY

Camanche: observed there (J. E. Warman, verbal, April 17, 1932).
Valley Spring: few; March, 1890 (Bryant, 1890, p. 290).
Valley Springs, about 10 miles west on highway: 2; December 25, 1930 (M. W. Wythe, MS); 12±; December 28, 1930 (M. W. Wythe, MS).
Jenny Lind: colony formerly; 1914 (J. G. Tyler, verbal, December 9, 1930).
Knight's Ferry, north of, between Church's Springs and Copperopolis: common in oaks since September; 1930 (J. H. Collins, verbal).
Salt Springs Valley, altitude about 1200 feet, between Milton and Murphy's: December 22, 1877 (Belding, 1879, p. 422).
Salt Springs Valley, Reservoir: 12± nesting colony; April 17, 1932 (J. E. Warman, verbal, April 17, 1932).
Milton: 1; April, 1894 (C. P. Streator, Biol. Surv. notes).

TUOLUMNE COUNTY

Quinn, north of: 2 colonies (D. D. McLean, verbal, 1929).

MARIPOSA COUNTY

Hornitos: colony near; about 1908 (D. D. McLean, verbal, 1929).
Hornitos, Peterson Ranch, 2 miles east of: 22± colony nesting in valley oaks; April 10, 1932 (A. E. Borell, 1932, p. 193).
Mt. Bullion: one seen once (D. D. McLean, verbal, 1929).
Yosemite Valley: 2; September 5, 1931 and November 8, 1931 (C. W. Michael, MS).

MERCED COUNTY

Irwin, 5 miles southwest of: about 100; August 18, 1935 (C. H. Feltes, letter August 21, 1935).
Stevinson, within 3 miles north and west of: about 15; September 15, 1934 (C. H. Feltes, letter December 9, 1934).
Howard Ranch, 14 miles north San Luis Ranch: colony (E. E. Horn, verbal, March 7, 1932).
Pacheco Pass, 2 or 3 miles east of summit: 4; June 28, 1930 (G. Pickwell, MS).
Pacheco Pass, near highway east of summit: several; September 8, 1930 (S. B. Benson, MS).
San Luis Ranch, 10 miles northeast of Los Banos: 4; March 21, 1911 (H. S. Swarth, MS).
Gustine, 3½ miles south of: 4±; April 18, 1932 (J. M. Linsdale, MS).
Los Banos, 5 miles northeast of (north of Duck Refuge): 1; February 23, 1931 (J. M. Linsdale, MS).
Merced River, near mouth: colony; August 8, 1929 (A. H. Miller, MS).
Livingston, between and Merced River: 1; August 10, 1934 (J. R. Arnold, MS).
Hopeton, Cowell Ranch: 2 in oaks; March 5, 1920 (J. Dixon, MS, p. 1142).
Hopeton, 5 or 6 miles west on Merced River (Buckley, verbal, December 12, 1930).
Sweeney's Ranch, 1 mile south of: 3 or 4; March 16, 1931 (E. L. Sumner, Jr., MS).

MADERA COUNTY

San Joaquin River, 5 or 6 miles northeast of Firebaugh, Fresno Co.: 20; December, 1930 (H. E. Black, verbal, December 12, 1930).
Cottonwood Creek, 10 miles west of Friant: "less than 6 pairs whole length of creek" (Tyler, 1913, p. 65).

FRESNO COUNTY

Letcher, near fig orchard: "small colony nearly gone" (Tyler, 1913, p. 65).
Riverview: "observed once" (Tyler, 1913, p. 65).
Laton: "reported from"; before 1900 (Tyler, 1913, p. 65).
Elkhorn Station, 2 miles out of: 2; July, 1918 (R. Hunt, MS, p. 189).
Fresno, 15 miles south of: sometimes occur (J. G. Tyler, verbal, December 9, 1930).
Alcalde, Waltham Cañon: 1; May, 1894 (McLellan, Biol. Surv. notes).
Waltham Cañon, 1100 feet: 1 specimen; April 7, 1934 (J. R. Arnold, MS).

KINGS COUNTY

Lemoore, north of: colony (J. G. Tyler, verbal, December 9, 1930).
Lemoore: several nests, birds wild; February-March, 1895 (McLellan, Biol. Surv. notes).
Lemoore, 4½ miles northwest of: 1; April 19, 1932 (J. M. Linsdale, MS).
Lemoore, 5 miles southwest of: colony, specimens taken; October 26, 1929 (A. E. Culbertson, MS).
Hanford, 2 miles west of E. W. Smalley Ranch and 4 or 5 miles north at cemetery: nesting colony (Mrs. E. W. Smalley, verbal, April 19, 1932).

TULARE COUNTY

Lucerne Valley: few breeding; before 1885 (Lillie, 1888, p. 177).
Visalia: common; July 3, 1893 (Van Denburgh, 1898, p. 212); several; July 23 (Fisher, 1893, p. 68).
Visalia, along route from there to Three Rivers: July 25 (Fisher, 1893, p. 68).
Lemon Cove, near: 2 along river; October 7, 1902 (C. H. Merriam, Biol. Surv. notes).
Cottage P. O.: common; September 17 (Fisher, 1893, p. 68).
Summit Lake: few nesting among valley oaks, 1 specimen; June 25 (Goldman, 1908, p. 204).

KERN COUNTY

Breckenridge Mt., ½ way up, on Rock Springs Road: 3; February, 1932 (D. D. McLean, verbal, October 13, 1932).

STATUS OF THE BLACK-BILLED MAGPIE IN UNITED STATES

The black-billed magpie (*Pica pica hudsonia*) is a common resident bird in the sparsely settled western states. No attempt is made here to recite details of occurrence

of the bird over its range, but rather, a brief statement is given to show the status for each state in which the bird is known to have occurred (see fig. 3). Of course, ideally, it would be better to give the occurrence of the species in terms of the natural physio-

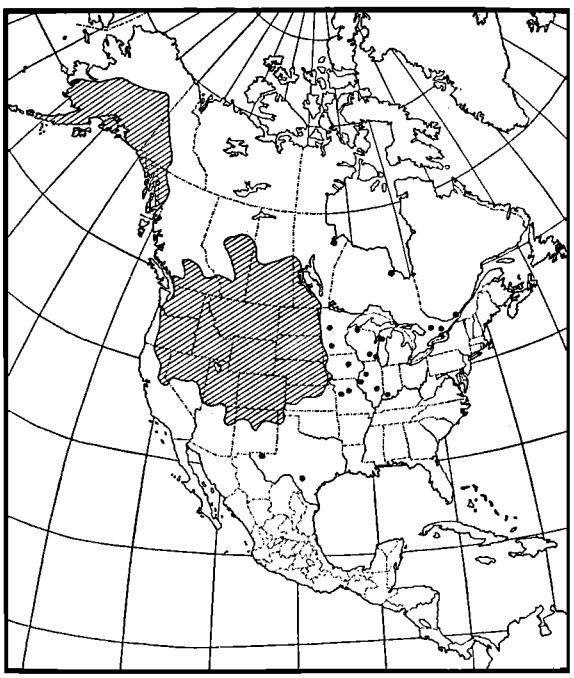


Fig. 3. Map showing range of the black-billed magpie (*Pica pica hudsonia*) in North America. From Kalmbach (1927, p. 3).

graphic regions and to ignore the relatively artificial political units, but the latter units are the ones most familiarly known to people interested in birds. The deficiency here suggested is partly compensated for in the discussion of the habitat of the magpie.

Washington.—The magpie occupies nearly the whole area of the state, eastward from the eastern slope of the Cascades. In winter a few individuals move through the mountains toward the coast, but this movement is not at all well-marked.

Oregon.—Practically the same statement applies to Oregon as to Washington, for here too the species is a common resident east of the Cascades, but it is an infrequent winter visitant to the coastal portion of the state. In their "Birds of the Portland Area, Oregon" Jewett and Gabrielson (1929, p. 28) state that this eastern-Oregon species occasionally straggles down the Columbia to that section. They record occurrences at Taylor's ranch on the Columbia River, December 26, 1900; Government Island, January 8, 1903, and November 14, 1908; near Kelley Butte, April 3, 1924; on the Columbia River bottoms, October 12, 1924. Jewett (1927, p. 46) mentions a magpie killed on November 7, 1926, at Bachelor Island, Clark County.

California.—Common resident in the Modoc region northward and eastward from the Sierran divide, west along the northern border of the state as far as Shasta Valley. Resides south along the eastern margin of the state through the Tahoe district as far as Independence, Inyo County. Recorded in winter at Death Valley.

Detailed records for each county are shown in the list which follows.

Siskiyou County

Lower Klamath Lake: common in the brushy and scantily timbered hills (Ferry, 1908, p. 41).

Bray, Orr Lake: 2 seen; June 2 (Mailliard, 1923, p. 15).

Pickard: common; September 26 to October 2, 1905 (Ferry, Biol. Surv. notes).
Shasta Valley, east side near Sheep Rock: one seen; September 29, 1898 (Merriam, 1899, p. 118).

Shasta County
Fort Crook: specimens taken by Feilner (Townsend, 1887, p. 210).
Fall River Mills: one seen; December 11, 1933 (D. D. McLean, conv.).

Modoc County
Goose Lake, Willow Creek near: two seen; August 7, 1896 (Merriam, Biol. Surv. notes).
Alturas: found abundantly about; in August, 1898 (McGregor, 1899, p. 78).
Surprise Valley: half a dozen seen; in August, 1894 (Stephens, Biol. Surv. notes).

Lassen County
McDonald Peak: several seen; January 11 to March 15, 1915 (Holt, Biol. Surv. notes).
Merrillville five miles north of Fredonyer Peak, Petes Valley, Eagle Lake at Spalding's, near Horse Lake, Secret Valley, Dransfield's, and Jones' (Grinnell, *et al.*, 1930, p. 298).
Bieber: common; September 10 to 22, 1904 (Hollister, Biol. Surv. notes).
Buntingville: one seen five miles south; June 18, 1906 (Bunnell, Biol. Surv. notes).

Plumas County
Sierra Valley: several; June, 1885 (Belding, 1890, p. 107).
Beckwith Pass: nest observed along road east of (Ray, 1901, p. 116).

Sierra County
Loyalton: pair seen; June 8 (Mailliard, 1919, p. 75).

Placer County
Summit: rare (Adams, 1909, p. 9).
Lake Tahoe: recorded from (Adams, 1909, p. 9).

Eldorado County
Tallac: one seen (Chapman, 1908, p. 306).
Meyer's Station: reported common during fall of 1901 (Barlow and Price, 1901, p. 167).
Rowlands: common; numerous nests in June (Ray, 1903, p. 185).
Bijou: three old nests found (Ray, 1910, p. 132).

Alpine County
Markleeville, West Carson River: several; August 18, 1900 (Bailey, Biol. Surv. notes).
Carson River: noted; August 18, 1900, and October 22, 1902 (Merriam, Biol. Surv. notes).
East slope: several seen (Belding, 1890, p. 107).

Fresno County
Florence Lake, Big Creek: one stayed during winter 1932–33 (Mrs. Lila M. Lofberg, letter, January 16, 1933).

Mono County
Walker River: noted; October 22, 1902 (Merriam, Biol. Surv. notes).
Mono Lake: common resident (Grinnell and Storer, 1924, p. 376).
Leavitt Meadows, West Walker Creek: several; August 29, 1900 (Merriam, Biol. Surv. notes).

Inyo County
Death Valley, near Furnace Creek Ranch: invasion; December, 1919 (Grinnell, 1923, p. 74); noted daily; late October, 1933 (Grinnell, 1934, p. 68); noted from October, 1933 to February 13, 1934 (Gilman, 1935, p. 241).
Laws: nesting, 1916 (Grinnell and Storer, 1924, p. 377).
Olancha: two or three seen; December 27 and 28, 1933 (A. H. Miller, MS).

Idaho.—Idaho lies entirely within the range of the magpie. The bird occurs in this state wherever a suitable habitat is found. Merriam (1891, p. 99) wrote of the species that it is "one of the most abundant and conspicuous birds of Idaho, occurring throughout the sage plains and valleys and extending up into the lower part of the Douglas fir zone."

Nevada.—The magpie is a common and characteristic bird of the whole state of Nevada except for the extreme southern portion, south of the line of 37° parallel. Occurs normally wherever there are trees, but has been driven out of some valleys by shooting and by poisoning.

Montana.—The magpie is an abundant permanent resident throughout the state according to Saunders (1921, p. 94). He comments that this bird breeds in the Transition life zone and rarely in the evergreens in the foothills of the mountains, but that it is not found in the mountains in the breeding season above the Transition zone. All observers mention the abundance of this species in every part of the state. With the first cold weather and snow-storms in the fall, usually in October, there is a movement of this species into the mountains, sometimes to an altitude of 8000 or 9000 feet.

Utah.—The magpie is one of the most characteristic and abundant birds of Utah, especially in the northern portion of the state. Toward the southern border there are fewer records of occurrence and these are chiefly in the winter. Tanner (1927, p. 198) wrote that the species is "occasionally seen about St. George in the winter." He has collected specimens from north of Santa Clara. Both these localities are in the southwestern corner of the state, in Washington County. Fisher (1893, p. 68) reported three individuals seen by Vernon Bailey on December 31, 1888, ten miles east of Toquerville. This species was not seen in the territory covered by the Death Valley Expedition of 1891.

Arizona.—Status given by Swarth (1914, p. 45) as follows. "Secured by Kennerly (1856, p. 10) on the Little Colorado River. Recorded by Henshaw (1874, p. 123) from the Rio Puerco, at a point sixty miles west of Wingate, New Mexico, and hence well within the Arizona boundary. Not otherwise recorded from the state." Recently the observation of several magpies along the south rim of the cañon in Grand Cañon National Park has been recorded by Clyde Searl (Grand Cañon Nature Notes, vol. 4, no. 11, Aug. 31, 1930, p. 8).

Wyoming.—The magpie is common in Wyoming below an altitude of 8000 feet and is occasionally seen above that level. The bird usually lives near a ranch or settlement but is seldom seen near the towns. According to Knight (1902, p. 104), all collectors of birds in this state have noticed the magpie.

Colorado.—The magpie is a common resident in Colorado. Along the eastern margin of the state the species is sparse, especially in summer, but it becomes more common westwardly. From the foothills through the mountains, below an 8000-foot altitude, the species is very common and characteristic. According to Cooke (1897, p. 89) a few breed as high as 11,000 feet and winter up to 9000 feet.

New Mexico.—The status and seasonal occurrence of the magpie have been given for many localities in New Mexico by Mrs. Bailey (1928, p. 481). These records show the magpie to be common in summer at many places in the northern third of the state. In winter it occurs south at least to the center of the state. In this state the magpie extends its range farther south, both in summer and winter, than in any other part of the United States.

Texas.—According to Oberholser (1918, p. 415) the magpie wanders in winter south to central western Texas. McCall (1851, p. 217) reported that "one pair of these birds was seen near Turkey Creek, in Western Texas, early in November, in the latitude of about 29° 15′. . . . A storm from the North had been prevailing on the plains for three days, and had no doubt brought them with it from the upper country."

North Dakota.—A summary of the published records of occurrence of the magpie in North Dakota is given by Wood (1923, p. 54). Several additional records are supplied by that writer, along with the information that the species has "become more common in the eastern part of the state since 1911." He also comments upon the magpies that "it is probable that they range as far east as the Red River" which forms the eastern boundary of the state.

South Dakota.—Over and Thoms (1921, p. 104) write of the magpie in this state, that it "is more or less common along the Missouri River and westward . . . where it is an annual resident. It strays eastward sometimes during the winter. Specimens have been taken at Vermillion in December and January."

Nebraska.—The magpie has always been fairly numerous in the western, and especially the northwestern, part of Nebraska. Swenk and Dawson reported (1921, p. 196) that "ordinarily the magpie does not move eastward in the fall beyond the 100th meridian, except along the northern border of Nebraska, and records of its occurrence east of the 98th meridian are few, usually not more than once every few years. The present fall of 1921, however, has brought these birds in unusual numbers into eastern, and even southeastern Nebraska." Four magpies were observed, October 10, 1919, near Gresham, York County, in the eastern part of the state (Mickel and Dawson, 1920, p. 75).

Kansas.—Reported as nesting in May, 1925, along the Arkansas River, two miles east of the Colorado-Kansas line, in Hamilton County (Linsdale, 1926, p. 179); also noted by same observer (1927, p. 55) at this locality July 11 and 12, 1921. Bunker (1913, p. 150) gives the magpie as a rare winter visitant in western Kansas. Goss (1886, p. 35) states that this species was found nesting in Graham County in the summer of 1873 or 1874 by a Mr. Jeff Jordan. The birds were not seen after 1875. There is at least one record of the occurrence in winter of the magpie in the northeastern corner of the state, January, 1922, in Doniphan County (Linsdale, 1928, p. 555).

Oklahoma.—Magpies have been resident in Cimarron County in the extreme northwestern corner of the state since 1919. This bird nested on the Brookhart ranch in 1919 and each year

afterwards, at least until 1927, and on the Hamm ranch in 1927. The species has been seen occasionally at Gate. Up to 1931 there was no record of a specimen collected in the state (Nice, 1931, p. 126). Sutton (1934, p. 31) found magpies in the vicinity of Kenton, and he obtained four specimens in 1932 and 1933.

Minnesota.—Although this state lies outside the normal breeding range of the magpie there are a good many records of the presence of single individuals or small groups there in winter. The report by Roberts (1922, p. 46) of at least thirty-four individual magpies being seen at nine separate localities in the southern portion of Minnesota shows the extent in one direction of the great movement of this species in the fall of 1921. These records extend entirely across the southern part of the state. They numbered more than half the total for this bird for all previous years. The following year (1922) there were only two records for magpies in Minnesota and these were near the western border (Roberts, 1923, p. 198).

Roberts (1932, p. 66) lists the following counties where magpies have been reported: Rock, Pipestone, Lincoln, Big Stone, Clay, Polk, Marshall, Roseau, Otter Tail, Douglas, Redwood, Lake of the Woods, Martin, Meeker, Blue Earth, McLeod, Morrison, Crow Wing, Mille Lacs, Sherburne, La Sueur, Rice, Goodhue, Pine, and Hennepin. All records are between September and February 11.

Iowa.—Anderson (1907, p. 294) wrote that "there have been no records of the Magpie in Iowa during recent years, and if any are taken they must be considered only as accidental stragglers from the northwest. In the early days the occurrence of the Magpie in the state was not uncommon."

Within recent years there have been numerous records of the occurrence of magpies in winter in Iowa. These have been summarized by DuMont (1933, p. 98).

Wisconsin.—On November 25, 1921, a magpie was seen near River Falls, Pierce County, Wisconsin. This county is on the western boundary of the state (Stevens, 1922, p. 51). Occurrence of the magpie at Bailey's Harbor, on November 15, 1849, and in Dunn County, in February, 1884, was reported by Oberholser (1918, p. 415).

Missouri.—It was reported by Harris (1922, p. 103) on the authority of Charles E. Dankers, of Corning, Missouri, that fifty magpies were under observation all through the winter of 1921–22, in the northwestern corner of Holt County. Other records, cited by Oberholser (1918, p. 415) are as follows: Corning, April 23, 1911; Saline County, November 1, 1890. Recently, Bennitt (1932, p. 45) reported a sight record by J. M. Peeler, November 12, 1927, near Kirksville, Adair County. Charles W. Tindall reported to the Biological Survey (letter) that he had a magpie killed there on December 5, 1925.

Michigan.—Recent records of the magpie in Michigan are lacking. However, Barrows (1912, p. 411) concluded that "there can be little doubt that it is, or formerly was, found occasionally in winter in the northern parts of the state, particularly in the Upper Peninsula." A definite occurrence cited by him is as follows: Eagle River, Kaweenaw County, in winter of 1856–57.

Illinois.—The statement by Kennicott in 1854 that the magpie was "not uncommon in winter" in Cook County, Illinois, has been the basis for mention of this species as a part of the avifauna of that state. Oberholser (1918, p. 415) reported occurrence of magpies at Chicago on October 17, 1892 (first reported by Dunn, 1895, p. 395) and Knoxville on May 16, 1896.

Hess (1914, p. 402) reported that "on April 26, 1914, the first American magpie recorded in Illinois since 1892, was being harassed by a half-dozen crows in a hedge on the S. S. Love estate, two miles east of Philo. His white markings and strange cries and chatterings made of him a conspicuous object. All other Illinois records are winter ones, and this visit was all the stranger because of its occurring east of central Illinois."

An actual capture of a magpie in Illinois was reported by Coale (1919, p. 113). This bird was an adult male "taken November 10, 1918, by Mr. J. Cropley, who saw two strange birds in a ravine at Lake Forest, one of which seemed to be crippled. He caught it and kept it alive for two or three days, when it died. About half the upper mandible was missing, evidently from an old wound."

Indiana.—A single individual magpie was reported by Chansler (1910, p. 210) as seen passing the winter a few miles north of Bicknell, Knox County. It kept around outbuildings, feed lots and slaughter pens and fed on offal. It was seen on December 24, 1907, and also February 10, 1908. So far as I am aware, this is the first record for the species for this State.

Maryland.—There is one report of the occurrence of a magpie in Maryland, at Point Lookout. Ball and Court (1931, p. 604) have recorded the observation of a single individual there on June 28, 1931. The observers were unable to determine whether this bird was a true straggler, far from the range of the species, or an escape from captivity.

CLIMATE AND MAGPIES

Analysis of distributional control of vertebrates has long been a fascinating subject, but it has always been difficult to determine what kinds of limitation are really significant or how they may work. This has been true especially in the case of those composite factors which come under the head of climate. In recent years, the use of graphs to demonstrate the relation of climate to the area occupied by various kinds of animals and to adjustments in their life cycles has proved especially valuable.

These graphs have been called hythergraphs when they show for definite localities the mean temperatures and precipitation by months. The temperature and precipitation for each month are plotted on coordinate paper. The irregular figure made by connecting the points for all the months is characteristic for a given locality, and it may be used as a basis for comparison with other localities with respect to these climatic factors. In the same way other pairs of climatic factors may be represented.

In general it is assumed in this work that an area where a species is abundant has a climate favorable for it. The graphs often show that areas of dense populations of a given species have similar climates. Further, it appears that critical periods of the life history, such as those associated with the time of reproduction, determine the suitability of the climate. Hence, we would expect an animal to be more closely restricted by climatic factors near the time of reproduction than at other times of the year.

The whole method is summarized by Uvarov (1932, p. 309) in the statement that "the actual comparison is made between the polygons representing the climates, and the differences, or similarities, noticed are then discussed from the point of view of their probable importance in the life-history" of the animal. He proposes a modification of the ordinary type of graph by making the lines connecting the monthly points serve to represent stages in the life of the animal during the interval. The method was used by Steggerda (1929, p. 337) in analyzing the relation of domestic fowls to climate. Shelford (1929, pp. 16–26) has given a lengthy discussion of the subject.

In the present application of this method emphasis is placed on the yellow-billed magpie because of the completeness of the information concerning localities of its occurrence. The bird occupies a small area which is entirely within the state of California. Limits of this range geographically are well known. Numerous Weather Bureau stations within this area furnish many records for analysis and comparison with records from other regions.

Records for the black-billed magpie are not quite so complete as for the Californian species, but they are more extensive and cover a much larger proportion of the continent. Both localities of occurrence and climatological data are considered sufficiently complete for analysis and comparison.

More specifically, the materials here dealt with are locality records of magpie occurrence and records from Climatological Data, a serial publication of the United States Department of Agriculture, Weather Bureau. Some of the topics which may be examined by such means are suggested by the following questions.

Do all localities inhabited by the species possess a similar climate?

Does the similarity, if present, extend to all ranges of all members of the genus?

Are all the factors composing the climate effective upon the bird?

What time of year is climate most effective?

What part of the bird's annual cycle of activity is affected?

Is the influence upon the bird direct or is it effective indirectly through vegetation or food supply?

A composite graph (fig. 4) was made by plotting the monthly average tempera-

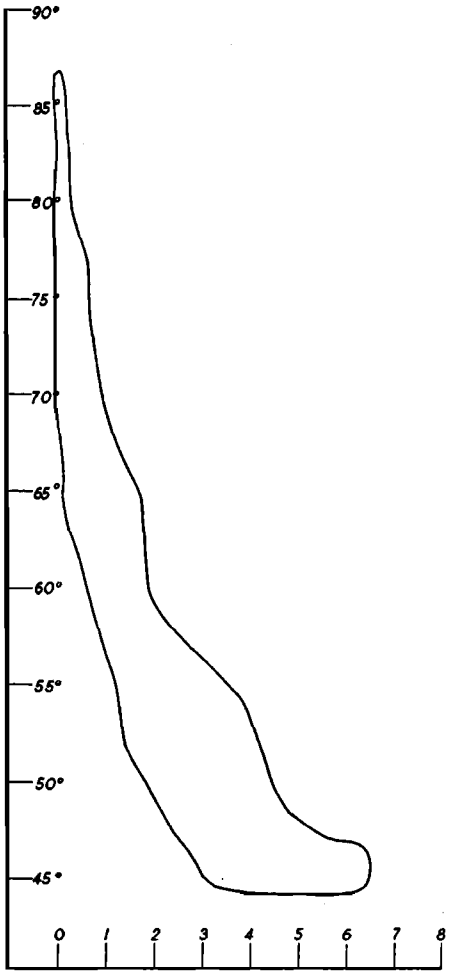


Fig. 4. Composite hythergraph for eleven stations in the Sacramento Valley, California (Chico, Colusa, Davis, Durham, Marysville, Orland, Oroville, Palermo, Red Bluff, Sacramento, Wheatland). Temperature is represented in degrees Fahrenheit, precipitation in inches. The solid line includes all points representing values for every month at each station.

tures in Fahrenheit and monthly precipitation in inches for the following eleven stations in the Sacramento Valley, California: Chico, Colusa, Davis, Durham, Marysville, Orland, Oroville, Palermo, Red Bluff, Sacramento, and Wheatland.

All of these places are in the northern part of the range of the yellow-billed magpie, and all of them are close to actual nesting sites of that bird. Careful examination of the detailed records represented and the graphs for the separate stations shows that the climate is uniform within narrow limits over the whole area represented.

Next, comparison may be made with stations near the actual limits of the bird's

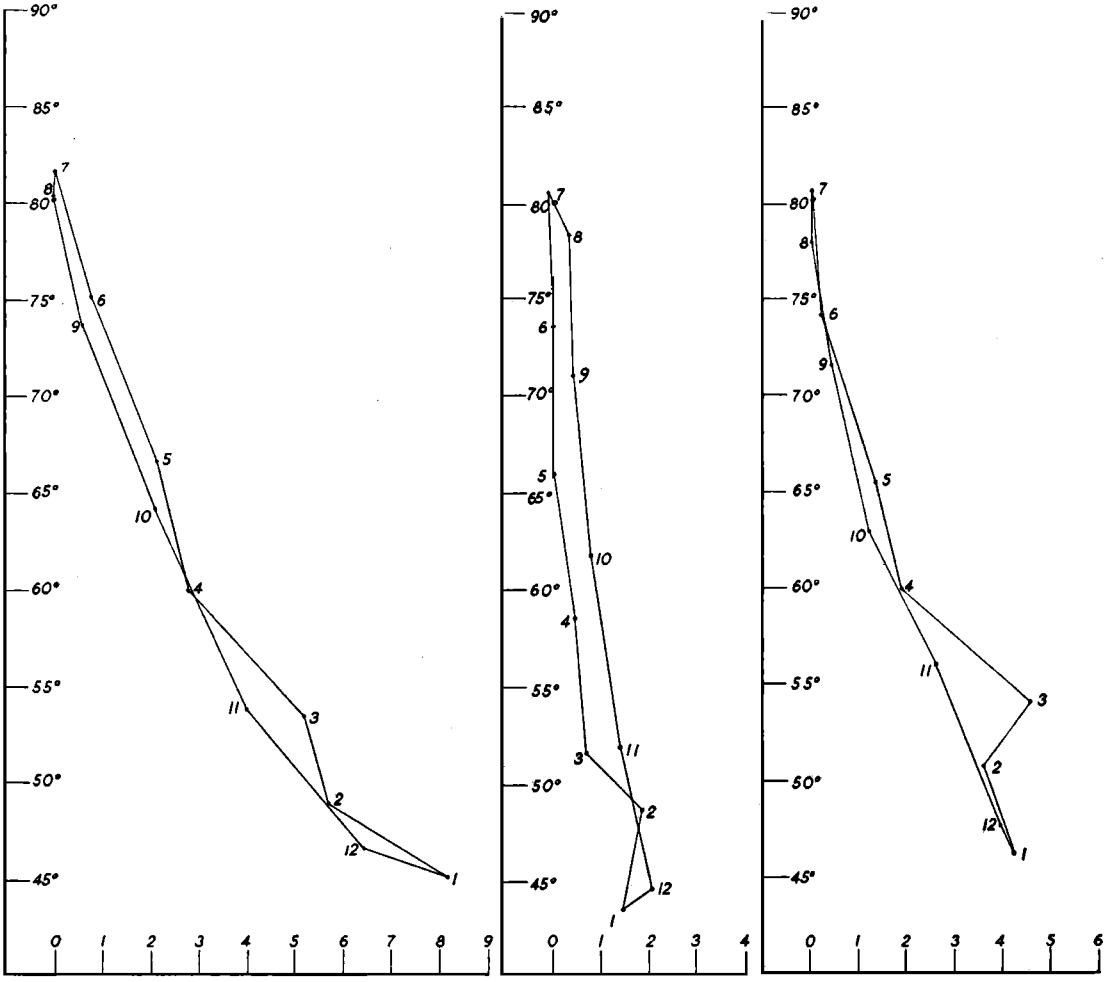


Fig. 5.

Hythergraph for Redding, Shasta County, California. Temperature is represented in degrees Fahrenheit, precipitation in inches. Numbers beside points on the figures designate months of the year. This station is near the northern limit of the range of the yellow-billed magpie (*Pica nuttallii*) in the Sacramento Valley.

Fig. 6.

Hythergraph for Visalia, Tulare County, California. See legend for fig. 5. This station is near the southern limit of range of the yellow-billed magpie in the San Joaquin Valley.

Fig. 7.

Hythergraph for Valley Springs, Calaveras County, California. This station is near the upper limit of the range of the yellow-billed magpie in the Sierran foothills.

range. Redding, at the north end of the Sacramento Valley, is at the extreme northern limit, and Visalia is near the southern limit in the San Joaquin Valley (see figs. 5 and 6). Valley Springs is near the margin of the range in the Sierran foothills. The graphs show that the climates of these marginal localities are similar to that of the Sacramento Valley, but they do differ, each in a separate way, from the valley climate.

By proceeding a few miles outside the yellow-billed magpie's range, up the slopes of the Sierra Nevada (fig 7) or into the Coast Ranges, a climate is found which differs in several respects from any within the bird's range. Lick Observatory at the

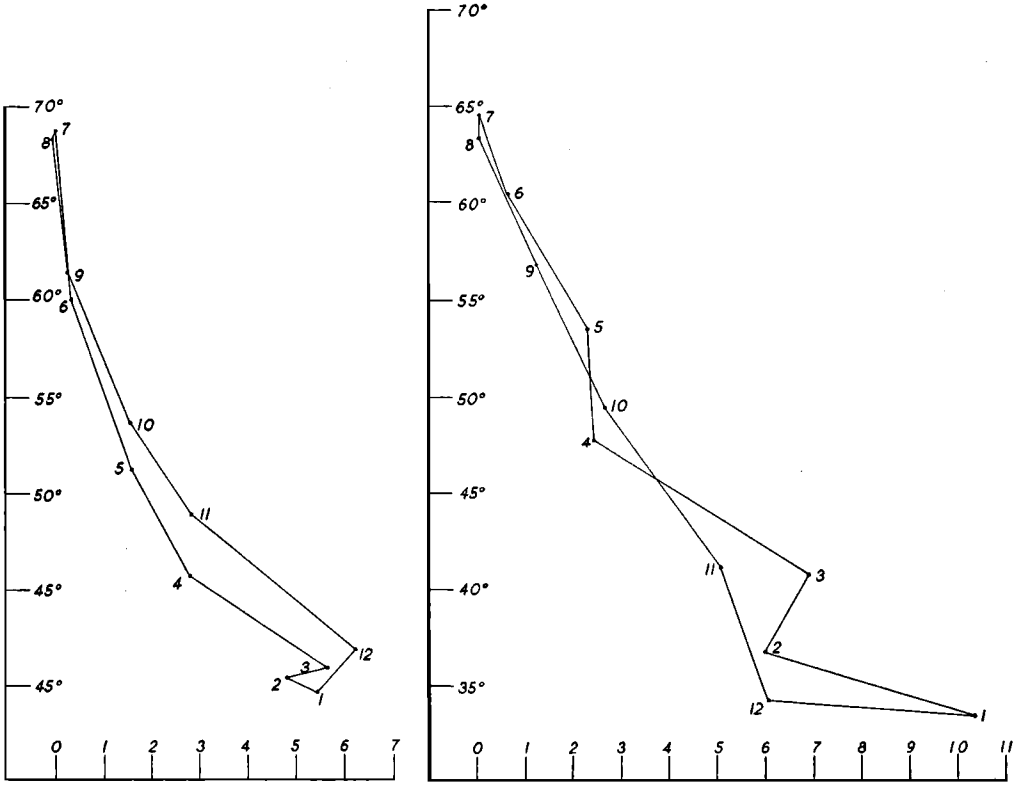


Fig. 8.

Hythergraph for Lick Observatory, Santa Clara County, California. See legend for fig. 5. This station is at the top of Mount Hamilton and is just above the normal range of the yellow-billed magpie in the South Coast ranges.

Fig. 9.

Hythergraph for Quincy, Plumas County, California. This station is in the northern Sierra Nevada and is several miles outside the normal range of the yellow-billed magpie.

top of Mount Hamilton, Santa Clara County (fig. 8), and Quincy, Plumas County (fig. 9), are examples. The regions represented by these stations differ from the Sacramento Valley in being colder and in having greater amounts of precipitation in winter. It seems obvious that the area occupied by the yellow-billed magpie is one of uniform climate, and that limitation of the bird's range occurs along with change in climate.

When comparison is next made between these localities and localities in the range of the black-billed species, it is noted that the climates agree in certain particulars, but that also they differ markedly. Madeline, Lassen County, California (fig. 10), for example, compared month by month with Red Bluff in the Sacramento Valley, proves to be close to 20 degrees F. colder. Other stations in the Great Basin and the

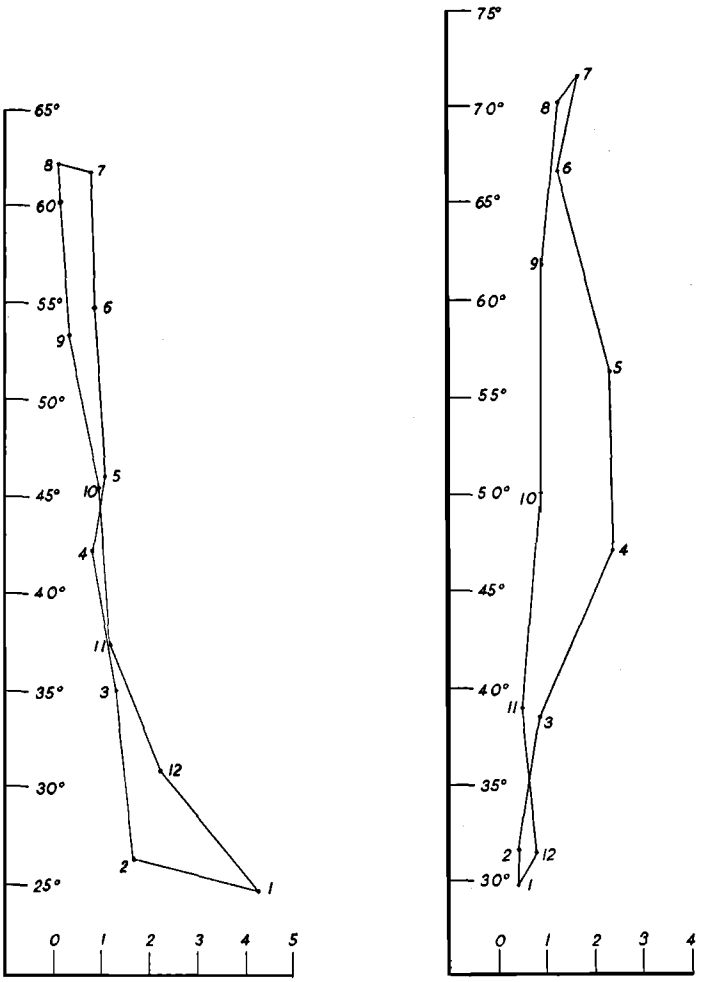


Fig. 10.

Hythergraph for Madeline, Lassen County, California. See legend for fig. 5. This station is typical of the Great Basin, near the western border of the range of the black-billed magpie (*Pica pica hudsonia*).

Fig. 11.

Hythergraph for Denver, Colorado. This station, on the eastern slope of the Rocky Mountains, is well within the range of the black-billed magpie.

interior, where magpies occur (see fig. 11), have climates in general like that of Madeline, but none approaches closely the typical Sacramento Valley type. It is also evident that these interior stations, over the area inhabited by black-billed magpies, vary more in their climates than do stations in the range of the yellow-billed bird.

The question of the effectiveness of the several climatic factors directly upon the birds probably can be answered only by carefully planned and tediously carried out tests of their physiological effect upon the birds. However, it may be worth while to point out some general relations to climate suggested by the graphs here presented and by some of the major structural features of magpies.

One character common to nearly all the ranges of different kinds of magpies is aridity. In the United States the birds are limited to the western areas where climates are characteristically of desert types. In many of the regions inhabited, the bulk of the small annual precipitation falls in winter in the form of snow. The plumage of the magpie is notably loose in texture, a quality which might make it unsuited to repeated soaking by rain. There is some observational evidence, not conclusive, that activities of this bird are really hindered by frequent and long continued rain. However, that this might not act as a factor in limitation of range is suggested by reference to the case of the cormorant, as discussed by Lewis (1929, p. 75). This bird actually spends much of its time in the water in spite of the fact that its plumage affords it little protection and the birds become thoroughly soaked. On the other hand the fact that cormorants can endure such wettings need not be considered as evidence that similar conditions would not harm magpies. Indeed, observations of Hou (1929, p. 171) on mallard ducks indicate that disturbance of the plumage in that aquatic species results in chilling when the bird becomes wet, to the detriment of the health of the bird.

Heavy snows appear to be not favorable for presence of magpies, possibly because the supplies of food are covered by them. Magpies tend to avoid areas characterized by heavy snows or to migrate from them during the winter.

The wide diversity in the degree of cold in the winter climates of the ranges of the two American magpies may mean that the two birds have different degrees of tolerance for cold, or it may be the result of a tolerance for low temperatures characteristic of the whole genus, but which is never exercised by the Californian form. In fact, it may never be reached by either form. In this case, some other kind of factor may delimit the range of the magpie so that it never is subjected to temperatures anywhere near the critical point. In other words, climate must be considered as possibly effective in many ways, but not all of them apply in all parts of the range of the bird.

The immediately preceding discussion involves a part of the immediate and direct response of the bird to climate. In addition to this possible kind of distributional control, allowance must be made for those kinds of limitation which are for the most part indirectly traceable to climate. For example, magpies may be prevented from living in a certain area because the vegetation (dense forest, low shrub, or grass) may not be suited to their habits. Unfavorable kinds of vegetation appear to be those too sparse to provide screen and nesting sites or those too dense to permit good visibility of the surroundings. Favorable vegetation is of the type characterized for each race elsewhere (see discussion of Habitat Relations, pp. 35-47). But this same unfavorable vegetation may be mainly dependent upon the type of climate in that area. Even in this case, where the influence is not direct, the climatic chart may serve as an index to the absence of the bird.

It would not be surprising to find that some special sorts of influence affect the birds during the breeding season, or that the range of toleration for some environ-

mental factors is narrower at that time of year than at other seasons. Whether the influence is directly or indirectly climatic, there is a chance of detecting it through study of these graphs.

It may be more than coincidence that both yellow-billed and black-billed magpies nest when climatic conditions reach those represented on a certain small section of the hythergraph. According to these records each of the two kinds now being considered starts nesting (lays eggs) when the average seasonal advance in temperature reaches 45 to 50°, and their nesting is mainly over (the young leave) when the seasonal average reaches 68° which occurs about two months later in the regions they inhabit. Moreover, these conditions come at different times of year for the two forms. According to the program of annual cycle of activity for each bird, the black-billed magpies in the Great Basin nest about one month later than do yellow-billed magpies which live near the same parallel of latitude. This differs somewhat from the recent discoveries of Rowan, Bissonnette, and others, which appear to indicate that the chief factor in setting the time of the breeding cycle is to be found in phenomena connected with photoperiodism.

Of course, the departures from such an expectation, shown on hythergraphs, need not be interpreted as contradictions of those findings. They do indicate that the breeding cycle may be adjusted to other factors additional to those involved in the periodic changes in light. In this case the two localities considered have nearly coincident, progressive changes as far as light is concerned, but their differing altitudes and positions on the continent cause them to have different sorts of climates. Spring comes earlier in the low ground occupied by the Californian bird than in high altitudes of the interior areas inhabited by the black-billed magpie. In the latter region the colder temperatures retard the growth of vegetation and the appearance of the small animals, and possibly they directly inhibit the nesting activities of the birds until temperatures come to be about the same as they are when the birds nest in California. However, the situation is complicated to some extent by the differing rates of seasonal change in the two areas.

The relation of magpies to climate may be examined from a slightly different view; comparison may be made between the area inhabited by the various forms and the types of climate shown on maps drawn wholly upon the basis of climatological data. Studies of the climate have been made for western United States by Russell (1926 and 1931).

The yellow-billed magpie in California occupies an area which forms parts of several climatic divisions as these are mapped by Russell, following the system of Köppen. In the Sacramento Valley the limit of range of the magpie follows closely the limits of the area mapped as Hot Summer Mediterranean (Csa). This is the warmer humid, mesothermal type of climate in which the ground is not frozen in winter and it is characterized by at least three times as much rainfall in its wettest month as is received during its driest summer month. In the hot summer type, "Olive climate," the warmest month averages above 71° F. Farther south there is less coincidence between this type of climate and the range of the bird: the southern end of the state has no recent magpie records, although it is true that fossil records show its former occurrence there.

South of San Francisco Bay most of the land in the Cool Summer Mediterranean type, "Heather climate" (Csb), with the warmest monthly average below 71° F., is inhabited by magpies. Practically all the rest of the yellow-billed magpies are found in the Mojave Desert Type of Dry Climate (BWh) which characterizes the San Joaquin Valley. Here the rainfall has a distinct winter maximum. According to Russell (1926, p. 78) the "differences in landscape between the San Joaquin Valley and the Mojave Desert are certainly not attributable to climatic causes but for the most part are edaphic." Magpies live in only a small part of the San Joaquin Valley even though they are strung out over nearly half its length.

On Russell's map of the dry climates of the United States (1931) the region marked as Cold Type Steppe Dry Climate (BSk) is almost exactly the range of the black-billed magpie (see fig. 12). The boundaries coincide everywhere within a few

Fig. 12. Map of the dry climates of the United States. Copied from Russell (1931). The area marked BSk is almost exactly the present range of the black-billed magpie in the United States; compare with map of this range, based on actual records of occurrence (fig. 3, p. 23).

miles. In this type of climate the mean January temperatures are below 32° F. The cold winter temperatures furnish the greatest contrast with the climate of the region occupied by yellow-billed magpies. (See also the graphs.)

HABITAT RELATIONS

In order to understand the life of any kind of bird one of the first steps is to study the home surroundings, the habitat, of that bird. It is not enough to know the geographic area occupied. Many other items concerning occurrence have significance. Among these are the features of topography which may influence individuals of the species as, for example, the relief of the land and conditions accompanying it, the positions of large streams, lakes or oceans and possible effects of them, roads, cities and other works resulting from culture.

In this connection an analysis of the vegetation is helpful to show relations to feeding, nesting, and resting. Other kinds of animals, especially vertebrates, provide important phases of the habitat relations of a bird. They deserve attention not only for their direct effects but because their presence may serve as an index to the presence or absence of the bird being studied.

From inspection of a magpie in the flesh one might expect it to be limited in occurrence because of peculiarities of structure which would seem to make certain types of habitat unfavorable. For example, it would not be surprising to find the bird avoiding localities characterized by especially strong winds where the long tail would be a distinct hindrance. It might be expected, from the loose texture of the feathers, that this bird would ordinarily live in regions of little rainfall. But other types of limitation which appear to be due to the mental constitution of the bird would never be suspected from examination, no matter how thorough, of the bird itself. To detect these limitations it is necessary to watch and study the behavior of the bird in its normal, natural surroundings.

Because no one observer can possibly study all the races of so widely distributed and so variable a group as the magpies, it is necessary to depend upon the observation of many people for this material. It happens that in reports such as contain much of the material included in this discussion the comments on habitat are usually condensed summaries of long periods of experience in the field. Thus, it is possible in a comparatively few paragraphs to review a vast amount of actual observation.

Detailed items showing the nature of habitat limitations in the several forms of magpies are given here with the hope that from them may be learned just what sorts of factors are concerned, whether each kind of limitation is wide or narrow in its scope, and whether the same factors are operative in all parts of the range of the bird. If the latter is not the case the problem arises as to whether limits of the affected areas correspond to limits of ranges of the recognized races of the bird. Another question of historical interest is whether the factors of the habitat are now the same or exert effectiveness in the same order as they have in the past. Also, these detailed observations may give an indication of the relative importance, in habitat restrictions, of the environment and the mind of the bird.

The various kinds of magpies in the world live in places which superficially appear to be widely different. For example the range in altitude through which they live extends from near sea level to well over 10,000 feet. However, a close inspection of the surroundings chosen by magpies in many places shows that there are many conditions and circumstances which are common to all the places occupied. By picking out and defining and studying these factors which have to do with distribution of the

magpie, we may better understand just where the bird lives with relation to each particular in its environment and possibly some of the reasons for its occurring where it does.

The magpie is one of the larger birds in any locality in which it is found. Its structure and inherited habits enable it to feed upon a wide variety of food objects, including both plant and animal matter. A bird of its size is able, probably, in the regions it inhabits to find food material of this nature in sufficient quantity most easily by foraging on the ground. The type of ground which is most productive is open ground where there is sod and low-growth vegetation.

A magpie's wings are short and rounded and so shaped that the bird cannot fly rapidly or far. Therefore if it is to escape from pursuit it must stay in places from which it can rapidly escape into thick clumps of brush. These furnish the only places of safety for a magpie that is being pursued. Once an individual is within a thicket it is comparatively safe from attack by birds of prey.

These two circumstances, then, tend to restrict magpies to places where there is open forage ground and where there are clumps of brushy trees and bushes scattered over the landscape. There is further limitation in that there must be trees or bushes large enough and sufficiently strong for supporting the bulky nest. These suitable nesting trees are most often found along the streams—at least within the range of the bird in North America.

NUTTALLII.—The yellow-billed magpie normally nests in colonies which occupy the small groves of valley oaks and sycamores which dot the meadows (Kaeding, 1897, p. 16). Dawson's (1923, p. 41) impressions of this bird led to the following characterization of its breeding habitat. He found colonies "either in the cottonwoods of river-bottoms, in the oak-trees, whether 'live' or deciduous, which dot the lower levels of the foothills, or else in the mixed cover, oak, ceanothus, and digger pine, which clothes the middle level of the hills."

It was noticed by Townsend (1887, p. 211) in 1883 that in the vicinity of Red Bluff magpies were always to be found about the buildings on the ranches. The birds have continued, until the present time, to pick out such surroundings in that locality.

Species of birds that were conspicuous about a nesting colony of magpies near Coyote, Santa Clara County, January 18, 1931, were the California woodpecker, Brewer blackbird, meadowlark, and flicker (Linsdale, MS). All these were within sight on the same area practically the whole time of observation. One pair of sparrow hawks was present. At another magpie colony on Coyote Creek only a few miles to the southeast, species present in numbers were California woodpecker, California jay, and Steller jay (a few).

In the neighborhood of Jolon, on October 19, 1918, at least six individuals were seen far-scattered in smallish blue-oaks (Grinnell, MS). A colony of yellow-billed magpies observed in November, 1918, in Peachtree Valley, Monterey County (Hunt, MS), appeared to be confined to the valley oaks on the flat valley floor and a little way up the hills. The birds were conspicuous, continually flying between the trees and from the trees to the ground. Within the valley the birds, during the three-day period of observation, were localized in one particular small area out of which none was seen. This situation was contrary to the observer's first impression which was that this species was abundant throughout the valley.

Observations were made upon magpies in the Colusa district in February and March, 1923 (Grinnell, 1923, p. 172). On February 26, sixteen birds were counted scattered in and about one farmyard where they were consorting with the pigs and chickens. Many others were foraging in the newly sown grain fields.

Six miles southeast of Colusa at 2 p.m. on November 11, 1930, four magpies were observed by me at a valley oak (on the ground and in branches of the tree) by the side of the road and three-fourths of a mile from the nearest other tree. This was about one mile from the Sacramento River. The group moved on farther into stubble fields and away from trees. The birds followed the course of a railroad, foraging over the bank and the rails. There were trees within sight, but there were extensive open spaces intervening. About an hour later at a place fifteen miles farther north magpies were seen in more normal types of surroundings. They were walking over a bare field next to the river, over the road (both on pavement and on dirt shoulders), on the railroad right of way, and in an orchard.

On October 6, 1929, I made observations in the Sacramento Valley near Colusa. The field in which magpies were foraging was a sheep pasture with dry ground, dead grass, and with a few scattered weeds in some places close enough together to hide the birds from view. Usually, however, the birds were plainly visible. At midmorning a group of about fifteen magpies was observed as it foraged in a three-acre alfalfa field between two farm houses. The plants were green but short; they were less than three inches high. There were several large valley oaks to and from which the birds flew occasionally. Meadowlarks and California jays were feeding in the same field. In a line of tall valley oaks between a road and the Sacramento River, the following kinds of birds were observed at one time: magpies, crows, California jays, California woodpeckers, and flickers.

On February 16, 1930, I saw magpies foraging in a five-acre hog pasture at the side of a road, sixteen miles southeast of Colusa. Half the field was covered with medium-sized valley oaks. In addition to forage ground in this grove there was ground where the birds fed in a young orchard on one side of it and in an open pasture on another side. On the other two sides were plowed fields.

The birds of a colony watched by me at mid-day on May 10, 1929, at fifteen miles southeast of San Jose spent much of their time perched on the tops of fence posts at the edges of fields.

Near Colusa on October 6, 1929, I watched a magpie on open ground where no trees were near by. This individual perched on a wire of a fence between two fields and on the ground close to the fence. Later it flew for one-half mile along the fence to where there was another magpie.

On the afternoon of February 16, 1930, magpies were observed by me in at least fifteen localities in the Sacramento Valley. In nearly every case the birds seen were on the ground, either where the surface was nearly bare or where the vegetation was so short that the magpies were easily seen from a distance. The afternoon was warm and nearly clear so that the birds tended to be quiet and to remain in the shade of the large trees.

In the morning of February 23, 1930, at five miles southeast of Gilroy, Santa Clara County, I saw eight magpies together in a nearly bare field. When the sun

came from behind the clouds, the birds flew to the top of a picket fence where they perched for several minutes and then scattered. Meadowlarks and flickers were foraging on the same ground.

A feature common to situations inhabited by the yellow-billed magpie is the presence of tall trees usually in linear arrangement bordering streams or in parklike groves either on valley floors or on hills. Another is open ground either bare, as in well kept orchards, or comprising cultivated fields or grassy pastures and slopes. This particular kind of magpie appears not to extend its range into lands where there is frequent high wind, long, snowy, and cold winters, or especially dry and hot summers. The nature of the restriction in each case is more or less obscure—sometimes it is evidently some direct influence of the environment upon the birds. This appears to be so as regards the strong winds. Again, the limitation may act indirectly by so reducing the available supply of food that magpies could not exist for the whole year or for a time sufficient to rear their young. Water supply may be important in preventing spread of these birds into desert regions. Water appears necessary for the birds to drink and also as an aid to nest-building.

HUDSONIA.—My own opportunities to watch black-billed magpies have been most extended in central Nevada. There, more particularly in Smoky Valley between the Toyabe and Toquima mountains, occur large areas (several hundred acres each) covered with thickly growing stands of buffalo berry (*Shepherdia argentea*). This tall shrub is the predominant plant in a belt one-half to two miles wide around the alkali flat in the center of the valley. It grows most densely on the alkali soil. The plants grow as isolated bushes or as parts of dense thickets averaging ten feet in height and varying up to fifteen feet. In 1930, most of the plants were dropping the small yellowish petals and were coming into leaf about the end of April. The leaves are small,

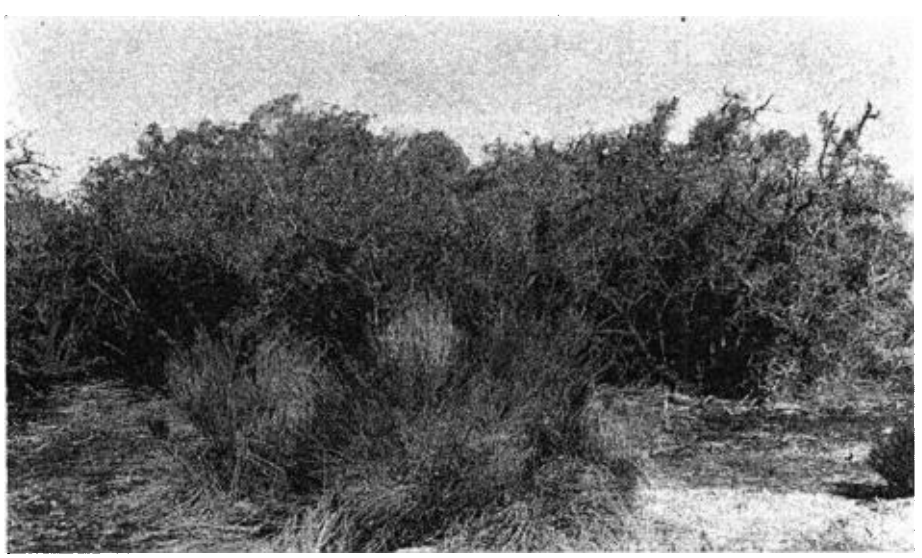


Fig. 13. Dense thicket of buffalo berry (*Shepherdia argentea*) such as pairs of black-billed magpies occupy year after year. The domed roof of one nest projects above the tops of the bushes. Photographed on May 19, 1930, near Millett P. O., Nye County, Nevada.

but they cover the branches densely. Branches are remarkably brittle, being covered with large thorns which are heavy and sharp, and which effectually bar the progress of a person or any large animal which attempts to move through a thicket. The dead branches droop to the ground, if broken, or they remain in place and add to the thorny barrier. Thickets vary in diameter up to fifty or one hundred yards. In some places rose vines have grown through the bushes and these add to the denseness of the tangle. Between the bushes and around the bases are scattered clumps of bunch grass. (See fig 13.)

This thorny, shrubby vegetation seems to be particularly suited to the needs of the black-billed magpie for nesting. The species responds to the situation outlined above by nesting in concentrated colonies wherever this type of vegetation is found. The dense thorny mass near the ground combines the characteristics most often found in magpie nesting-sites. The birds appear to prefer not only thorny bushes for holding the nests but also the thorny twigs for nest construction. The natural factor acting most often here for limitation of numbers appears to be the restriction of food supply at unfavorable seasons in this locality. Then, too, this type of place is always subject to raiding by people who desire to diminish magpie numbers. Even in this highly favorable set of surroundings the magpies do not show as great a tendency to colonize as do the yellow-billed birds in California. Each nest is separated from the others enough to provide some degree of isolation.

In other parts of this general region magpies are present but in smaller numbers. They are restricted to the near vicinity of streams, and further to certain portions of the streams. This restriction may be due largely to the fact that the kinds of trees in which the nests are placed grow along the streams. A few magpies live in the lines of trees along the lower portions of streams below the mouths of cañons (fig. 14). The

Fig. 14. Vegetation along North Twin River below the mouth of its cañon, Toyabe Mountains, Nye County, Nevada. Trees of this type supplied nesting sites for black-billed magpies. Photographed on May 12, 1930.

bird is absent from the narrow gorges of the streams on the lower mountain sides—although there are trees in these cañons. When the cañons spread to open meadows and above these where the mountains are more open, magpies nest in the clumps of willows, birch, and aspen. Usually in these places the pairs are scattered so that only one occupies a meadow or section of a stream. The birds nest farther apart in higher parts of the mountains than at lower levels. Also, they appear to nest later in these high mountains than in the valleys, probably on account of the lateness of the season at higher altitudes.

Magpies may be seen occasionally in any part of the mountains in this region. For example, on June 17, 1930, one was seen moving through the margin of an aspen thicket on a steep slope south of Kingston Creek at a 7000-foot altitude, in Lander County. On June 19, one was seen moving from tree to tree over a mountain mahogany covered slope at a 7600-foot altitude. When last seen the bird was flying toward a clump of birches in a cañon bottom. For several hours on the morning of June 6, 1930, two magpies were watched as they foraged near the top of the ridge west of Kingston Creek (altitude 9000 to 9300 feet). The birds perched in mountain mahoganies and repeatedly made flights into the air after insects.

This magpie ordinarily, throughout its range, prefers rather open country; it shuns the heavy forests and strictly desert regions. The shrubbery and undergrowth found along water courses and springs in the foothill regions and the cañons in the higher mountains make up the usual habitat (Bendire, 1895, p. 351). Criddle's (1923, p. 25) experience led him to say that magpies prefer "the semi-wooded or broken lands for breeding places. River flats surrounded by prairie, or valleys bordered by high hills, seem to afford them the situations they desire most."

An important factor in the choice of the environment by a magpie has been mentioned by Taylor and Shaw (1927, p. 180). They pointed out that the bird avoids deep timber and prefers brushy cañons, where, alone or with others, it can travel from tree to tree or rocky ledge and still comprehend in its glance a broad expanse of country.

The distribution of the magpie in Alaska was remarked upon by Nelson (1887, p. 163). He wrote that "these birds extend their range west on the Shumagin Islands and on the peninsula of Alaska to Isanotsky Pass, where the alder-bushes and the mainland of Alaska find their western limit together. The alders are used by the magpies to support their nests, and the lack of such support farther west is probably the chief reason for the birds' absence beyond. Their northern limit on the upper Yukon is near the Arctic Circle at Fort Yukon, but on the Lower Yukon and its tributaries it is about latitude 63° or 64°."

In the Copper River valley, Alaska, A. M. Bailey reported (1926, p. 175) the magpie to be restricted in December to the vicinity of the villages. Along the seacoast of southeastern Alaska the same observer (1927, p. 354) found this species fairly common in winter at several places. The birds were a nuisance to trappers by continually stealing bait and snapping traps. Groups of magpies would be seen "sailing along the beach, against the wind, the whole flock settling on some point for a few moments, only to drift farther on immediately." The birds seemed to be restless individuals. Hartlaub (1883, p. 270) wrote that in winter magpies in Alaska sought the beaches in the neighborhood of houses. There the birds searched over the strand for shellfish.

Bendire (1895, p. 349) quotes B. J. Bretherton who wrote from Kadiak, Alaska, that "a remarkable fact about this bird is its inability to keep dry; in rainy winters it may be seen day after day hopping around, literally wet to the skin, and looking as if it had been dipped in a bucket of water."

The nesting habitat of the magpie in Okanagan Valley, British Columbia, was characterized by Munro (1919, p. 72) as follows: "They usually nest in colonies, in patches of nearly impenetrable Black Haw (*Crataegus douglasi*) or in brushy coulees, on open hillsides." He considered the species an abundant resident in the river bottoms and on the yellow-pine benches but less common in the forests.

In Walla Walla County, Washington, magpies are abundant in the timber along streams, but they also wander out into the bare bunch-grass hills. Dice (1917, p. 121) recorded the birds rarely in the open, but he noted that when alarmed, they retreated to the thick brush or timber. On the prairies of Walla Walla and Columbia counties, Washington, where magpies are normally abundant in the timber along the streams throughout the year, Dice (1918, p. 148) noted that the birds also wandered long distances out into the bunch-grass hills.

Magpies often find suitable home sites around the borders of lakes where these occur within their range. For example, Brown (1926, p. 50) found the species abundant about Moses Lake, Grant County, Washington. The nests were in the larger sage bushes, in thick reeds in the marsh, and in bushes on islands. Similarly, Silloway (1901, p. 57) found the birds inhabiting the dwarf trees along the shore of Flathead Lake in Montana. At this place they were also abundant in thickets of the foothills and along the streams.

In Montana, Saunders (1921, p. 94) lists the breeding habitats as cottonwood groves, willow and alder thickets, or thorn bushes; rarely in evergreens in the foothills of the mountains. In the neighborhood of Missoula, Dice (1922, p. 17) saw the birds in cottonwoods, Douglas spruces, yellow pines, chaparral, bunch grass and on rocky slopes. In Montana it has been reported (Saunders, 1914, p. 135) that in winter magpies frequently make use of their old nests as shelters from the heavy winds.

Skinner (1928, p. 140) recorded magpies as common in winter in Yellowstone Park at altitudes up to as high as 8000 feet. However, in the same region he found that breeding birds of the species were always below a 5000-foot altitude. A similar situation has been reported for the vicinity of Mount Rainier National Park (Taylor and Shaw, 1927, p. 180) where magpies regularly occur in winter on mountain slopes far above the usual breeding grounds. In Wyoming, Fuller and Bole (1930, p. 63) found magpies everywhere below the Canadian Life Zone. They were found wherever there had been cultivation of ground along the Green River. In the eastern part of the state magpies frequented pastures and barnyards.

At Fort Sherman, Idaho, in the nineties (Merrill, 1897, p. 356) a few individuals were noted each winter making daily visits to the back yards of the quarters and to a garbage pile a short distance outside the fort. The birds increased in numbers about mid-February, but were rarely seen after March. None was found nesting near the fort.

Magpies were commonly attracted to the vicinity of Fort Klamath, Oregon, by an abundance of food (Merrill, 1888, p. 261). The birds visited "the stables, yards, hen-

coops and 'dump-pile'," and were always about when a steer was being butchered. They left for their nesting places late in March.

In northwestern Nevada, Taylor (1912, p. 377) found the magpies nesting just on the line between the Upper Sonoran and Transition life zones. Individuals invaded the latter zone in their daily wanderings. During the nesting season the birds were found in that region only at stations below a 6000-foot altitude. Later they occurred along streams in the mountains as high as 8500 feet. Although the magpies were usually limited to the immediate neighborhood of streams, individuals were found on the dry sage slopes of the mountains and on the sage-covered desert. Always, however, there was a supply of water within sight. The birds found at high altitudes and at points far away from the natural habitat were young ones.

In Colorado, Dille (1888, p. 23) found the black-billed magpie confining itself strictly to the heavy timber along the borders of the largest streams. Warren (1912, p. 33) found magpies in Colorado especially abundant along a stream where there were willow and cottonwood trees for nesting sites. The birds were absent from places along the stream where there were no trees. Not one was seen on the flat prairie on either side of the stream. On the La Plata River, Gilman (1907, p. 9) found magpies to be especially abundant at a place where the river bottom widens and where there was a dense growth of trees of the following kinds: narrow-leaf cottonwood, black birch, paper-leaf alder, two kinds of willow, aspen, and pine, along with undergrowth characteristic of the altitude, 7500 to 8100 feet.

Rockwell (1908, p. 168) wrote that although, in Colorado, magpies were most common in the settled country during the winter, he had found them as high as an 8000-foot altitude in January when the upper country was covered with three feet of snow, and miles from a ranch. Near Breckenridge, Colorado, magpies have been reported breeding almost to timber line at a 10,500-foot altitude (Cooke, 1900, p. 210).

According to Bergtold (1917, p. 123) the magpie occurs in the city parks of Denver, Colorado, more frequently in winter than at any other season.

In the southernmost part of its range, in New Mexico, the magpie nests at altitudes between 5000 and 9500 feet. In the fall it ranges in the upper parts of the mountains at least as far up as 10,700 feet. Later in the winter, the birds withdraw from these higher lands and the flocks congregate in the valleys between 5000- and 8000-foot altitudes (F. M. Bailey, 1928, p. 482). The altitudinal breeding range of magpies in San Miguel County, New Mexico, was given by Mitchell (1898, p. 309) as being from 7000 feet to 12,000 feet.

Bennett (1915, p. 134) noted that a winter-visitant magpie in Iowa had difficulty in flying against a rather strong wind and had to rest frequently.

OTHER KINDS OF MAGPIES.—Brown (1924, p. 124) indicates that in Cumberland, England, magpies often nest in a hedge beside a poultry run or a clump of trees surrounding a farmhouse. Magpies in Essex are more frequent on the coast than inland (Glegg, 1929, p. 11).

The comments by MacGillivray (1837, p. 565) on the status of this bird in the early part of the last century are interesting to compare with its present status in the same territory. He wrote that "the Magpie is [was] generally distributed in Britain, being more or less common in all the cultivated and wooded districts of England and

Scotland, both in the interior and along the coast, although nowhere numerous, . . . in large tracts of the central regions of Scotland [it] is rarely if ever met with, because its habits are such as to induce it to remain at no great distance from human habitations."

Yarrell (1876, p. 315) commented on the habitat of this race (*pica*) as follows: "Partial as it is to cultivated and wooded districts, the Pie is not by any means a strictly woodland-bird, and it is well content with an open country if a sufficiency of bushes or trees standing apart is there to be found; for its flight being laboured and comparatively weak, it seldom goes willingly far from a place of shelter."

Dubois (1887, p. 204) characterized the habitat of the magpie in Belgium as in bunches of trees in fields, upon the borders of woods and in gardens. It hunts out the neighborhood of habitations. According to van Havre (1928, p. 52) in Belgium the magpie nests at the tops of high trees in the neighborhood of plains, on the reclaimed land sometimes in hedges, and in young pines or dwarfed pines scattered on the moor, in the absence of high trees.

In France, according to Coursimault (1917, p. 103) one sees magpies throughout the year along the roads, in meadows, in isolated trees, and upon shocks of grain at the time of harvest. In Lorraine, France, the magpie lives not in the forests but in the small patches of woods, parks and gardens (Hamonville, 1895, p. 269). The bird is resident and plentiful in the more open country of southwestern France, but was never seen by Burleigh (1919, p. 502) deep in the pine woods. One nest was in a large maritime pine at the edge of a short stretch of woods. In northern France, in parts of the Somme, where most of the large trees had been felled, magpies, in 1917–18, nested in quite small trees (Boyd, 1919, p. 59).

The magpie was recorded by Clarke (1895, p. 194) as abundant throughout the Camargue, "where it nested commonly in the low tamarisk-trees scattered over the wastes and among the sandhills bordering the Mediterranean." Griscom (1921, p. 598) observed that magpies were abundant everywhere in the Camargue, "not even objecting to wading in shallow water".

A recent account of the Magpie in France summarizes its habitat relations as follows. We could characterize the biotope of the magpie no better than to recall the comment of Meylan who considers this species as being a 'caractère anthropophile accentué' and only visiting a 'milieu à caractère essentiellement agricole.' Although well distributed over France, the magpie nevertheless is absent in certain regions, the conditions of the environment for it being unfavorable. It is the cultivated land with the lines of trees, the thickets, the small patches of woods, especially coppices which constitute its chosen habitat. The forests are unfavorable for it, and it is absent there at present. But the magpie can be found frequently at the edge of the forest or in large cultivated glades. It becomes attached to the same small woods and coppices as a place of retreat and for a roosting place during the summer and fall. The magpie then is found in all the cultivated parts of France, and it is especially frequent in the fertile plains with some small patches of trees and rows of trees along the roads. It is absent in the areas of the great forests, of waste lands or of rocks. It is also absent from the mountain masses above a certain altitude variable according to the mass and even the locality. (Mayaud, 1933, pp. 377–378.)

Facts bearing on the distribution of the magpie in Denmark have been gathered and summarized by Skovgaard (1927, p. 121). The magpie is found over all Denmark but very irregularly in different parts. On the majority of the small islands and in heathery country, in big forests and in the large sandbanks by the sea, it is absent. It is most abundant near old country towns which have old gardens where big trees and thorny hedges furnish it nesting sites, and where garbage furnishes it with easy food. Out over the country it is associated with the spreading settlements, hedges, small woods and over-grown marlgroves. In west Jutland it has spread with the plantations and has followed the plowing and planting activities into the heather growths.

Tratz (1919, p. 137) wrote that in southern Venice this race lived everywhere in the meadows, in vineyards and about the single poplars at the brooksides. In the maritime lands he found the birds in vineyards, about solitary mulberry trees, and in the meadows.

Clarke (1884, p. 143) records the magpie in Slavonia as nesting in the sallows [willows] of the "bara" and in the trees in the village streets. In Rumania, in 1928, Congreve (1929, p. 450) found magpies in all localities except in mountains. Boetticher (1919, p. 247) wrote of this bird as very frequent at altitudes of 1800 to 3300 feet in the Rila Mountains, Bulgaria, but stated that it was absent higher in the mountains.

In Macedonia, Chasen (1921, p. 195) found magpies in winter in great numbers on a plain and away from the wooded districts. In December chattering flocks were seen in nearly every leafless tree along a river. In the autumn, like true crows, they foraged on the stony ground for food. In Macedonia, Fehringer (1922, p. 287) found magpies nesting abundantly in the low vegetation close to the streams. The birds were entirely absent in the low vegetation on the mountain slopes. In Macedonia (Harrison, 1925, p. 424) magpies nest everywhere "from the coast-line to the very hilltops." Tristram observed magpies in small numbers in Armenia, living in the white poplars which fringe the streams (1882, p. 410).

Witherby (1910, p. 515) found magpies of the southern coast of the Caspian Sea, frequenting the dense "reed-beds around the lagoons" and also the villages high up in the mountain valleys. The same writer (1903, p. 519) found the species breeding "in considerable numbers in a dry river-bed thickly overgrown with thorn-trees and willows. An occasional pair was seen here and there in moist parts of the oak-woods."

Magpies were found by Buxton (1920, p. 851) in northern and western Persia to be common in most of the gardens and small woods of the plateau.

In the southern Ural region magpies in winter congregate in cities and villages where they become truly house birds and boldly display themselves about the buildings and yards. In the city of Orenburg at least 20,000 wintered in 1880–81. They withdrew and went to their northern breeding grounds by the middle of March or a little later (Grote, 1919, p. 357).

In Russian Turkestan, Carruthers (1910, p. 441) observed magpies all over the cultivated districts, from 300 feet up to 3000 feet, and scarcer at higher altitudes. One was seen in June at snow line at 10,000 feet.

Radcliffe (1915, p. 745), in Baluchistan, observed magpies especially in the higher valleys. At Ziarat, 8000 feet altitude, they were breeding in a juniper forest. North-

ward from Kelat, St. John (1889, p. 169) found the magpie to be "common in gardens, groves, and wooded hills".

Osmaston (1925, p. 673) wrote as follows, of magpies in Ladakh where the species was very common between 9000 and 13,000 feet.

"As Ladakh is almost treeless, except near villages, where poplars and willows have been planted on irrigated lands, and as the Magpie requires a tree or at least a bush in which to place its nest, these birds are only found in the neighborhood of villages.

"In some villages there are small willow or poplar plantations covering an acre or more. In other cases the number of trees in a village may be counted on the fingers of one or both hands, with the result that there may be as many pairs of Magpies in a village as there are trees. In the village of Gya, elevation 13,000 feet, there is only a single tree, which was occupied by a pair of Magpies. Mr. Ludlow, who visited this spot two years before, also saw a single pair in possession of this tree.

"In certain villages, where trees are scarce, magpies' nests were found in thorny bushes as low as five feet from the ground."

Magpies were found by Whitehead (1910, p. 178) to occur commonly in the Upper Kurram Valley in northern India, where they occurred "up to the tree-limit." Harington (1914, p. 2) found as many as twelve nests in one tree on the frontier of Burma where trees were especially scarce. In the southern Shan states of Burma that observer (1903, p. 596) found magpies common in valleys "keeping to the open cultivated land round villages and bazaars." In French Indo-China, Delacour and Jabouille (1925, p. 253) found magpies only in the plains. They never saw any in the hills.

In southern China an interesting relationship exists between the magpies, a jay (*Gracupica*) and a kind of tree (*Bombax malabaricum*), as has been explained by Mell (1924, p. 287). The bombax tree was introduced into southern Asia from Mexico after the discovery of America. Now both of these bird species show an outspoken preference for nesting in high examples of this tree, and, as a rule, pairs of both species nest in the same tree. Before the invasion of the bombax these birds nested in a kind of pine (*Pinus massoniana*). In southeastern China, Vaughan and Jones (1913, p. 26) recorded magpies as exceedingly common both on the coast and up the rivers.

Buxton observed that during the winter these birds (*kamtschatica*) stayed "around the isolated houses and settlements, feeding on refuse and the bits of fish that the dogs leave." (Allen, 1905, p. 247.) In 1906, the magpie (race *kamtschatica*) was the most conspicuous bird in all situations about Petropaulski, but it was seen most frequently on scrubby hillsides (Clark, 1911, p. 62). According to Allen (1905, p. 247) the nesting grounds are in the foothills and along the streams.

In Formosa, Swinhoe (1863, p. 383) observed magpies in great abundance in the large level tracts near Tairvanfoo but rarely in the hilly parts of the northwest of that country.

In the region of Batna in Algeria, Koenig (1895, p. 209) found magpies (form *mauritanica*) to be common in the summer of 1892. At the same season of the following year and at the same locality this species was absent. The only observed features by which the two seasons differed were with respect to rainfall. The first year was a

wet one and the second an exceptionally dry one when there was practically no surface water. It was Koenig's explanation that the magpies were absent because, being weak fliers, they were unable to travel the necessary great distances to obtain water and so were forced to live elsewhere. In Algeria, Jourdain (1915, p. 135) found magpies nesting in colonies in ilex scrub which "clothes the foothills" of the mountains. Taczanowski (1870, p. 48) observed in this region that the birds are cautious, keep back in the thickets and seldom come to the habitations of man.

On the plains of central Tunisia, Whitaker (1905, p. 11) found parties of the magpie frequenting "patches of cultivated land dotted over with thorn bushes. Farther south the birds were among the tamarisk bushes." That writer's comments on the habitat relations of the bird were as follows: "Like the Grey Shrikes, Bush-Babblers, and other wary birds, this Magpie is fond of open country, where the monotony of the level plain is only broken by isolated clumps of bushes. These afford sufficient shelter to the birds and at the same time offer admirable points of vantage from which to spy the surrounding country."

Salvin (1859, p. 312) in the Eastern Atlas found this bird on the wooded hills, nesting in terebinth trees. In the Great Atlas and in Morocco, Meade-Waldo (1903, p. 211) saw nests of magpies in tracts of acacia at the foot of the mountains. South of the Atlas range in Tunisia magpies were found by Erlanger (1899, p. 491) to be nowhere extensively distributed. There the bird loves the bushy regions and shuns the steppes and woods.

Heim de Balsac (1926, p. 396) commented on the weak powers of flight of this bird and pointed out that the colonies are sharply restricted and that the birds rarely move more than a few miles from their home. Lynes (1925, p. 35) wrote of this species in Morocco that the magpie was "very common in the argan 'bush' and scrub-wastes, where inclined to be local, and in the latter absent if none of the bushes are higher than two metres."

General comment.—A review of the types of habitat occupied by each kind of magpie shows that, for the most part, all of the several kinds live on the same general type of ground. At the same time, in some of the races, peculiarities can be distinguished in the type of ground inhabited. These peculiarities result from more than the differences in appearance of the land resulting from topography or the kind of vegetation. For example, in the American forms the yellow-billed bird characteristically lives among trees while the black-billed form shows no preference whatever for trees but seems actually to prefer certain types of tall shrubs. This bird lives among the bushes even where there are trees. The yellow-billed bird seems never to choose to live among bushes. In other regions there seems to be less contrast in the type of vegetation characteristic of each race. However, most of the forms show a preference for tall shrubs. At the same time certain colonies or individual pairs are likely to be found among trees.

When the whole range of the genus is considered the similarity in habitat is much more noteworthy than are the differences. As has been intimated previously this uniformity in living quarters appears to be prescribed by the structure of the bird. In other words it seems that a bird of the size and with structural characters of a magpie would be most at home in just the sort of surroundings in which it occurs. It is evident

that, although magpies as a group choose to live in certain types of vegetation, they do not select any particular species of plant. Any one of dozens of kinds of bush satisfies the requirements of the bird. Thorny bushes are preferable but they are not necessary. Even in a single locality magpies may make use of several kinds of bushes.

As to altitude, there seem to be no fixed requirements for this group of birds. Apparently they can get along at sea level or at heights far above 10,000 feet, as well as at any intermediate level. Suitability of the habitat is dependent on many factors which may be controlled by altitude, so that in some cases altitude may be thought of correctly as having an indirect effect upon the presence of the birds.

Ranking next to the appearance of vegetation as an indicator of favorableness of an area for magpies may be the presence of water. For the needs of these birds water is usually supplied by streams. However, any supply of water at the ground surface will suffice even if it is a lake, a spring, or an artificial tank or pond.

A feature of magpie occurrence that has been observed possibly more than any other is the bird's apparent selection of the neighborhood of human habitation. There may be several explanations for this preference, but all of them have some connection with the forage requirements of the magpie. A human settlement on the border of habitable magpie territory may supply just the needed supplement of food at times of food shortage to enable the birds to exist. A favorable influence usually goes along with the presence of domesticated animals. This relationship has been demonstrated where the birds have extended their range into a region along with extension of human settlement. The benefits to the birds from this association are likely to be greater than the injury to them from their human rivals for subsistence.

There are some indications that other animals are important in determining the choice of home surroundings of magpies. The preference for thorny bushes may result from a need for quickly available places of refuge from predatory birds or even mammals. The natural inability of magpies to escape pursuit in the open lends support to the supposition that presence or absence of means of escape from predators may help to determine where they live.

The places inhabited by magpies are not necessarily the most favorable for them. This is shown by instances in which the birds have taken over for living quarters some introduced kind of plant. The same point is demonstrated by the spread of magpies in a region where they have been accidentally introduced. Another type of example is found in places where fluctuation in population has resulted after some marked change in the environment which has accompanied human occupation of it.

An interesting feature of magpie habitats, especially in America, is that the bird is almost alone in the surroundings it inhabits. Although at any one place other kinds of birds are certain to be seen along with it, none of these occupies the same type of habitat as that bird or has a range which duplicates that of the magpie.

It is necessary to study the conditions throughout the whole area occupied by the bird to gain an adequate judgment as to what constitutes its choice for home surroundings.

FOOD AND FEEDING HABITS

Food and feeding habits together account for a large share of our interest in the life of any animal. The type of materials eaten is a certain index to the activity of the species, for through long periods the presence of any kind of bird at any locality is conditioned upon availability of food of sufficient kind and amount. For this reason a study of any bird species involves also more or less study of the biology of the animals or plants upon which it lives.

To get the required food materials, a magpie's more than ordinarily generalized structure enables it to obtain and use a wide variety of organic foodstuffs—both of animal and plant origin. These supply the necessary carbohydrates, fats, and proteins. In addition, water is taken in regularly. Nothing is known as to how this particular bird is especially fitted to obtain the mysterious vitamins which it is assumed to require.

In the summary which follows, it is indicated what general classes of food materials are drawn upon by magpies and to some extent the seasonal shifts in composition of food. Also, it is pointed out how the daily routine of the bird is adapted to securing sufficient amounts of the required substances. The habitats occupied are not always richly supplied with forage so that success of the bird becomes dependent upon its ability to accommodate itself to seemingly new situations. These adaptations in behavior, for gleaning food from a relatively barren land, provide some of the most interesting phases of the behavior of magpies. Comparison of geographically separated races provides an avenue for analyzing the deep-seated character of this ability.

The problem of obtaining enough food is probably not important for most birds, but it is an important one for magpies, and they are quick to take advantage of any opportunity presented by situations where more than ordinary amounts are available. The close vicinity of ranch houses or any small group of human habitations usually offers more than ordinary amounts of food.

With these birds, winter is a time of few activities. About all they have to do is to eat, and this means most of the daylight hours each day must be spent in searching for food. In California, the task is simpler than in other parts of the range of the bird. Here it is warm and moist, relative to the other places, and thus there is plenty of animal food. In the interior magpies must go where food may be found in quantity. They go to the neighborhood of stock farms and slaughter houses and must depend a great deal upon scavenger habits.

NUTTALLII.—Individuals of a colony observed in November, 1918, in Peachtree Valley, Monterey County, repeatedly descended from the oaks to forage on the open ground or among piles of dead brush and fallen tree-trunks. One bird was watched, hammering at something hard on the ground; it was thought that they were cracking open and eating the acorns that lay thickly on the ground (Hunt, MS).

Birds shot in late February that had been foraging out in newly sown grain fields in the Colusa district had their stomachs filled with sprouting barley (Grinnell, 1923, p. 172). Birds from other types of places had been feeding largely on ground beetles.

On the morning of November 11, 1930, I observed about thirty magpies near Meridian in the Sacramento Valley. First, a single bird was seen in the middle of the road close to a five-acre, close-growing grove of large valley oaks, where there were

farm buildings. On the opposite side of the road several magpies were foraging in a small patch of recently mown alfalfa. Adjacent to this was an equally small field of ripened grain (some sorghum crop). The individual plants were low and bushy, with large heads. Magpies were flying to this field, perching on the heads, and picking off the grain. There was much flying away from, and back to, the grain. Usually on these trips the birds went merely to the ground on a bare levee which surrounded the field. Many of the birds perched on the posts of a fence between the fields; nine were there at one time, all facing the same direction, into the strong north wind. After ten minutes, about twenty-five magpies flew up together from the grain patch and into the tops of the trees in the grove. By 10 a.m. the birds were practically silent.

Beginning at 10:45 a.m. at another place in the same neighborhood foraging magpies were watched. In one corner of a stubble feed lot there was a group of about twenty-five valley oaks. Fifteen head of cattle were lying in the shade or close to the trees. The ground here was nearly bare with some litter of straw and accumulated droppings of cattle. Some horses were grazing in an adjoining pasture. Several small sheds and some farm implements near by were exposed to the weather. Other kinds of birds foraging here were junco, Gambel sparrow, and lark sparrow. About twenty-five magpies were present, chiefly feeding on the ground in the shade beneath the trees. Occasionally individuals would perch in the crowns of trees, on implements, on the roof of a shed, or on the fence—on a post or on any of the cross strands of a woven wire fence.

Once, a magpie hopped at least a foot above the ground to pick some object off the lower trunk of a tree. Another was seen picking at something close to the ground and beneath the edge of bark on a stump. Most of the foraging, however, was done among the litter on the ground. The birds walked, or hopped when hurried, back and forth across the area, watching continuously and stopping frequently to pick at something on the ground. Whenever a piece of dried manure was reached, it usually was turned over with either a forward or sidewise thrust with the bill. Next, the bird would pick at the uncovered surface or at the overturned object. Sometimes one foot was used to hold down some object that was being pecked. Scratching in the litter was accomplished by a forward thrust, away from the feet, with the bill.

Once, ten birds were feeding on an area only ten feet across. On several occasions when one bird had made a find, another individual would make a quick rush to the spot, whereupon the first bird would withdraw. It was rare that the first bird would hold its ground. No actual encounters were seen.

Individual magpies almost continuously were seen flying off among, or to, trees in an adjoining orchard, but never more than two or three were seen at once. Either these returned soon, or others arrived to take their places, for the number present was nearly the same for more than an hour and a half. The birds seemed to pay no attention to automobiles passing in the road, and repeatedly individuals foraged to within fifteen yards of a parked automobile. A horse, pawing at the fence, frightened two or three birds that were close to it, but others, at a greater distance, stayed on the ground. Calls were given by the magpies with sufficient force to be noticed by me only a few times. A flock of crows present for a short time, but more than three times as far away as the magpies, made more noise than did the latter at any time.

At the colony near Coyote, Santa Clara County, on January 25, 1931, throughout the morning pairs of magpies, or single birds, foraged over the ground in the grove of valley oaks or in the open. One pair moved along near and past a feeding flicker, with neither species paying any attention to the other. All these birds were on the ground. The ground was covered with dead weeds, knee high, and with a carpet of newly sprouted plants two to three inches high. Also, some of the magpies went to feed in an orchard near by. About noon a magpie lit in the middle of the crown of a valley oak and then immediately dropped almost straight to the ground as if it had sighted some food object. Another individual hurried to the same spot. One of these birds left within a few seconds, but the other one stayed for several minutes.

Near the Sacramento River east of Maxwell on October 6, 1929, I watched a small flock of magpies as the birds actively foraged over the ground. Occasionally a bird gave a single note or a short series of notes. Large objects on the ground were held down with one foot and hammered at with the bill. Several individuals flew to a walnut tree where two or three picked at walnuts. One bird pulled a green walnut off the tree; this it held beneath one foot on a limb. It pecked into the husk three or four times and then dropped the walnut to the ground and flew away.

At another place a magpie was seen standing on the ground beneath a tree and holding a walnut in its bill. Late in the morning several magpies were seen carrying acorns or other objects in their bills. Birds, several times, flew up from the ground after large insects which they tried to catch. This was unsuccessful in at least three attempts. Once two magpies flew after the same insect.

At eight o'clock on the morning of November 11, 1930, I saw about ten magpies feeding in a bare field near the Sacramento River southeast of Colusa. Most of the birds were foraging singly or in two's, and occasionally there were three close together. Frequently one bird flew from one part of the field to another. On these flights the bird would often turn quickly and fly back a short distance as if some food object had been sighted from the air. One individual that was flying across the field carrying some object stopped on the ground and began pounding at the object. Also feeding on the ground and in the same field were many Brewer blackbirds, meadowlarks, a few crows, and one flicker. The magpies were much less noisy than foraging crows that had been watched a few minutes previously. Also they kept farther apart than did the crows.

A slaughter house situated about one mile from the town of Plymouth, Amador County, is said to be a favorite feeding ground of magpies and a place where they are always found.

On the afternoon of February 16, 1930, a magpie was watched on a main limb sixty feet up in the top of a valley oak where it held a food object down with one foot and pounded at it, swinging the whole body at each stroke. This was continued for more than a minute. A magpie watched on February 23, 1930, near Gilroy was holding an acorn of valley oak on the ground with one foot and picking at the meat of the acorn. Finally the bird picked up the acorn, crosswise in the bill, and flew with it one hundred yards away to a valley oak.

Three magpies were watched by me in Santa Clara County (February 23, 1930) as they foraged on a steeply sloping south-facing pasture hillside. On this slope were

many dried chips of cow manure. The magpies moved from one to another of these heaps of droppings which were about one yard apart. At each one the bird would stop, grasp the chip by the edge in the bill and pull until it turned over. The bird would then look on the uncovered spot for food, sometimes picking up something. At other times the bird walked on without obtaining food. One bird repeated this seven or eight times in less than two minutes.

On May 10, 1929, I observed magpies on open hillsides, fifteen miles southeast of San Jose, feeding especially where the ground had been cultivated recently. When feeding the birds ordinarily walked, but they often would make short, quick, running dashes, apparently in chase of moving insects. Eight individuals were seen in one scattered company on the ground at one time.

In the morning of May 11, 1929, I saw several magpies fly into the air from perches in the tops of trees and catch flying insects. In one instance the insect was actually seen as the bird took it. On two or three occasions birds in direct flight interrupted their courses, apparently to fly after a moving insect.

Near Colusa in the Sacramento Valley in late afternoon of October 4, 1929, I watched about fifty magpies actively feeding on bare ground, along with several flocks of the Brewer blackbird. The magpies were more scattered and were in less compact groups than the crows which foraged in flocks not far away.

The importance to wild birds of water for drinking has probably been underestimated because the birds are so seldom seen actually drinking. The needs of an individual bird for this substance can be satisfied in such a short time that it is not surprising that this activity is easily overlooked. An opportunity was afforded me on November 11, 1930, to watch magpies of a group satisfy their thirst for water. The birds were watched for several hours during the middle of the day as they foraged. The locality was near Meridian in the Sacramento Valley. For a few minutes just after noon all the magpies were off the ground at once, and they were resting quietly. Then, at 12:15 one flew down from the branches and perched on a pump at a metal water trough. After a few moments the bird hopped down to the edge of the tank and looked toward the water. This, however, it could not reach until it moved to a lower cross piece. From this latter perch the bird, by reaching nearly straight downward, was able to touch the water with its bill. After each dip of the bill the head was raised high, just as it is when a chicken drinks. By the aid of field glasses the drops of water could be seen on the bill.

Within a remarkably short time after this there were five magpies at this trough and two Brewer blackbirds at an adjacent one—all seeking to drink. Within the next few minutes several other magpies were seen at this trough. Possibly all the birds in the flock went there. A count was not kept. Birds came to drink at this tank many times in the next hour. Often there were five or six individuals there at one time. They appeared to be more intolerant of the presence of others of the same species than when foraging. Many dashes of one magpie toward another were seen, but no resistance was offered by any one individual. All the birds were forced to perch on a cross piece or at the end of the trough in order to reach the water. One bird tipped backward too far and this movement allowed the end of its tail to get wet.

HUDSONIA.—Mr. E. R. Kalmbach of the United States Bureau of Biological Survey

has made the most extensive laboratory study of the food of the magpie in North America. His published report (1927) is based upon the study of 547 stomachs, of which 313 were adults and 234 were nestlings. This material is fairly representative of the bird's range and is well distributed throughout the year. The chief points of interest concerning food of adults in this report are included in the following abstract. (See fig. 15.)

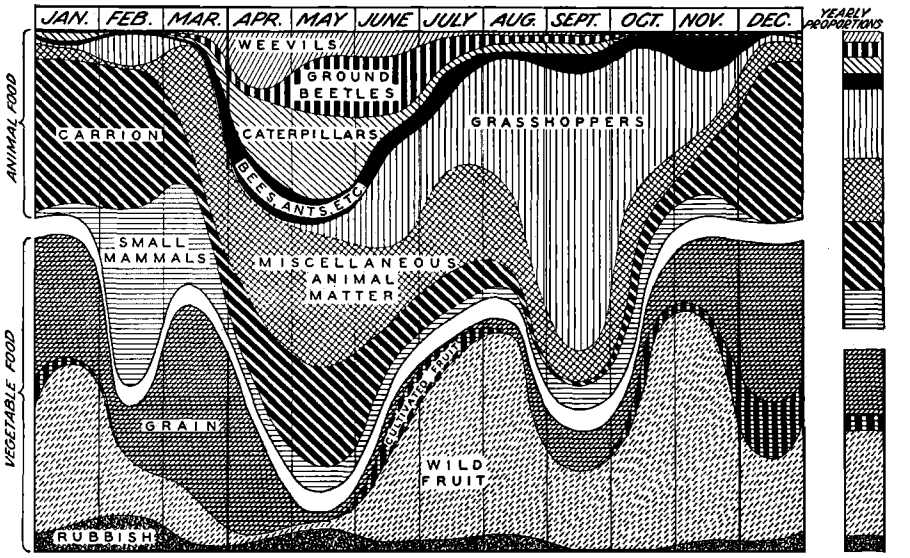


Fig. 15. Principal items in the food of the adult black-billed magpie, showing the varying proportions of each by bulk, from month to month, and the relative proportion of each in the aggregate annual food; based on the examination of the contents of 313 stomachs. From Kalmbach (1929, p. 8).

About three-fifths of the food of the magpies examined was of animal origin; the greatest proportion was found in May, during the breeding season. November, December, and January mark the period of smallest consumption of animal food. Insect food constitutes the predominant item for the magpie through the year. The species is more highly insectivorous than any other of the common species of the crow family in this country. The kinds of insects eaten were chiefly ones that live on or close to the surface of the ground. Grasshoppers form a conspicuous part of the diet during the late summer and fall. Insects associated with carrion were important in the magpie's food. It is pointed out (Kalmbach, 1927, p. 11) that in many local outbreaks "magpies doubtless have an important controlling influence" upon insect abundance. Two other items of animal matter that were important in the yearly averages of food were carrion (13.81%) and small mammals (7.61%).

The stomach examinations indicated that the magpie is "by preference carnivorous, and that the vegetable portion of its diet is taken more or less as a matter of necessity and not from choice. Notwithstanding the fact that wild fruit of one kind or another is as readily obtainable in September as in August or October, the magpie's food preferences lead it to resort extensively to grasshoppers during that month and to

reduce its consumption of wild fruit. There is every indication, also, that the grain eaten by magpies during the winter months is consumed largely as a matter of necessity. Grain could be secured in quantity during July and August at many points in the bird's range, but it turns naturally to an animal diet during those months. The rigorous weather of November, December, and January forces the magpie to adopt a diet that is more than 60 per cent vegetable, while in May the abundance of animal food permits it to reduce the vegetable portion of its diet to 8 per cent of the total."

The following detailed record of observations of magpies made by my mother, Mrs. Lena Linsdale, on a trip across Nevada, shows where these birds spend their time and where they obtain their food during late summer in that region. Also it shows clearly the importance of highways as providers of food for magpies. The numerous jackrabbits and other animals killed by automobiles add importantly to the food supply available for this bird. The chain of circumstances thus represented plays an important part in determining the local occurrence of the species during those seasons when search for food is the predominant activity, and when there is travel on the highways.

August 14, 1930. 7 a.m. Ten miles east of Battle Mountain, on Victory Highway. A desert between two mountain ranges covered with sage brush. Saw a flock of about ten magpies fly up from the brush and cross the road. Two miles farther, saw a magpie feeding at a dead snake in the road; a little farther, a flock of about ten, some on a wire fence, others sitting on the sage brush beside the road. The railroad ran about 100 feet from the highway, and a farmhouse stood on the other side of the railroad. Two miles on, saw three magpies flying, and on another mile, one was sitting beside the road. In the road near by, saw a dead jack rabbit. A quarter of a mile before reaching Farrell (a railroad station), two magpies were seen in the road feeding at a dead jack rabbit. Still in the desert of sage brush, a mountain range about half mile to the south. Thirty miles from Battle Mountain saw eight magpies, two feeding at two separate dead rabbits, the others flying.

Emigrant Pass (41 miles from Battle Mountain), saw magpie flying. Just over the summit saw one magpie sitting on sage brush and one flying. Then on a short ways, six magpies and four buzzards were flying across the road. Another quarter of mile, four were feeding at dead rabbit in the road. Forty miles out from Battle Mountain (still on the Pass), saw magpie eating dead rabbit. About another quarter of mile farther saw four others, one eating rabbit in road. This was about a mile before we reached Carlin.

Two miles east of Carlin, saw two buzzards and twenty-four magpies eating at dead rabbit in road. Half mile farther, one was sitting on sage brush. Another half mile, three were feeding at dead rabbit in road. In the valley east of Carlin about four miles, saw four magpies flying; cattle grazing in the pastures in the valley. Four or five miles farther, saw five magpies feeding at two rabbits. Two others sitting on telegraph wires. A mile farther, another was eating a dead rabbit. A farm house stood near the road.

Fifteen miles east of Elko, saw three magpies, one eating a dead rabbit. Thirty-three miles east of Elko, saw magpie flying. Here, rolling hills were covered with sage brush. Near Mountain View (41 miles east of Elko), saw three magpies, one eating rabbit. This was a wide valley, pasture lands, with cattle and horses grazing. Five miles farther, saw magpie sitting in pasture, four on fence beside the road. A farm house near. Two miles farther, two others were flying. A buzzard and four others were eating a rabbit. Six miles east of Wells (about noon) we saw one fly over the road. Here, rolling hills were covered with sage brush and trees four or five feet high. This was the last one we saw.

A foraging magpie was watched by me at close range in Smoky Valley, Nevada, on May 21, 1932. The bird flew to a place directly in front of an automobile in which I sat and picked up scraps of food on the ground. First the bird hopped and then it walked. It looked over the ground carefully and tested many objects such as egg shells and rejected some of them. It came within ten feet of the automobile, apparently taking no notice of me and finally left without being frightened.

Further evidence that magpies quickly take advantage of new forage opportunities that are offered them was obtained on May 22, in the locality mentioned above. On a recently flooded pasture, at 5 p.m., at least six magpies were seen foraging on the wet ground and at the margins of pools. This was on ground that was open, where magpies were rarely or never seen under ordinary circumstances.

Carcasses of dead cattle offer attractive feeding situations for magpies. The birds seem to be attracted regardless of the age of the carcass or of its location. Regular flight lines to such carcasses out in the sage brush were noted day after day. Probably a part of the attraction was supplied by the many scavenger insects that abounded at these places.

In an article on the shedding of the stomach lining by birds, McAtee (1917, p. 419) reported that one specimen of magpie, collected on May 7, 1914, at Farmington, Utah, had numerous pieces of old lining free in the stomach, the largest having been tightly rolled up by muscular action of the gizzard. In this specimen the new lining of the stomach was perfect.

Nestling black-billed magpies that were reared by me in captivity were fed portions of adult white rats, before they were able to pick up objects of their own accord. The bones and fur contained in this food were not digested, but they were later ejected through the mouth in compact pellets. Later, when the birds could pick up their own food, no pellet formation was noted.

These young birds regularly carried objects of food to various parts of the cage and attempted to hide them. Crevices of any sort, either on the floor or higher in the cage, were accepted as storage places. Usually, as soon as a bird deposited its piece of meat or other food, it would pick up a leaf and place it over the object. There were three birds, and a store of food, as a rule, was pounced upon by another individual almost as soon as the first bird turned away from it. Nearly always, however, a marked effort was made to protect the hidden store from any intruder. Many times, the food was pushed too far into some crevice whence it could not be retrieved. The behavior here reported upon is evidently paralleled by similar habits in the wild. Magpies are regularly observed carrying food in their bills, and doubtless much of this is hidden. The question, whether the birds ever return to and make use of these stores, needs further inquiry. The widespread persistence of the habit suggests that it serves to benefit the species. Similar behavior in young California jays was reported recently by Mailliard (1932, p. 189).

Henderson (1927, p. 227) recorded that a magpie "is reported to have killed a rattlesnake after a long struggle." He concluded from a general study of this species that the "bad habits probably outweigh the good done in the destruction of noxious mammals, insects, etc., especially where the birds are abundant."

The following observations on the responses of captive magpies and alligator lizards (*Gerrhonotus*) to one another were made by Mr. Henry S. Fitch (MS) in October, 1932. When the lizard was placed in the cage with the birds, it assumed a defensive attitude, standing high off the floor with its body tilted toward the nearest bird. The head was turned sideways and lowered with jaws gaping, thus protecting the neck on the side from which attack was expected. The body was bent slightly, and the tail was looped in a half circle so that after a cautious approach the magpie pecked at the

tail first. The lizard sprang at the bird with a sudden straightening of its body. The bird dodged and jumped back. When the magpie was eight or ten feet away, the lizard seemed to lose track of its position except when it was moving. Several times when a magpie came near, the lizard charged straight toward it for a foot or more and drove it back.

All three magpies became highly excited and hopped around the lizard, each in turn closing in to deliver a peck as it turned in the opposite direction. The lizard showed inability to watch more than one assailant at a time, or to shift attention rapidly from one to another. During the encounter the lizard's tail was broken. At the instant the tail parted, none of the birds was touching it, but undoubtedly it had been injured by them, as many blows had landed upon it. Up to this time the lizard had made no attempt to escape but for the most part had taken the offensive. It now made a short run to the nearest shelter, a dish in the cage, beneath which it hid. At this instant the attention of all three birds was focused upon the squirming tail whose lively movements contrasted with the previous inactivity of the lizard itself. Evidently they failed to distinguish between the tail and the lizard. No further search was made for the reptile after one of the birds had "overpowered" and eaten the tail. Many other individuals which were placed in the magpie cage at different times showed similar defense reactions.

OTHER KINDS OF MAGPIES.—In Cumberland, England, throughout the winter, Brown (1924, p. 127) noticed magpies often overturning the droppings of beasts in order to get concealed insects.

An extensive study of the food of magpies was carried on in Hungary by Csiki (1919, p. 76). His report gives detailed results of the examination of 351 stomachs, including a table arranged to show the number of stomachs containing each item in each month of the year. Vegetable matter was eaten mostly in the winter months, and but few kinds of material were found. Corn, wheat, and barley were taken most often, being found in 75, 24 and 23 stomachs, respectively. The greater bulk of the material was animal matter. The stomachs of 59 birds contained small mammals, as follows: *Crocidura leucodon,* 1; *Arvicola arvalis,* 9; mice, 49. Seven stomachs held portions of birds, 19 contained lizards (*Lacerta*), and two contained egg shells. Most of the remainder of the food was insect matter. Beetles made up the best represented group, 207 different kinds being found. Fifteen kinds of beetles were each found in ten or more magpie stomachs. Inspection of the list of species names reveals that many, or most, of them are ones which would be found close to the ground surface. Nine kinds of Orthoptera were found, the three most numerous being *Gryllus campestris,* in 57 stomachs, *Gryllotalpa vulgaris,* in 20, *Stenobothrus* sp., in 18.

Another extensive study of the food of various members of the Corvidae has been published upon by Madon (1928). Comments are made upon the food habits of magpies in central Europe, Russia, Italy, Great Britain, France, and northern Africa. In the report of experiments on digestion it is stated that a seventeen-day old magpie (weight 155 gm.) was fed three grams of magpie-flesh and fifty grains of wheat that had been soaked for 30 hours. When the bird was killed one hour and five minutes later its stomach contained five vertebrae, one feather and fifteen intact grains and seven broken ones. Another bird was fed two grams of meat and 50 grains of wheat.

It was killed two hours later, and in its stomach there were two large vertebrae and fragments of bone and nine whole grains and three broken ones.

Knight (1921, p. 34) has reported that once, while watching young buzzards, he "saw a magpie fly into the tree, and take from a branch below the nest a piece of rabbit—or rabbit skin—which had fallen overboard; I have also seen magpies thus searching for scraps of food under a Heron's nest."

The Zoologist (1845, p. 1073) quoted from the Lancaster Gazette an account of a magpie attacking a half-grown rabbit and endeavoring to pick out its eyes. The rabbit died shortly afterwards.

The formation and ejection of pellets by magpies in England was noted long ago by Cox (1864, p. 8952), who wrote concerning the food habits of the species, as follows: ". . . let anyone who has the opportunity examine the surface of the ground under a magpie's nest, and he will be astonished to find numerous pellets, about three-quarters of an inch long, and nearly half an inch in diameter, which have been cast up from the crop, and composed almost entirely of the undigested hard wing-cases of small beetles. . . . Again, I am prepared to state that I have never found any portion of the eggs of other birds under the trees where the magpies build in my garden. I have found four heads of mice, and once that of a young mole." It seems possible that this observation may apply to some secondary occupant of the nest.

Whitaker (1905) has remarked that on the arid semi-desert wastes of Tunisia the diet of the magpie consists largely of locusts and Coleoptera, which abound in those regions.

Collinge (1930, p. 155) who is perhaps the most prominent student of the food of birds in England has summarized his investigation of the food of magpies as follows. Animal food constitutes 74.5 per cent of the total consumed, of which 34.5 per cent consists of injurious insects, 2.5 per cent of beneficial insects, 8.5 per cent of neutral insects, 3 per cent of slugs and snails, 5.5 per cent of rats, mice and voles, 3.5 per cent of young birds, 5.5 per cent of eggs of wild birds, 0.5 per cent of frogs, 4.5 per cent of earthworms, and 6.5 per cent of miscellaneous animal matter. The vegetable food consists of 2.5 per cent of cereals, 2.5 per cent of fruit, peas and potatoes, 16.5 per cent of wild fruit and weed seeds, and 4 per cent of miscellaneous vegetable matter. He estimates that 43 per cent of the food constitutes a benefit to the farmer and fruit-grower, 40.5 per cent is of neutral nature and only 16.5 per cent injurious. The obvious conclusion, then, is that the harm done is more than counterbalanced by the benefits conferred.

Newman (1863, p. 8762) and Norgate (1881, p. 321) have given summaries of the food of magpies by months in England.

MIGRATION

The part which true migration occupies in the annual life cycle of magpies varies from practically nothing in some of the forms to a highly developed and regularly occurring movement on the part of others. The races which exhibit the highest development of migration are the ones which live in Asia, and which are least known. For this reason the present discussion is closely limited to material dealing with the nature and extent of movements in the more sedentary forms of the genus. In one sense these are most interesting as indicating, possibly, latent tendencies relict from, or beginning tendencies toward, better developed and more regularly expressed annual travels.

The migratory habit in magpies is developed to different degrees, depending, apparently, upon the necessity for escaping severe winter conditions. In California, southern Europe, northern Africa, and many parts of southern Asia, the birds stay in practically the same places in which they nest. As we proceed northward and encounter more and more severe winters we find more and more migration of magpies. Some of the birds make annual round-trip migrations of thousands of miles.

Within recent years there have been many winter records of magpies in Kansas, Iowa, Minnesota and other central states which ordinarily are outside the range of the species. There was one invasion of Death Valley in California when many hundreds appeared suddenly one winter.

NUTTALLII.—Yellow-billed magpies are rarely seen more than a few miles distant from locations of nesting colonies. This gives basis for the suggestion that wanderings of the individuals are markedly limited and probably never reach the status of being a migration.

HUDSONIA.—A resident of Death Valley, Mr. Denton, reported that great flocks of magpies, about 1500 in all, came from the north about October 25, 1919, and swarmed all over the fields of Furnace Creek ranch. He had never seen the birds in that region before. The magpies gradually drifted away until by the end of December only a small number of individuals was left (Grinnell, 1923, p. 75).

In Montana, although the bird is resident, there is a movement of many individuals into the mountains in the fall (Saunders, 1921, p. 94). This takes place in October at the time of the first cold weather and snowstorms. The birds have been seen as high as 8000- and 9000-foot altitudes. The same writer reported that the birds were not seen at these high altitudes in winter.

Bendire records (1895, p. 349) that along the eastern border of its range the magpie occasionally wanders eastward in late fall and winter. He thought that the birds were driven away from their usual haunts by scarcity of food or the severe storms which so frequently occur in those sections of the country.

An especially well-marked movement of this sort took place in the Missouri Valley in the fall of 1921. Several notices of this movement have already been published for Iowa, Nebraska and Kansas. Stephens (1930, p. 362) has summarized the records for Iowa where the invading birds extended well into the central part of the state. He has "no explanation to offer" and knew of none that had been offered to account for the invasion. One taxidermist in Sioux City received eighteen specimens of magpies for mounting in the two-month period from October 3 to December 4, 1921. Most of

these birds came from different localities but all within a rather limited area. One of them was shot out of a flock of twenty-five. The easternmost record for this movement in Iowa is of a magpie killed on December 1, 1921, near Cedar Rapids, Linn County (Stoner, 1922, p. 44).

The extent of this winter movement across Minnesota was recorded by Roberts (1922, p. 46). At the time of his report the species had been seen at nine different localities, widely separated but all in the southern half of the state. Thus within two months beginning October 10, 1921, the records numbered more than half the total for all previous years. The number of individual magpies seen was thirty-four. The farthest east locality was at Red Wing in the Mississippi Valley, on the Wisconsin line. There were at least two records of magpies in the southwestern part of Minnesota in the fall of 1922 (Roberts, 1923, p. 51).

In Manitoba, Criddle (1923, p. 25) noticed that "in the fall of 1921 Magpies invaded the province in much larger numbers than usual and as a result they were met with at least as far north as Dauphin and east beyond Winnipeg." At his home near Treesbank the birds were in daily attendance around the farmyard, where they picked up any article of diet available, the dust heaps being especially attractive to them. A similar bunch of visitants was present at most of the farms where trees afforded shelter and many found their way into the hands of taxidermists."

Migration of magpies was observed on the Taku River, Alaska, in the fall of 1909 (Swarth, 1911, p. 77). The first bird was seen on September 14, and shortly after that the species became common. Flocks of eight or ten individuals were sometimes seen flying overhead. The general movement was from the interior out to the coast where the birds spent the winter. The two specimens obtained had just acquired the first winter plumage.

In the fall of 1904, a flock of seventeen magpies was seen near the Costilla River, New Mexico, at a 10,000-foot altitude (Bailey, 1928, p. 481). Two days later the same flock was seen, five miles farther up the valley, at 10,700 feet.

In writing of the migration of magpies from eastern Washington and back Dawson (1909, p. 30) made the following interesting comments: "They return early in spring by way of the major passes, and are not again seen within the heavily timbered areas during the breeding season. Mr. D. E. Brown, then of Glacier, on the north fork of the Nooksack River, records under date of March 4, 1905, the appearance of several bands of Magpies passing eastward at a considerable height, perhaps something between three and five thousand feet. He says they were unrecognizable until glasses were trained on them, and he thinks he must have seen at least fifty birds, with chances for many more to have passed unobserved."

In the vicinity of Tacoma, Washington, Bowles (1906, p. 145) reported the magpie as a "rather common migrant from east of the Cascades."

A black-billed magpie banded at Laramie, Wyoming, May 30, 1925, was recovered, January 14, 1926, at Rosita, Colorado (Lincoln, 1927, p. 41). This latter locality is approximately 220 miles from the station of banding and is almost directly south of it.

In northern British Columbia, Swarth (1926, p. 119) was told by local resident persons that magpies did not nest about Atlin but that they appeared there at the end of the summer. He saw several at Gladys Lake, September 8, and on September 19 one appeared at Atlin. The species was seen each day until the 23rd, when he left.

Time of fall dispersal of magpies in Washington was determined by Taylor and Shaw (1927, p. 180) who observed the first birds on Mount Rainier on August 28 and saw individuals thereafter until late in September.

OTHER KINDS OF MAGPIES.—Witherby (1920, p. 22) says that there is some evidence on the eastern and southeastern coasts of England that magpies there migrate. Otherwise the bird is generally considered sedentary and resident in that country.

Recovery of banded individuals has furnished the most dependable information as to the nature and extent of movements in this bird. A magpie banded in Germany on June 7, 1922, was caught two years and seven months later in a fox trap in the same vicinity. Another one banded May 29, 1921, as a nestling was recovered thirty kilometers to the northwest in May, 1924 (Thienemann, 1926, p. 65). The same writer (1924, p. 212) records a magpie banded as a nestling on June 11, 1919, and recovered in July, three years later, in the same vicinity. Another, banded on July 6, 1922, was killed on September 24, of the same year, only two or three kilometers from the place of banding. A nestling bird, banded on June 11, 1919, was recovered on July 16, 1920, eight kilometers to the southward (1922, p. 81). An old bird, marked in February, 1919, was found dead on April 24, 1920, only two kilometers away. One, marked on May 31, 1912, at the age of 15 to 18 days, was found dead 8½ months later, in the same vicinity (1914, p. 473). One marked on June 9, 1913, was recovered on August 23, 1913, 2½ kilometers from the marking place (1915, p. 492). One, marked on July 24, 1913, was killed, December 14, 1915, over 2 years later, 37 kilometers to the southwest.

Schenk (1919, p. 39) reported that a young magpie banded on June 6, 1917, at Lepsény, Hungary, was recovered on December 29, 1917, at Polgárdi. The latter locality is twelve kilometers to the southwest of the place of banding. Lucanus (1919, p. 43) reported that two young magpies remained at the place of banding.

The magazine, *British Birds,* has reported the recovery of three magpies marked in recent years, as follows: A young bird marked, May 13, 1929, by C. R. Stoner, near Wells, Somerset County, England, was recovered where ringed by H. S. Lumber on June 2, 1930 (*op. cit.,* 1930, p. 179). Another young magpie, marked May 21, 1930, by T. L. Smith at Kirriemuir, near the center of Forfar County, Scotland, was recovered on April 24, 1931, by A. Robertson, at Edzell, in the northeastern part of the same county. The second locality is about sixteen miles, in an air line, northeast from the first. A third young magpie was marked, May 30, 1930, near Appleton, Berkshire County, England, and was recovered, March 11, 1931, at Kingston Bagpuize, in the same county, by W. Chapple (*op. cit.,* 1931, p. 45). The locality of capture is about five miles southwest of the first one.

In a summary of returns from banded birds Schüz and Weigold (1931, p. 73) reported that in no case had a marked magpie been recovered more than fifty kilometers from the place of marking. They had returns from the British Isles, Holland, Germany, Denmark, Finland, Switzerland and Hungary.

Stewart (1928, p. 49) points out that he had "mentioned the Magpie's very sedentary habits, and in Lanarkshire the maximum movements of immature individuals consist of pushing their way into districts where game is preserved, and where a warm reception awaits them. Migratory movements are entirely absent."

Magpies were observed in summer but few times in Orenburg, in eastern Russia, by Grote (1919, p. 357). In the fall, beginning about September 1, they became more frequent until, during the cold winter months, this was the dominant bird. In the fall he often observed them especially in afternoon hours, as small troops or single individuals flew over in a southern direction. The implication is that in this region migration takes place chiefly in daylight hours.

Whitaker (1905, p. 11) reports that although the magpie (form *mauritanica*) is a resident bird in Tunisia, it is sometimes not found in a district where it was formerly abundant. He suggests that possibly the absence of food or water in a place may be the cause of the bird's moving from one locality to another.

NESTING TERRITORY AND COURTSHIP

Territory has come to signify a phase of field study of birds of more than ordinary interest. The importance of and the justification for the interest need not be questioned in pointing out that other sides of the activity of a bird merit attention and an attempt at analysis. Without in any way detracting from the value of the discovery of a way to bring order out of the records of bird watching it can be recalled that territory is only one of the unifying elements in the life of a bird. A complete understanding of the rôle of territory would leave much to be explained in bird behavior. It may be better to consider this part of the life of a bird in its relation to the whole cycle of activity than to continue to give it separate emphasis.

In the magpie this procedure seems the more natural because, in this bird, the responses to territory appear to be less conspicuous than they have been shown to be in some species. In this bird, territory seems less distinct than in kinds where it has been studied most. These may have been selected because of a high degree of development of this habit. It is difficult, in the magpie, to separate the actions of the nesting time, which have to do with territory, from other phases of the life cycle of the bird. For this reason discussion of territorial relations has been combined with consideration of courtship and other phases of the early portion of the nesting cycle. This includes the characteristics, extent, selection and defense of the territory and such influents of courtship as season, manner, voice, display, and the problem of "mating for life."

As with many other kinds of birds it seems to be usual for a magpie which has lost a mate to find another one and go on with the nesting cycle from whatever stage was interrupted. Many instances are known in which one of a nesting pair of magpies has been killed and the remaining bird has secured a mate. As many as six successive mates have been replaced at one nest. Either the male or the female may be replaced. Usually the lost mate is replaced within twenty-four hours. The activities of finding a lost mate seem to be much like those of the regular season of courtship. There is a congregation of birds, and after the birds scatter a new mate is in the place of the lost one. A strange thing in this connection is that one seldom sees lone birds during the nesting season, or at least is seldom able to recognize them as such.

NUTTALLII.—In 1931 first indications of nesting activities of magpies were noted by me on January 18. In a small grove of valley oaks two and one-half miles southwest of Coyote, Santa Clara County, at 8:15 a.m. about ten birds were on the ground and several more were in the trees. Most of the magpies watched during the next hour and a half were paired birds which kept near one another. Birds were seen at three nests and appeared to visit several others. All the nests seemed to be the same ones as were observed the previous year. A bird left one nest just before 8:30, and this nest was then watched closely. No bird went near it for an hour, when two came and perched close by. They went to a nest in an adjacent tree, remained about it for several minutes, and then flew to the ground.

As nearly as could be made out, the birds of each pair spent most of their time on the ground, usually close to their nest-tree. Every few minutes one, or usually both birds, of a pair would fly to the nest and perch in the tree either close by or directly on the nest, or even inside the nest cavity. No bird was seen to carry any material for nearly two hours.

A jay-like clicking noise was heard several times. Also, on several occasions when more than two birds were together, there were loud notes, in tones which gave an impression of excitement. One bird gave calls and appeared to make a sort of posture —holding the head farther back than usual, with the tail slightly raised and body lowered. However, it could not be determined definitely whether this posture was an habitual one.

On the same day, for the first two hours after noon, magpies were watched at a colony three miles east of Madrone, also in Santa Clara County. Much of this time birds were within sight perched close to nests in the tops of tall sycamores (fig. 16).

Fig. 16

Fig. 17

Fig. 16. Nesting site of yellow-billed magpie, in a small sycamore close to Coyote Creek, three miles east of Madrone, Santa Clara County, California. Photographed on April 13, 1930.

Fig. 17. Nest (A) of yellow-billed magpie in partly dead valley oak near Coyote, Santa Clara County, California. This is the nest referred to most often in the text. Photographed on April 13, 1930.

The two birds of a pair would perch within a few inches of each other or, sometimes, as far apart as ten feet. At one time there were two pairs in the same tree. Most of the time the birds were quiet, but some single notes were given, as well as low, soft sounds that barely could be heard by a person one hundred yards away. It was apparent that in each pair one bird showed more concern than the other one to keep with

its mate. When one bird moved, the other usually followed within a few feet. That is, it left its perch within a second or so.

Near Coyote, Santa Clara County, on January 18, 1931, a pair of magpies flew to a tree where a California woodpecker was perched. The latter repeatedly flew after the magpies, driving them from perch to perch until they left the tree and flew to an adjacent one in which there was a nest. Immediately two birds flew from the ground toward this tree, making loud notes of alarm. Just as this pair of magpies reached the tree the first pair left. Two or three times, when intervening limbs obscured the view, one or two magpies were seen flying after another or others.

At 9:30 a.m. on January 25, the pair of magpies at nest A in this grove was being watched when magpies in another part of the grove began an excited chattering and at least two of them flew directly to this nest (fig. 17). There was active fighting, at first, among these four birds. Later one or two other individuals joined them. By two's and three's they fluttered together and, leaving their perches, dropped to the ground. Striking with the bill and with fluttering wings was continued for a few seconds; then all returned to the crown of the tree. One pair remained at this nest, and the others moved off to the eastward into the main part of the grove. The calling and conspicuous moving about of the half-dozen birds continued for more than half an hour. The exact procedure of the demonstration was not clear beyond the appearance of extraordinary excitement and the evident organization by pairs. A reasonable objective for the whole performance was not evident. Neither the cause nor the result of it could be determined satisfactorily. Finally, the birds became more quiet and were noted active about their nests again. The pair at nest A, the birds attacked at first, seemed to pay no attention to the others after they left the nest tree. These two perched on branches of their tree and moved into and out of their nest.

At nine o'clock on the morning of February 22, 1931, both birds from nest A, near Coyote, flew at a California woodpecker perched near the nest and drove it from its perch. Later in the morning when four or five woodpeckers were moving about near the nest, a magpie flew out from it and at one of the woodpeckers, driving it from the tree.

At the colony near Coyote on January 25, 1931, the magpies at nest A were watched as they perched near their nest. They kept side by side and one of them, over and over, gave jay-like clicking notes—with its bill opened. It appeared to peck, gently, about the head of the other bird. The second bird seemed to be rather indifferent to these attentions. Once or twice it moved a few inches to another perch, as if to avoid annoyance. On every such occasion the first bird followed immediately.

The hours between 8:30 a.m. and 1 p.m. of February 28, 1932, were spent at the magpie colony mentioned above. A blanket of fog hung close to the ground over most of the valley during the morning, but, even when we arrived, there was a small clear area immediately about the oak grove. The sun was shining there about half the time during the morning. Magpies were present during the whole time, and they were noisy most of the time. Apparently, most of the birds in the colony had paired and had selected sites for nests—or rather they had selected last year's nests to occupy. At least, particular pairs seemed to be attached to particular nests which they kept near, and to which they flew on the approach of any other bird. There was more

activity that could be interpreted as territorial defense than I had noted before. Evidently this stage is an important one in the establishment of the home range of each pair of birds.

Throughout the morning there was a continual chatter and movement among the birds. From the center of the grove a group of 3, 5, 7, or some other number of birds, would fly out from the tops of the trees and would circle among and through the branches, obviously in some sort of pursuit flight whose significance could not be seen. These groups would break up, usually into pairs and even trios which would settle in the trees, and remain quiet for several minutes. Some time was spent on the ground, foraging, but this was limited. The excitement of the birds was too great to permit them to spend much of their time away from the immediate vicinity of the nests.

Possibly some of the magpies were still unmated, and the flights may have been groups of males in pursuit of single females; the male persisting longest being the accepted one. In other cases the pursuit was plainly an effort to drive away intruders from the neighborhood of a chosen nest site. Several times, one or two magpies would light in a tree in which there was a nest, and almost immediately the owners would hurry there and drive away the intruders.

One bird was seen to break off a short twig (about 3 inches long) which it soon dropped. Others went to and entered the nests many times, but I did not detect any one of them carrying any material there. One was seen carrying some object which it held on a limb and pecked. Some freshly broken twigs were found on the ground beneath the nests, indicating that some carrying of material had taken place that season.

Particular watch was kept to see if birds were noisy at their nests. Individuals were seen repeatedly to perch on or very near a nest and there to call loudly.

At least one pair of sparrow hawks remained in the grove all morning, but evidently the birds had not located a satisfactory nesting site. One or both birds were seen to enter at least three different magpie nests, including one that was used by hawks last year, but each time magpies came and drove them off. The hawks showed little resistance; once one flew at and drove away a magpie; evidently they had not yet made a selection and so had nothing to defend.

On this day, the chief activity in the magpie colony seemed to be the formation of habits which would preserve the territorial rights of each pair and yet permit the whole group to occupy, harmoniously, the single small grove. Later the birds would be busy, each pair about its own particular nest, and fewer encounters would be expected. However, it is plain that without some such period of preliminary preparation and establishment of property limits it would be hard for the birds to carry out the remainder of their nesting without giving much of their time and energy to keeping off intruders. Watching only late stages of nesting might easily give the impression that this species has no territorial instincts. On the other hand, watching only early stages might lead to the conclusion that nesting activity is predominantly a struggle for the defense of territory. Observation of the whole cycle is necessary to show the proper sequences and importance of these changing activities.

A week later, on March 6, the birds in this colony were much more quiet in the morning than they had been on February 28. They spent much more time foraging

on the ground beneath the trees in the grove and in the orchard on the north side of the road. At 11 o'clock one bird flew rapidly to the grove and perched in the top of a tree. Soon others made a commotion, and there were loud calls. Three or four birds clashed in the tree, and there was a determined effort to drive away at least one individual, but it moved among the small branches so as to remain protected from the approach of the others. Later the four birds were on the ground, and there were several skirmishes between individuals. One bird would run at another, they would jump into the air, claw at one another and settle to the ground again.

Evidences of territorial defense were noted in this colony, on March 13. Two magpies flew from a nest that had been occupied the year before by sparrow hawks, and they lit in the top of the same tree. A minute later a third magpie flew toward and lit near the nest. Both the first two flew to and drove off the intruder, and one of them pursued it for a short distance. The third bird lit in a nearby tree.

Later in the morning, at 10:05 a.m., a group of about fifteen magpies flew to the trees from a freshly plowed field to the east of the grove, where they had been foraging on the ground for more than an hour. Two of them perched near an occupied nest, and then one moved to the top of the nest and began to pull at the sticks which made up the roof. On the third attempt a stick was successfully extracted, and the bird flew off to the southern part of the grove where, presumably, it was building a nest. The guarding against this smuggling of nest material may be an important function of the territorial defense reactions in this species. The birds ordinarily feed together in groups and usually at a distance from the nests. Defending the area about the nest may thus be more useful as protection of property that has been obtained at expense of energy than for insuring an adequate feeding ground.

Near West Butte at about 10 a.m. on February 16, 1930, I saw a magpie pursuing another one close to the ground among oak trees for about one hundred yards. Both birds then settled on the ground and became quiet. At another time when four magpies were near together on the ground, a chattering commotion was heard, and one or two of the birds fluttered a short distance into the air, but they settled back quietly to the ground.

Magpies from nest A in the colony near Coyote on April 5, 1931, flew at a group of four or five Brewer blackbirds in a tree adjacent to the nest tree and drove them away. Then a magpie flew after and chased a single blackbird.

On one occasion at this same colony an opportunity was afforded for me to watch a part of a conflict presumably for some sort of territorial privileges between a magpie and a sparrow hawk. One of the trees contained a magpie's nest which was used by a pair of nesting sparrow hawks in the 1931 season. At 9 o'clock on the morning of April 12 a magpie was in this tree. At least four times within half an hour a sparrow hawk was seen chasing the magpie. Once it merely flew at and drove the magpie from its perch to another one close by. The other three times the hawk persisted in the chase which was over a circular course among the trees or in the open and extending for more than one hundred yards. These flights were either continuous or interrupted by short pauses on some perch. All of them ended in the tree from which they started. Once the magpie appeared to turn on the hawk and drive it back to the tree. At least the hawk was in the lead and by only a short distance. When not being pursued, the

magpie seemed to be searching for food among the branches of the tree. It continually made short, quick dashes from one branch to another as if foraging.

Later in the morning the magpie (supposedly the same one) came to this tree. It perched near to and then flew at the sparrow hawk, thus indicating that it had been the aggressor in previous encounters, but had fled when the hawk was roused sufficiently to pursue it.

On March 6, 1932, two magpies were working at a nest at this colony. When two sparrow hawks perched near the nest, one of the magpies flew at them. Soon the sparrow hawks perched on a nearby stub. The magpies perched near the intruders and then gradually moved nearer until the hawks became restless and finally left. Two magpies and two sparrow hawks were perched close to a nest on March 13. A magpie nearly lost its balance in dodging one of the hawks that started to fly away.

In one of the cages in the San Diego Zoo, on April 21, 1932, I watched magpies in one of the sections of the pigeon cage. There were two yellow-billed magpies, three black-billed ones, and a foreign corvid. The keeper said that these birds often carried pieces of food about the cage in efforts to hide them. These birds appeared to pay no attention to persons standing outside the cage, and it was thought that the two yellow-billed ones would nest if they were separated from the others. They "fed each other" and stayed close together. I was assured that the smaller one was the male; the two had been seen copulating. During most of the time I watched, this smaller bird was perched close to the other one and was working its opened bill through the feathers about and mostly on the top of the head of the larger one. This is just what I have seen mated pairs do many times in the wild. The feathers were preened and worked over just as though the bird were looking for parasites, but the real significance of the behavior must be connected with mating behavior. Most of the wild birds observed, behaving thus, have been perched directly on the nest or on a limb very close to it.

During the early days of California it was observed that colonies of the yellow-billed magpie would nest in certain localities for a long time if they were not molested (Belding, 1890, p. 108). However, Cooper (1875, p. 198) commented upon the propensity of this bird to wander and indicated that it, "like the other races," may reside at a place for a few years and then disappear for a time. He had been told that the birds had been formerly numerous in places where none were then found. In 1855 he found magpies twenty miles nearer San Francisco than in 1873, when none was seen nearer that city than sixty miles in any direction.

It was pointed out by Dawson (1923, p. 41) that these birds sometimes show great attachment for certain nesting localities, even in some cases enduring persecution year after year to occupy the same trees. However he adds that at other times, especially in level country dotted with valley oaks, a colony may shift from year to year.

HUDSONIA.—It was the experience of Bendire (1895, p. 351) that sometimes two or three pairs nested close together, but that more often each pair had its own small cañon or ravine in which it would be found from year to year.

The opinion has been expressed by Bendire (1895, p. 351) that magpies remain mated through life. Similarly Goss writes (1891, p. 376) that the birds appear to remain mated during the year. One nest near Lake Tahoe, California, was occupied for at least six years, presumably by the same pair of magpies. The nest-tree was within ten feet of a dwelling (Wheelock, 1904, p. 384).

Tullsen (1911, p. 90) records a note of the breeding season, not heard at other times. He characterizes it as "a soft, tender call, hard to describe or imitate."

Often two or three unoccupied nests, probably built by the same pair of birds, are close to the one in use. However, the same nest may be made use of for several seasons in succession (Bendire, 1895, p. 351).

There has so far been no opportunity to make satisfactory observations on the behavior of magpies at the time of sexual union. However, there are two records of probable significance for interpretation of this part of the breeding cycle. Just before 6:15 a.m. on May 15, 1930, magpies were about my camp in central Nevada, picking up scraps of meat. Next, two of the birds were seen on the ground in a roadway at a distance of one hundred and fifty yards. They were so far away that every move could not be made out distinctly, but they appeared to be in copula for about thirty seconds. For a part of that time there was flapping of wings and a series of peculiar, high-pitched, one-syllabled notes. At the conclusion of the time the birds faced each other and the female (?) flew off for a short distance while the other bird remained for a minute or so before flying. Immediately, when the calls were made, fifteen or more magpies flew rapidly and straight from several directions to this place, but they merely perched near there and hopped or walked about. They soon scattered. Whitman's observations (Carr, 1919, p. 14) on pigeon behavior revealed a closely similar habit in that group of birds.

Additional information on the mating behavior of magpies was supplied by E. I. Dyer (MS). His observations were made on two captive birds obtained by him in February, 1934, and supposedly taken from the nest, in eastern Washington, the year before. The birds were kept in a large outdoor cage, and in the spring of 1935 they built a nest. Copulation, accompanied by much noise, was observed on April 27, when it was determined that the smaller bird was a female. About 4:30 p.m. on April 28, Mr. Dyer was watching the magpies in the cage. The male was carrying a cashew nut about; the female was looking at the nest and occasionally touching it with her bill, and everything was quiet. Then, the female moved to a perch and displayed, seeming to invite the attention of the male; he alighted beside her and raised both wings. The female seemed seized with vertigo, fell over backward and hung from the perch by one foot, tried to recover, lost her grip, but hung on by her chin, fluttering wildly, without vocal sound, nictitating membrane oscillating. She fell to the ground, wings useless, and lay gasping on her belly, wings extended, tail spread, seeming to be in a fit. The male dropped down and fanned above her with his wings, standing to one side.

The female tried unsuccessfully to get up and fly. She managed to climb a few inches up to the mud sill on which the cage was mounted and to which the wire mesh was stapled. She fell off, recovered, tried to fly to the perch, and then climbed the wire by inserting her bill through the mesh as an aid, making plaintive sounds and fluttering. When she had reached the level of the perch and was displayed flat against the wire, the male tried to mount her, but was shaken off. The female fell to the ground and seemed to be dying. She recovered partly, reclimbed the wire and got onto the perch, swaying dizzily, and appearing bewildered and stupid, with the nictitating membranes closed for long periods of time. She swayed and fell off, landing on her back in the top of a bush, but was unable to right herself and slid off. The male was

much excited and noisy, but did not bother her. Again she climbed the wire to the height of the perch, but was unable to transfer herself to it and clung there motionless. Mr. Dyer took her off the wire without resistance and held her in his hands; she lay quiet. When placed in the nest, she screamed and flew to the perch. The male then became greatly excited and made twice as much noise as before. Mr. Dyer had to leave at this time, but when he returned less than an hour later, the birds appeared to be normal and were moving about freely. By 9 o'clock the next morning everything appeared normal, and more work had been done at the nest. On April 30, at 10:30 a.m. the magpies had an egg which the male was carrying about, but there was no trace of it a few minutes later. Later eggs were treated similarly, both in 1935 and 1936 and by both birds.

It is impossible to say how much of this incident resulted from captivity of the birds, but I suspect that many of the traits exhibited were really only slightly exaggerated aspects of normal behavior.

OTHER KINDS OF MAGPIES.—Graves (1884, p. 344) recorded that in England, a certain pair of magpies began each year to nest in February "selecting the sites often with much deliberation" but he gives no further explanation as to the behavior of the birds at this stage of their nesting cycle.

In Cumberland, Brown (1924, p. 178) has known of instances in which magpies attacked crows which came near their nests; one pair disputed with a pair of carrion crows the possession of a clump of fir trees, evidently for the breeding site.

An instance has been recorded (Calvert, 1897, p. 427) in which a magpie's nest in a slender birch tree was not more than three yards from a wood pigeon's nest in the upper part of a sapling oak. The former contained young birds nearly ready to fly, while the latter held two well-incubated eggs.

Four magpies kept in captivity by Bree (1863, p. 8632) paired, and each pair took possession of a lignum-vita tree in the garden. The birds "most assiduously" drove away rook, royston, jackdaw, or heron, whenever they approached. One pair built a nest and incubated.

Howard (1920, p. 219) recorded an instance of "apparent waste of energy" in which a pair of magpies after a great struggle drove two wood pigeons from the nesting tree of the former.

In a part of an account of the carrion-crow (*Corvus corone*) in France, Selous (1912, p. 327) gives the following observation recorded on March 29, 1910, and which bears upon the territorial relations of the magpie. "About a week ago I saw a Crow busily engaged in chasing away several Magpies, not only from three or four slender trees close together, in one of which it had its nest, but also from various other trees, not far off, round about. In this the crow had a good deal of trouble, as the Magpies were always returning. After a time it was joined by another Crow, which, however, did not take so active a part in the drama, nor did I see either of the two actually go to the nest, though I could only explain their action by supposing it was their own. This morning I saw the same thing reversed, for a pair of Magpies, with an undoubted nest, kept attacking a Crow that insisted on settling in one of a row of trees—also tall and slender—in which it was placed. Both were equally persevering, the Crow, though often chased away, always returning, and settling generally in the last tree of the row,

where he would be left alone sometimes for a minute or two, but before long one of the Magpies always flew at him, and put him to flight. The Crow defended itself, but not, it would seem, very successfully, and in the last attack upon him, made, with great spirit, in the air, a large black feather floated to the ground, which I made no doubt was his, yet this did not drive him from the trees, and it was only on my approaching nearer that he finally left them. Thus we see that both the species look upon the approach of the other to within a moderate distance of their nest as an intrusion."

The observations of Brown (1924, p. 122) in Cumberland, England, give a full notion of magpie display in the season of courtship. His account is as follows: "The first display was seen on February 16th, a warm, sunny day, but lost some of its value through my inability to recognize the sexes, though perhaps the birds which indulged in flights were males. There were seven Magpies in the top branches of a tree, chattering a good deal and pursuing one another about the branches. Now and again a bird would give expression to some musical-sounding notes like 'Chōōk, chōōk', and as well as one could judge these notes were uttered by either sex. Also, fairly frequently, but always separately, three Magpies (males?) would fly from the tree, perform a short flight, and then return to the same branch whence they started. Only these three birds indulged in flights, each one usually flying the same distance each time, and whilst one was performing a flight the others kept chattering, pursuing each other, and uttering their 'Chōōk, chōōk'. The flights were generally carried out in silence and in the case of one bird the flight was twice as long as that of the others, wavering for some time before it turned and went back. Once two Magpies were seen fighting, using their feet, but the fight lasted only for a minute. After half an hour of this display the birds flew away, one by itself, the rest in pairs.

"On March 11th, another sunny day, five Magpies flew into a holly bush in a neighboring field. They began to pursue each other about the branches, chattering the while, and sometimes uttering their 'Chōōk, chōōk' notes. Two birds indulged in flights, and the five performed as already described. After about twenty minutes of this the birds separated, one going by itself, the others in pairs. Five minutes later they returned, performed as described for ten minutes, and then departed as before."

"The last display was noted on the evening of March 29th, when four Magpies were seen in a fir tree, performing as described above. However, in the early morning of April 17th I noticed four others pursuing one another about the branches of a tree, but as none of them either indulged in flights or uttered the 'chōōk' notes, it is probable they were paired."

Stewart (1910, p. 188) gives records for ceremonial gatherings of magpies in England as follows: Early, 25 on January 8, 1908, and 30 on January 10, 1901; late, 25 on March 15, 1909, and 35 on March 22 and 29, 1910.

Extensive observations on the ceremonial gatherings of magpies have been reported upon by Stubbs (1910, p. 334) in part as follows.

"In February, 1895, in south-east Lancashire, I counted no less than two hundred birds in one flock. I have never seen anything approaching this number since, but in January, 1909, Mr. J. Middleton counted eighty in a wood in Longendale, Cheshire, and considered the flock to contain at least one hundred birds. In Longendale, and

in the surrounding districts, I have several times encountered gatherings of a score or so in the early part of the year; and I have heard of them so often that I am quite confident these assemblies are annual affairs. In going through the many published records of Magpie-flocks, a vagueness as to the exact time of the year is noticeable. I have seen both November and December mentioned, but there is the possibility of error due to the observer being unaware of the import of the gatherings.

"On January 24th, 1909, while with Messrs. Chadwick and Milne in a small wooded valley in south-east Lancashire, we came across a small party of eight birds, and decided to watch them. They were in the branches of a sycamore, and were jumping about and parading in a most ludicrous manner. It would be impossible to describe in a few words the actions of these birds, but there was no room for doubt as to the real meaning of the function. Although crowded together they were evidently in pairs; one would 'show off' to its mate, and when she(?) turned away, he (?) would promptly jump round to be in front of her. Owing to the trim way in which the birds carried themselves (with feathers pressed close to the body) they seemed slimmer and the legs showed more of the tibiae, than usual. Every few seconds the head-feathers would be rapidly erected and depressed, and the tail uplifted and opened and closed like a fan—an action that I remember noticing in an amorous Jackdaw. The voices of the birds were markedly different from those of other seasons. Sometimes one of these magpies would leave the others and take a course through the trees in the wood, but it was always followed by a companion. On these journeys they approached within a few feet of our heads; we were greatly struck by the unexpected grace of flight displayed on their amatory excursions.

" . . . On February 7th, a few miles away, I saw a party of ten 'holding a meeting' on a low stone-wall near a wood. Although their actions differed somewhat from those of the others, the import was the same. As there were no twigs to spring about in, some of the birds were jumping about the field or the wall, or even hanging like kestrels a foot or so above the ground in front of their prospective mates. There was a puzzling disparity of colour amongst these birds, and about half of them (the males?) were far whiter than the others. I soon found the reason for this. In these lighter birds the wings were almost entirely hidden by the white feathers of the flanks; and the shoulder-patches, and even the few feathers on the rump, were fanned out to such an extent that the birds looked at first glance almost as white as gulls—or 'male Smews', as I put in my note-book at the time. I need not lay stress on the importance of this eloquent action.

"On February 14th, in Longendale, I found the flocks (which had been there very large) broken up into pairs or odd birds, all very noisy. . . . so far as we know the birds *do not quarrel nor fight*.

"Of course there is still need for a great number of observations in this interesting subject. It is quite without known parallel amongst British birds, for it differs greatly from the performances of the Ruff and the Blackcock."

Hudson (1921, p. 168) writes that magpies pair for life, but he gives no evidence to support the statement. Also, Montagu (1802) noted that "these birds generally continue in pairs the whole year." Yarrell (1876, p. 316) held this opinion.

Morris (1925, p. 20) has heard in spring "a chattering medley of notes, partaking

of the nature of song, into which the familiar 'mag' is frequently interspersed with more or less coarse embellishments."

The version of the courting behavior of magpies as observed in Brittany in 1910 by Selous (1927, p. 107 ff.) is worth quoting rather fully both for the facts given and for the interpretation given them by that observer. Beginning with February 23, the chief portions of the entries are as follows: "My attention was attracted this afternoon by a chattering of magpies which was in a somewhat lower key than usual and went on for some time, then stopped a little and recommenced. . . . One thing is certain, that there is now a constant forgathering of the magpies which during the winter proper has not been the case, and my idea is that such assemblies will gradually take the form of courting or nuptial ones, but whether they have yet assumed anything of that character I cannot be sure. There was, however, another long and close pursuit of one bird by another, which I thought had the same amatory character as that last mentioned.

"March 2nd.—From my last entry till now I have seen nothing very particular with the magpies, and the cold of the last two or three days, crowning six weeks of almost perpetual storm and rain, seems to have thrown them back. This morning, however, in a field quite near the town, numbers of magpies kept chattering to one another from this tree and that, flying round about in couples or in threes and fours, and gathering together in some one tree or in two or more contiguous ones, to the number of half a dozen or more, though beyond eight or nine I was never able to count with certainty. But though all this, and the general air and manner of the birds, suggested some amatory feeling, the ultimate legitimate outcome of this never took place between any of them, nor was there anything very marked in the nature of courting display. What I did see of this kind was aerial, which I had not been expecting. On several occasions one or another of the birds circled at some height, beating its wings quickly and regularly, and at intervals expanding the tail. When it did this the effect was very striking, and altogether the bird assumed a much more graceful and beautiful appearance. Yet it was not frequent enough to be termed a marked feature in the general activities, nor did it appear to be addressed markedly to any particular bird. Rather it seemed a sort of general aesthetic display. In fact the courtship of magpies, if they have any special one, as their plumage—like that of the peewit, a bird that also puzzles me in this respect—seems loudly to proclaim, is very elusive and difficult to make out—at least I find it so . . .

"On March the 3rd, however, I decide that magpies have certainly a nuptial flight which is very like that of the turtle dove. Sweeping in a wide circle, the bird alternately beats its wings some half-dozen or dozen times in succession, and then floats upon them outspread, and, as it does so one sees the upper feathers of the long tail, which floats behind it, boldly expanded, by which its beauty is very greatly enhanced. When the wings are beaten, as described, they are, at the same time, expanded to their fullest extent, and the motion is rapid and rhythmical. In all these points it differs from the ordinary flapping of the bird's ordinary flight, nor does it stand in any intimate relation to the rate of progress. . . .

"March 22nd.—A number of magpies—over thirty when at the maximum—were congregating in trees or on some ploughed land adjoining, for a long time, this after-

noon. Sometimes, I think, there were over thirty in some one tree, but it was very difficult to count them, as they kept flying from branch to branch in a state of liveliness, it rather seemed, than of any very marked excitement. This was always the case with any great number in one tree, but generally there was a constant flight going on from trees to ground and ground to trees. I watched these restless gatherings and dispersals—yet never to any distance for long—for a considerable time, trying to detect anything of the sexual element in them, but I was not able to do so to any convincing degree. What most suggested this was when a pair, going up most noticeably from the ground, would fly in long and close pursuit of one another, gliding gracefully on sail-set wings, rising, sinking and turning for sometimes quite a distance, almost touching all the while. Sometimes, perhaps, they did touch, or at any rate one would overlap the other, the effect being then very striking. I feel sure that these were either mated or engaged couples, for there must be a beginning. Magpies, I believe, are supposed to pair for life, and I have myself little doubt of it, but the question, perhaps, is rather what birds do not in so far as they can. But it was always from feeding over the ploughed land that they went up thus, nor was there any indication, stronger than this, that their congregating either on the ground or in the trees was for any amorous purpose. It was more like the ordinary banding together of birds in winter, yet with a little something more—or other—in it than that, too; whilst the fact that in winter, as far as I have been able to see, these magpies do *not* congregate (unless to roost) seems to discount this interpretation. The nuptial activities of magpies seem difficult to make out."

"On the whole," Selous continues, "I would hesitate before calling magpies ardent. They may pair for life, which would make actual courtship the less necessary. Could we suppose that what were once gatherings for the sake of mutual display, have gradually lost this feature and become socially merely or social-sub-amatory—as at human dances—whilst the nest, as with the rook, is Hymen's true sanctuary for this species, the facts, in so far as I have been able to observe them, would become intelligible, at least, even if disappointing."

Tomlinson (1896, p. 188) placed a male magpie, at least four years old, in a small cage next to a larger cage occupied by a female only one year old. This was on March 22. Both birds showed excitement, especially the female. Then both birds were placed in the larger cage where they mated, built a nest, and successfully hatched out five young. The first egg was laid on April 21.

Another extensive account of magpie congregations during the latter half of winter was published by Stewart (1928, p. 47) in his work on birds of Lanarkshire, Scotland. He comments upon "these gatherings being significant from the fact that they are entirely different from the usual roosting parties seen at certain places in the autumn and early winter. They might rather be described as sportive and ceremonial occasions. . . .the true purpose is nuptial."

Continuing, he writes (p. 48): "If it be correct to assume that the purpose of these gatherings is nuptial, then we may also assume that this is Nature's way of reshuffling and re-mating this very sedentary bird. Further there is little doubt that these nuptial centres have acquired some sort of traditional continuity, for year after year, in summer, we find them frequented by immature and non-breeding birds, that are no doubt requisitioned to fill casualty gaps."

After quoting from the experiences of Weir *in* MacGillivray Stewart (*loc. cit.*) comments: "Now, Boghead, Mr. Weir's place is less than five miles from two nuptial centres, Gavieside and Bedlormie, which exist today, and no doubt did so in Mr. Weir's time; while Mid-Calder is less than four miles from Gavieside, where forty years ago over one hundred Magpies were yearly congregated.

"The following congregating grounds are situated within the county:—Cadder, at Garnkirk and Chryston often over sixty Magpies; Old Monkland, at Bredisholm usually about forty; Blantyre, between Calder Glen and Blantyre Ferme always over thirty; Avondale, at Castle Brocket once over forty—we have heard, however, of larger congregations in previous years; Glassford, fairly large flocks reported.

"The following are situated near the Lanarkshire boundary:—Torphichen, West Lothian, at Bedlormie often over thirty; West Calder, Mid-Lothian, at Gavieside in the 'eighties' the gatherings always exceeded one hundred. In recent years they have been much smaller."

One instance has been reported in which two magpies on April 5, two days after the completion of their nest, had a fight with a carrion crow (*Corvus corone*) which came too near the nest (Boubier, 1929, p. 39).

Moffat (1903, p. 158) cites Dr. Jenner as authority for the statement that a magpie was shot from a particular nest no less than seven times on consecutive days, but all to no purpose, and the last pair reared their young.

After an especially severe winter in Ireland, Moffat (1917, p. 96) noticed that the "spring assemblages" of the magpie were "attended as numerously as usual, and began about the usual time (first noticed February 18th)."

Concerning the question of life mates, Hunt (1815, p. 57) wrote that "these birds generally continue in pairs the whole year, but during the winter, assemble sometimes in great numbers." Dombrowski (1912, p. 36) believed the magpie to be monogamous, for he saw the birds even in mid-winter in Rumania very often in pairs.

The magpie in Algeria (*mauritanica*) occurs in pairs at all seasons according to Loche (1867, p. 119).

Zimmerman (1919, p. 312) reported that on April 29, 1917, he watched a pair of magpies during coition. This took place on the nest. The male whipped the tail actively and gave low call notes.

Gordon (1931, p. 496) writes of magpie gatherings as follows: "On certain spring evenings—I cannot say how often it happens—all the magpies within a considerable distance assemble in some favourite spinney, and there hold the strangest and noisiest conference one could ever wish to attend. Upon the first occasion when I had the good fortune to witness such a gathering, I was lying in wait for woodpigeons in a larch planting. One or two magpies usually roosted there but upon that evening I should hesitate to guess at the number that came in. The wood seemed full of them, and the noise they made baffles description. In the midst of it all some mischievous impulse prompted me to imitate the alarm-note, the effect of which was astonishing. There was complete silence for a moment, then a tremendous clatter of wings as every bird appeared to change places with its neighbour—a sort of general post—followed by an outcry compared with which the previous clamour was nothing, and during the disturbance, which lasted several minutes, I walked about in plain view without a bird taking the slightest notice of me . . ."

Concerning the spring song of the magpie Kirkman and Jourdain (1930, p. 5) state that "in the spring the birds may be heard chattering together 'with a great variety of tone and emphasis.' It is to this apparently that Naumann refers when he credits the Magpie with 'a kind of song or chatter', adding that generally some 'piping' notes are introduced; these correspond possibly to the 'musical' 'chōōk, chōōk' of English records. The song of a captive bird sounded to the writer like 'ka,ka,ka,ka; ko-wee-ou,' the 'ka's' being strident and the 'ko-wee-ou' liquid."

One observer in Ireland (Seigne, 1930, p. 112) has had a nesting pair of magpies in some tall beeches in front of his house for as long as he can remember. He knows that the male of the pair remained the same individual for more than six years for it had been injured by having a leg cut off early in life.

Hudson (1924, p. 16) comments on a lone pair of magpies at Hampstead, near London, as follows. "For several years this pair had their nest in an unclimbable tree at the Grove; at length, one of the pair was shot by a local bird-stuffer, after which the surviving bird twice found and returned with a new mate; but one by one all were killed by the same miscreant."

Selby (1833, p. 359) has remarked on the short period of time necessary for replacement of a lost mate—"in some instances scarcely exceeding the space of a day." Another writer (Pitt, 1922, p. 251) expressing surprise at this trait added that "one hardly ever sees a solitary magpie, other than lone cocks when their mates are sitting."

In one case cited by MacGillivray (1837, p. 570), three birds, presumably females, were shot from the same eggs on one nest. The intervals before replacing the lost mate were never more than two or three days. He gives still another record of *six* successive magpies, which sat upon the same eggs, being shot from a nest.

Raspail (1901, p. 104) reported that on at least three occasions he shot one of a pair of magpies which were in the last stages of nest building. In at least two cases the bird killed was a male. In every instance the lost mate was replaced within twenty-four hours. After the bird was shot there would be a gathering of all the birds of that kind in the neighborhood. After more or less commotion the group would scatter, and the interrupted nesting activity would continue with a new mate in place of the lost one.

An instance is cited by Thompson (1849, p. 330) of a man in Ireland shooting one of a pair of magpies before noon and the survivor obtaining another mate before evening.

Brown (1924, p. 123) noted that in Cumberland the magpie shows a decided preference for the same nesting locality year after year. Often the same tree is used for several years in succession, and sometimes a nest is built upon the remains of those of one or two previous years. A solitary tree known to Edward (1859, p. 6670) was nested in by magpies for thirteen successive seasons.

The attachment formed by magpies for a chosen nesting place is exemplified in the statement of Weir (*in* MacGillivray, 1837, p. 571). "'. . . I shot off the foot of a female magpie, as she was coming out of her nest. She forsook it but continued to hop up and down in the neighborhood the best way she could in pursuit of her food.'" This same lame bird was shot on the same nest about the middle of the following summer as it was feeding a brood of well-fledged young.

Osmaston (1925, p. 673) recorded the finding in Ladakh of many cases where several nests, in one instance five, were found superimposed, "the top nest only being occupied, those below being old ones of previous years."

Jourdain (1906, p. 19) has noted two instances in which magpies have been dispossessed after the completion of nests, once by a pair of squirrels, another time by long-eared owls.

It was reported by Schinz (1854, p. 41) that during nest construction there is often great alarm, for very often other magpies or crows seek to rob the materials from the nest; the latter even attempt to take the naked young.

MAURITANICA.—Meade-Waldo (1903, p. 211) in certain localities in Morocco saw many flocks of old magpies "which had not bred."

General comment and summary.—Attempts, like the present one, to build the life-story of a bird according to the mosaic style, naturally are inadequate to show all the true racial peculiarities in habits. The method offers some compensation, however, to the extent that it provides broad outlines which should be useful in planning more detailed studies of individual birds.

All observations that have been made upon magpies indicate that mated pairs tend to remain together as long as both birds live. Each pair, whether in a race which lives in colonies, or in one which scatters more widely, appears to return year after year to the same nesting site. The tendency which is so greatly developed by some kinds of birds for each pair to establish and preserve a definite territory for nesting is present in magpies but is so modified that close observation is required to detect it. It is only rarely that a magpie shows that it notices the presence of another bird (aside from its mate) of the same or any other kind near its nest.

The courtship activities of birds present a great many varied and interesting problems for study. So far they are not well understood although many persons have made important observations on this subject. Several series of observations on this phase of the life of the magpie have been made in England. The most complete accounts record activities somewhat as follows: On some bright and sunny day in mid-winter a company of magpies gathers in the top of a tree, and there is much chattering and pursuing of one another. At intervals pairs separate themselves from the group and fly out and back in a circling course. The notes given on these occasions are more musical than the ordinary ones, to be heard at other times of the year. After some time the company of birds breaks up, and pairs scatter. These congregations are noted only at the beginning of the nesting season. The fact that they have been reported mostly by persons in England probably is merely an indication of greater activity on the part of bird watchers in that country. It is to be expected that close observation at the proper season in this country would reveal the same behavior here.

THE NEST

The study of the nest of a bird is related to the study of the bird's behavior in much the same way that gross anatomical studies relate to experimental physiology. The nest provides a concrete object about which observations may center. Visits may be made to the site of one of these structures with some degree of assurance of finding something worthy of attention. It is possible to interpret to some extent part of the behavior of the builders after an elapsed time by a careful examination of this record. Even with the incentive for developing a study of the nest into a wider analysis of the behavior of birds, little seems to have been accomplished in this direction by bird-watchers. Too often an interest in the nest has led only to acquisition of a set of eggs or to a brief description of the location and appearance of the structure.

A magpie's nest is especially notable on account of its possessing a domed roof. In this connection many questions arise as to the kind of behavior involved in this type of structure. The possible effects of such a nest on actions of its owners need to be looked for. Queries may arise as to whether this structure has adaptive value which might lead to increased survival rate or compensate for increased mortality from some other cause. In connection with the history of the group and its geographic occurrence, the nest structure may furnish clues as to relationship within the group or between it and nearly related ones. In these and other ways the nest of this bird is of more than ordinary interest. In this discussion chief emphasis has been given to examination of the relation of the nest to the habits and life cycle of the bird.

The place in which an animal lives during the summer—which is usually when the young are born—may be thought of as its true home. In the case of birds the nest is usually one of the most interesting features in this home ground, or habitat.

Magpies more often than most other birds return to the same place for nesting each year. The typical nest position utilized by the yellow-billed magpie contrasts more strikingly with that of the black-billed species than any other one feature in the lives of these birds.

The yellow-billed magpie places its nest in large trees and at the very tips of the branches, usually in the top of the tree. (See figs. 18–19.) The black-billed form, even where it nests in California and wherever it is found in the interior, selects sites in low bushes close to the ground. Even when it nests in trees, the nest is most often in the lower part of the tree. These traits seem to reflect actual differences in the make-up of the bird, for it is usually possible to find examples of either kind of site in the area occupied by each bird. However, it is true that there are more sites available in bushes in the black-billed bird's range and more in trees in the range of the yellow-billed form.

Those magpies which nest in bushes usually pick ones which bear a dense framework of thorns. These thickets are often almost impenetrable by persons.

POSITION

NUTTALLII.—Some of the earliest observers of this magpie remarked that all the nests were in the tops of tall oaks, yet the nests of the black-billed magpie were never seen by them in high trees, not even in the river valleys (Cooper, *in* Baird, Brewer, and Ridgway, 1874, p. 270).

Out of over thirty nests examined by Kaeding (1897, p. 16) in one season all except one were in valley oaks and at heights between twenty and sixty feet from the ground. The exceptional nest was in the top of a locust tree. Most of that lot of nests were at the tips of horizontal branches or in the extreme tops of the trees. Some nests were

Fig. 18

Fig. 19

Fig. 18. Nests of yellow-billed magpie in sycamores near Tehama, Tehama County, California. Photographed on April 20, 1929.

Fig. 19. Valley oak close to stream and containing nests of yellow-billed magpie; Tehama County, California. Photographed on April 17, 1929.

in the centers of trees, and a small number were in crotches or on main horizontal limbs.

Observations made by Grinnell (1923, p. 172) in Colusa County in February, when the trees were leafless, and when the nests were visible for long distances, showed that most of them were situated high in sycamores, valley oaks, cottonwoods, or large willows. Not more than two nests were seen in any one tree, and the nest trees were widely scattered.

One peculiar point in the economy of yellow-billed magpie nesting is the striking resemblance of a nest to a clump of mistletoe. (See Dawson, 1923, p. 41.) It happens that in California the area occupied by this bird, and that occupied by two kinds of mistletoe are closely similar in their boundaries. Not only are the areas nearly the same, but the species of trees concerned are the same. Cottonwoods, sycamores and valley oaks are kinds of trees concerned in this peculiar relationship. The bird is credited not only with building in trees having many clumps of this plant but even with actually building within a clump itself. Without implying any exceptional reasoning powers on the part of the bird in this connection it might be pointed out that such a close resemblance might be conceived as, at times, helping to screen the presence

of nesting birds. It seems possible that such a lot of decoys, even if the result of accident purely, might save some nests from discovery and destruction by persons not closely observant.

Sometimes, but rarely, magpies place their nests in digger pines. On April 10, 1930, Mr. W. B. Davis, of Oroville, recorded observations upon a colony of about eight pairs that were nesting in a clump of digger pines near the Western Pacific roundhouse at Oroville. Several nests had fallen to the ground, indicating the difficulty encountered in trying to make them stay in the trees. The efforts were noted in particular, of one pair which tried to build on the sloping limbs of one of these trees. The birds would work hard all day and build the foundation of a nest only to have it slide off the branch as the weight increased so as to bend the branch slightly downward. Several attempts were made to build on that one limb, but all were futile. Finally the pair moved across the road and built in an oak tree. Mr. Davis has noticed that after high winds the nests in the pine trees are more likely to be found out of place on the ground than those built in other trees.

On May 10, 1929, at a point fifteen miles southeast of San Jose many nests were seen in tall sycamores and valley oaks near a stream that was nearly dry. In a large colony near Llagas school house, also in Santa Clara County, nearly every nest was at the tip of one of the highest limbs of a sycamore. Some trees held two or three nests.

Out of about eight nests in a colony found by Tyler (1913, p. 65) all except two were in the extreme tops of sycamores, oaks, or cottonwoods, or at the ends of horizontal limbs from forty to sixty feet from the ground. The nests were on such small branches that it was impossible to get to them by climbing. The two accessible nests were at least forty feet above the ground.

All of the nine nests found by Evermann to be occupied on April 2, 1881, in Wheeler Cañon, Ventura County, were in the tops of trees: five were in sycamores, two in live oaks, one in a willow, and one in a cottonwood.

A nest, examined by Mr. J. S. Appleton, in a sycamore tree at Santa Susana was sixty feet above the ground in a bunch of mistletoe. The nest itself could not be seen from the ground.

HUDSONIA.—Dille (1888, p. 23) wrote that in Colorado, magpie nests are often placed in the branches of slender saplings, or in some very scrubby willow. The height from the ground varies from six to sixty feet in that region. In the mountains that observer found the large black pine to be a favorite tree with the magpies; often as many as four occupied nests would be found in one tree.

In the prairie region of the eastern part of Montana nests are found in either bushes or trees. In bushes the nests are often as low as five feet from the ground. The buffalo berry is a commonly chosen bush, the thorns of which probably provide some protection. Nests in bushes are usually built around the central bush stem, involving other branches as the bulk of the nest spreads outward. Nests in trees are seldom over twenty feet from the ground. The site is often some distance out on a horizontal limb, the nest being anchored to one or more erect branches on the limb (Felton, 1925, p. 42). Saunders (1910, p. 196) in Montana recorded one nest placed in the top of a fir tree, a rather uncommon situation for that region.

Warren (1912, p. 330) wrote that most of the nests he had seen were in cottonwoods or willows. He thought that the birds did not care to nest in coniferous trees, since they were not often used when available. In his experience the height of nests from the ground varied from ten to fifty feet, and he knew of one whose entrance was only three feet above ground. The nest may be in the crotch where the tree makes its first division, or out on a branch. Often a nest is placed on the side of a tree trunk where a short branch furnishes a foundation. When built in clumps of willows, without a single main trunk, the structure is placed among the closely growing small stems. In the last named type of situation the nest is often almost concealed by the thickly branched foliage.

In the experience of Gilman (1907, p. 10) on the La Plata River nesting sites varied; "many of the birds" built in big pine trees on the mesa, but the majority used cottonwoods along the river. Nests were placed also in scrub-oaks, willows, and black birches. Height from the ground varied from four to sixty feet, sixteen or eighteen feet being an average. Nests in pines were usually highest, while those in willows, oaks, and birches were nearest the ground. The high nests were usually in trees near a highway, or in isolated trees on the mesa, or in a clearing. The low nests were mostly in trees or shrubs that stood in thickets or in marshy places. The lowest nest (four feet from the ground) was in a willow on a small island surrounded by stagnant water. Study of thirty nests formed the basis for these statements.

Of all the nests observed in 1916, in the vicinity of Mono Lake, California, the greater number were placed at from 10 to 12 feet from the ground in willow thickets and buffalo berry. One was in a clump of antelope brush, only six feet above the ground (Grinnell and Storer, 1924, p. 377).

It has been reported (Bendire, 1895, p. 351) that along the Alaska Peninsula the birds place their nests in alder bushes wherever these are tall enough to hold the nests out of reach of foxes. Within his own experience in the United States that author observed the favorite nesting plant to be the thorn bush [*Crataegus?*] Other plants nested in, in order of frequency of use, were willow, cottonwood, juniper, pine, alder, and fir. The height of nests from the ground was rarely under four or above twenty feet.

A nest especially close to the ground was found in South Dakota by Tullsen (1911, p. 90). It was saddled on buffalo-berry saplings and was so low that the observer had to look down to see into it. The entrance of a nest recorded by Warren (1907, p. 1), in Colorado, was only three feet above the ground. Three-fourths of the nests seen by this observer were between ten and twenty feet from the ground.

A strange site for a magpie's nest was that reported by Potter (1927, p. 249). This nest was in a railroad bridge, directly under one of the rails and between two ties. It was supported by two intersecting braces and was protected above by girders. In the restricted space there was no room for a dome, and none was needed. The track was used by at least one train each day.

In the vicinity of Flathead Lake, Montana, some nests were high in pine trees, but most of them were in dwarf haws and other low growths, where they were within reach without climbing (Silloway, 1901, p. 57).

Two nesting colonies of magpies were observed by Taylor (1912, p. 377) in northern Humboldt County, Nevada. In one, all the nests were between eight and fifteen

feet above the ground in aspen trees. Nests of the other colony were in varied situations; one being in a willow, and another in a clump of elder. In Malheur County, Oregon, Peck (1911, p. 67) found nests along "dry watercourses in willow bushes not more than two or three feet from the ground."

Kalmbach (1927, p. 4) characterizes the usual nesting site as being from ten to twenty-five feet up in a cottonwood, willow or hawthorn. Dawson (1909, p. 29) remarked that he had never found a magpie's nest in a pine tree in Yakima County, Washington, although scores of nests were seen there. However, in Chelan, Okanogan, and Spokane counties pine trees were freely used for nesting, and the birds appeared to show preference for the tops of trees.

In Smoky Valley, central Nevada, most of the magpie nests I found were in buffalo berry bushes. In some instances, rose vines climb through the bushes. The position in the bush varies from near the center to the very top. The latter have conspicuous canopies built by the birds. Some of the nests near the centers of thorny bushes have almost no sign of a roof. Evidently, the natural tangle of thorns here is sufficient protection. In such a situation, even where a roof is present, there are scarcely any indications of walls, only a few sticks being present.

A freshly built, empty nest was found on June 12, 1930, at an 8700-foot altitude on Kingston Creek, Lander County, Nevada. It was placed on a lower limb of a birch clump growing over a seep on a steep southwest-facing slope. The nest was eight feet above the ground and only twelve feet from a new, empty nest of a robin. The latter was in the same clump and in almost exactly the same sort of position as the magpie nest.

OTHER KINDS OF MAGPIES.—According to Davies (1892, p. 29) magpies in Norway always nest in bushes if these are available. Many nests observed by him were built under the eaves of houses. In some cases large props had been placed under the eaves, upon which the nest rested. In one low fir tree close to a house there were nine magpies' nests. In that country it was noted by Slater (1883, p. 13) that the nests were in low trees close to the farm houses, and that the birds spent a great deal of time on the roofs of outhouses or near the doors. Wooden church steeples here furnish sites also (Norman, 1864, p. 8866).

MacGillivray (1837, p. 568) characterized the most usual nesting site in Britain as "the top of some tall tree, a poplar, an ash, an elm, sometimes a willow, or a beech; or, in defect of such in a favourite locality, placing it in a thick bush of hawthorn, holly, or other low tree, or even in a hedge." Witherby (1920, p. 22) indicates the choice of nesting place in England has remained the same to the present. He remarks that nests in Scandinavia are placed occasionally under eaves of houses and on telephone poles.

Most magpie nests in Cumberland, England, are built either in hawthorn bushes or in Scotch pines or larches (Brown, 1924, p. 124). Whenever possible the nest is supported by two or three branches. When in a hawthorn or fir tree the nest is usually in the topmost branches, but in a hawthorn hedge the site may be in the middle of a bush, sometimes as low as four feet from the ground. Other kinds of trees utilized in that region are oak, ash, sycamore, and alder. Stonham (1907, p. 239) cites an observer who found magpies in Sussex, England, nesting in monkey-puzzle trees.

In Lanarkshire, Scotland, Stewart (1928, p. 45) found several nests "in old beech

trees, the majority of them bulky structures, for as a rule when a site of this kind is chosen it suffices for several years' occupancy. In the low ground of Clyde Valley, and of some of its tributaries, preference is shown for the poplar as the nesting tree. In the higher districts nests are often built in hawthorn, either hedge or isolated bush, and at Blackhall, Cambusnethan, we found one in a heap of unburned thorns, the nest being exactly four feet from the ground. No doubt they had been dispossessed from their selected nesting site by the cutting of the hedge." In Berwickshire, Scotland, the nest is usually in high trees, often in the top of an old bushy Scotch fir (Muirhead, 1889, p. 205).

Gordon (1931, p. 495) considers the ideal nest site for this bird to be "deep in the prickly heart of a blackthorn thicket, the actual bush selected being one that not infrequently defies negotiation, except at considerable cost to clothes and skin. The bird is also peculiarly partial to an overgrown hedgerow of thorn or holly, and failing such a stronghold, it falls back upon height, as offering the greatest assurance of safety, usually building in the crown of some tall, willowy sapling, or among the topmost twigs of a lofty beech. In the woods it is also fond of larch trees, but, whether by chance or otherwise, I have never yet seen the great nest in a Scotch fir, which is a tree most favoured by other branch builders."

Kirkman (1910, p. 8) characterized the nest position in England as "generally high up in a tree, but also not uncommonly in hedges and thorny bushes." Elms (1906, p. 53) writes that the nest is placed "among the smaller branches at the top of some tall tree; sometimes in a thick hawthorn hedge." The nest site of the race *P. pica pica*, according to Hudson (1921, p. 163), is usually in a "tall tree in or on the borders of a wood; sometimes in a low, isolated tree or large bush, or in the centre of a thick hedge."

Unusual nesting sites for this bird in England have been commented upon by several writers. Young (1892, p. 227) gives two records of nests within six feet of the ground near London, and another where the nest bottom was not more than eighteen inches from the ground, in North Devon. At both places tall trees were available in the neighborhood. Jesse (1889, p. 184) records a nest ten feet above the ground in an apple tree.

Nests of magpies near Hamburg, Germany, are in hedges, in thickets, in fields or in high trees near farms. Groebbels and Möbert (1929, p. 235) record nests in birches and firs. Müller (1887, p. 168) wrote that in Hessia the nests were either in the outermost branches of the highest poplars or in remote pine thickets, many times scarcely as high as a man. Leverkühn (1887, p. 204) reported a newly built nest of this race in a pear tree, on April 12. A nest found in Prussia by Hausmann (1874, p. 390) was six feet up in a crooked alder. Hesse (1914, p. 369) reports this race as nesting in the largest willow bushes in marshes. Reichling (1917, p. 201) reported an occupied nest in Germany that was built on top of one of a previous year, the lower one being within one-half meter of the ground.

In one part of Bohemia magpies place their nests by preference in the damson tree, *Prunus domestica damascena* (Peiter, 1899, p. 183). Near one part of the coast in Germany a magpie built a nest only four feet from the ground in an oak six feet high. In the same neighborhood there were oaks eight meters high. In these trees, magpies built their nests which were used by two kinds of hawks (*Falco tinnunculus* and *Buteo*

vulgaris) (Jour. für Ornith., 1884, p. 29). Congreve (1929, p. 450) found some nests in lilac and other bushes in Rumania, but most of them were in situations in trees.

Two nests recorded by Comte (1926, p. 45) in the neighborhood of Geneva, Switzerland were placed one among the flexible branches of a willow, the other in the top of an oak.

The usual nest position in the neighborhood of Vendome, France, is in the top of a large tree or in a thicket (Coursimault, 1917, p. 103). Nests found by Schuster (1923, p. 291) in northeastern France during the war were in bushes of blackthorn and hawthorn. The latter offered especially good protection against both persons and animals. Other nesting trees were larch, hornbeam, and plum trees. The height from the ground averaged six to nine feet, the lowest being only 1.7 meters. One nest in another locality was high in a poplar tree.

Nests of magpies (*bottanensis*) found in Tibet by Ludlow (1928, p. 53) were high in the topmost branches of tall poplar trees or low in a thicket only a few feet from the ground. An observer, cited by Baker (1932, p. 24), in the same region found nests in pollard willows, plane trees and in thorn bushes. That writer added that the nests were built around houses, in single trees in cultivation or open plain, or in clumps and thickets "just as the bird may find convenient", but with no attempt at concealment.

In northern Russia (Kiew) Goebel (1870, p. 191) noted that magpies placed their nests in gardens only three or four feet from the ground. This he considered the result of impudence of the birds, which resulted from the fact that people never killed a bird not a game bird.

In northern India, Whitehead (1910, p. 178) found the nest usually "placed in an Ilex, . . . though often within six or seven feet of the ground." Stuart-Baker (1922, p. 38) gives the usual nest location of a magpie's nest in Kashmir, as "well up in a fairly high tree but sometimes comparatively low down in thorny bushes." In Ladiak, Ludlow (1920, p. 141) records magpie nests in willows and poplars and "occasionally in bushes."

In southeastern China magpies' nests are usually in tall trees, but Vaughan and Jones (1913, p. 26) found one on the top of a literary post (a sort of a monument to a scholar), one on the top of a pagoda, and three in bamboos. One nest which they considered unusual for that region was only seven feet above the ground.

Nests found by Buxton (race *kamschatica*) were in the tops of low willows (Allen, 1905, p. 247). Stejneger (1885, p. 241) records one that was nine feet up, in the first branches of a willow.

In Macedonia, Chasen (1921, p. 195) found many nests, some in trees and others in tall dense bushes. Often the nests were well-hidden. Fehringer (1922, p. 287) found nests in Macedonia sometimes in low trees and bushes, often below the height of a man.

In northern Portugal the nests are usually in pine trees, but Tait (1887, p. 200) records one on a low bush, only three feet from the ground, in the middle of a large marshy treeless plain. In southern Spain, Noble (1902, p. 74) found nests in low cork trees and in bramble bushes only a few feet high. One nest was no higher than his knee. Many of the nests in the thick bramble bushes were not roofed.

Concerning the magpie in northern Africa (form *mauritanica*) Hartert (1915, p. 16) remarked that all the nests he had seen "were placed in bushes, so that one could reach

them from the ground." In the Batna region of Algeria, Koenig (1895, p. 211) found nests of magpies in thick bushes of *Zizyphus, Pistacia, Juniperus,* an evergreen oak, and, infrequently, in the taller aleppo pines. The nests, according to Menegaux (1919, p. 41), are ordinarily 5 or 6 feet above the ground. Nests found by Lynes (1925, p. 35) in Morocco were "almost exclusively in argan and jujube bushes, and quite low down, 1½ to 2½ meters above the ground, but so built into the middle of the bush as often to be unexplorable without hedging tools, and never without a severe thorny battle." Nests found by Whitaker (1905, p. 11) were "nearly always placed in the middle of a thick and almost impenetrable thorn-bush, and at a height of from six to ten feet from the ground." In eastern Algeria nests found by Jourdain (1915, p. 135) were nearly always in ilex bushes, usually about five feet from the ground. An exceptionally high one was nine feet up. In southern Tunisia a favorite place for nests of magpies was the thick crown of a gum-tree (Erlanger, 1899, p. 440).

MATERIALS AND COMPOSITION

NUTTALLII.—A nest commented upon by Barlow (1895, p. 20) as "by far the best specimen" out of a number he examined was two feet high and one foot in diameter at its thickest part. It was composed outwardly of dried oak twigs of various sizes. The inside was plastered with mud and lined with fine rootlets and horsehair. The top of the nest was latticed; yet it was securely put together. The weave was sufficiently loose that the eggs could be seen from the outside.

The inner bark of cottonwood (as lining) and cow manure have been mentioned as materials used by this bird in nest building (Bailey, 1902, p. 271).

A nest found by Mr. J. S. Appleton at Santa Susana, Ventura County, was in the midst of a clump of mistletoe. It had only a few sticks woven into the mistletoe to serve as a canopy.

Barlow (1894, p. 111) wrote that "a typical nest of the Magpie is situated in the topmost branches of an oak, and composed of sticks about a foot long. It is about a foot and a half in diameter. The sticks are cemented together at the bottom with mud, which, becoming dry, forms a very solid structure. The walls are built up and completely arched over the top. The nest proper is composed of fine rootlets and grasses, and is about 5 inches in diameter and 3½ inches deep. The entrance is level with the brim of the inner nest and four inches across."

One of a group of four nests near Oroville, Butte County, was examined in detail on June 15, 1931, by W. B. Davis who supplied me with the following notes concerning it. The nest was twenty-five feet up in the forks of a nearly vertical limb of a blue oak and was in good condition except that the lining had been trampled into a mat on the bottom leaving the bare mud walls exposed. The lining was composed of 162 pieces of rootlets and small twigs, 6 pieces of grass stem, 24 pieces of horsehair, and 210 pieces of plant fiber. Most of the rootlets and small twigs were three or four inches long, though one was at least eighteen inches in length. The grass stems were three or four inches long and the plant fibers ranged from short to long. The horsehairs were mainly from the tail and measured from eighteen to twenty-four inches in length. The more than four hundred pieces of material in the lining alone represented a great deal of labor in transportation and arrangement. It is no wonder that the time from apparent completion of the nest to the beginning of egg-laying seems long.

HUDSONIA.—In Colorado, Dille observed the lining of the nests to be either the finest grass roots or black horsehair. He records one exception, where the birds had used a large piece of Canton flannel for a lining, and another nest in which the lining was composed wholly of pieces of string (1888, p. 23).

Felton (1925, p. 42) reports that in eastern Montana the nests are built of small sticks mostly from sage brush and cottonwood trees. The lining is of the soft inner bark of the same woods. Strangely, he reports that he has never noticed any mud in the structure or lining of the nests. Furthermore, he has seen nests as far as four miles from any natural mud. The experiences of this observer indicate then that mud is not used characteristically in his vicinity.

A study of thirty nests in one colony along the La Plata River, gave basis for the following observations by Gilman (1907, p. 11). All the nests had a well-defined canopy of twigs, with an entrance at one side. Sometimes the hand could be inserted only at the entrance, so strongly was the canopy built; at other times a hand might be thrust through the siding easily. Nearly all the nests built early in the season were well constructed, while the frail and flimsy ones were among the late-built group. All the nests had thick mud-plastered walls, well lined with rootlets and horsehair.

Bendire has summarized his observations on the composition of magpies' nests somewhat as follows (1895, p. 351). The nest is usually globular in shape. Sticks used in the outer construction of the nest are often nearly two feet long and an inch thick. The coarser material is usually placed in the base. The inner coating of mud reaches well up the sides of the cup, but not quite to the rim. Usually the nest is domed with small sticks, and the sides are protected by an open latticework, often of thorny twigs. In the more flimsily built nests the dome is less complete, and in some instances the nest is almost open at the top. In the case of one nest recorded at Kodiak, Alaska, three small firs formed the support, the arrangement of the tree stems being corners of a triangle. A roof was built about five inches above the nest rim but the sides were left open all around.

Sloanaker (1926, p. 37) records observing a magpie in eastern Washington using fresh cow-dung instead of mud in building a nest.

Most of the nests examined by Knight (1902, p. 104) in Wyoming had but one opening. Others had two openings nearly opposite one another.

A nest from Inyo County, California, was examined carefully by Grinnell and Storer (1924, p. 377). Outwardly the construction was loose, many of the twigs being ready to fall away at a touch. The nest had been made of pieces of all the common woody plants in the vicinity. These included willow, saltbush, and sagebrush. An outer part was made only of twigs; the middle framework included a considerable amount of mud that had been applied wet. The lining was of small twigs of soft texture. The three parts graded insensibly into one another. In another nest from the same region the lining was of fine rootlets and horsehair.

One nest found by Taylor (1912, p. 377), in Nevada, had a dome made of thorny rosebud twigs which made a rather open cover. The nest appeared to have no definite opening; several possible entrances were available on one side.

In many of the nests in buffalo-berry thickets examined by me in Smoky Valley, Nevada, mud showed conspicuously in the structure on the lower side. Evidently it

had been carried early in the construction of nests in those densely thorny bushes. A nest found at an 8400-foot altitude in the mountains near by, was ten feet above the ground in a dead aspen, one of a group of trees of that species. The nest was constructed of aspen twigs and it had a well-formed canopy. On May 21, 1930, it was in good repair although at least a year had passed after its occupation.

One nest that was examined on May 16, 1930 in this same locality was six feet up in a lone buffalo-berry bush. Its outside height over-all was 85 cm., but its greatest width was not over half that. Almost all of the structure was contained in the cone-shaped dome extending above the top of the bush, but so loosely constructed that a person could see through it in any direction. The network was uniformly open. An exceptional feature of this nest was its especially small cup, which measured less than 20 cm. in outside horizontal diameter. It was compact, with mud showing on the outside, and contrasted markedly with the tall superstructure. The lining was composed of rootlets.

A nest of exceptionally large size was discovered on April 23, 1901, by Silloway (1903, p. 41). This one was in a small haw tree in a small coulee in Fergus County, Montana. "This nest was made on nearly horizontal branches, though they might have bent later beneath the weight of material piled upon them. This nest was four feet high, four feet long, and forty inches wide; a great mass of tangled sticks formed the canopy, while the base contained enough material to fill a large clothes basket. It is fair to say that one-fourth of the material in this nest would have made the average nest." Dawson (1909, p. 28) photographed and described a nest which he found in April, 1905, in Benton County, Washington, which measured seven feet from top to bottom. This nest was actually a double one. The upper third of it was the dome. Contrasted with this, the same writer mentions a nest found near Odessa, Washington, which was not over a foot in diameter and scarcely that in depth. There was only a "light half-cover of thorn twigs."

Clues as to the probable function of the dome on the nest were obtained by me, June 6, 1933, in Smoky Valley, Nye County, Nevada. At dusk when the long-eared owls became active magpies near the camp showed much concern. Alarm notes were heard from three different magpie nest locations and birds were seen in flight. Whenever an owl flew up it was followed closely by a magpie. In this locality an owl's nest was situated usually close to each magpie nest. The owls did practically all of their foraging at night when the magpies probably slept, and, hence, they most likely required some special protection. This was about the time for the young of both species to leave the nest.

When it is considered that throughout the range of magpies their old nests are used also by raptorial birds of some sort, and often night-hunting ones, this circumstance seems to offer, if not the reason for the origin of the dome, a logical explanation for its persistence as a character in the life of the magpie. (See also p. 90.) Protection from owls may be a chief function of the dome on a magpie nest. Other observers have reached a similar conclusion but based on slightly different lines of evidence which, however, are not necessarily in conflict with the explanation here proposed.

Further evidence along this line was obtained on several occasions in 1933, when I tore holes in the thorny canopies in order to examine the contents of the nests.

Sometimes these holes were left, but in several examples the birds set to work and repaired them within a few days by adding new material. This refilling of holes that were made in domes makes it appear even more probable that these structures are placed on the nests by the birds for protection against prowling animals. Openings left in the sides of the canopy must be there, generally, from choice and not from accident as their irregular appearance might suggest.

OTHER KINDS OF MAGPIES.—Magpie nests in Cumberland, England, do not always have the usual lining of fibrous roots. Brown (1924, p. 123) records finding nests lined with binder twine only, with a mixture of horsehair and roots, with hair, roots and twine, and with horsehair only. He noted paper in one nest lining. One nest, in a sycamore tree, was lined entirely with oak leaves. Domes of most nests in that region are built of thorny sticks, or of a mixture of thorny and non-thorny material.

Blake-Knox (1862, p. 7997) found a magpie's nest in England, which contained four eggs, but which had no dome. In the vicinity of Hamburg, Germany, Groebbels and Möbert (1929, p. 235) reported at least four nests which when occupied had no dome. Two of the domeless nests were in firs. In the case of one pair which built a nest in a fir and without a roof, two other nests built by the same birds in birches had the usual type of arched roof.

Another nest was once found in Germany which was without the roof, and which from a distance looked like a crow's nest (Reichling, 1917, p. 201). Out of all the nests seen by Detmers (1912, p. 27) only one occupied one was without a dome.

Concerning the possible purpose of the dome over the nest, MacGillivray (1837, p. 568) wrote that it could not be for protection from rain, for the texture is so loose as to afford no protection of that kind and if it is for the purpose of a "defence against the attacks of other birds, it is strange that the rook and the wood pigeon, which build in similar places, should need none."

As contrasted with the usual lining of roots found in nests in Europe those in southeastern China may be lined with grass, hair, feathers, paper, wool, or other suitable rubbish (Vaughan and Jones, 1913, p. 26). Nests observed in Shantung by Jones (1911, p. 672) were "precisely the same" as ones found in Europe.

Witherby (1920, p. 22) states that in England the nest lining of earth is nearly always covered over with a layer of fine roots, rarely with hair. He says that the dome of sticks is nearly always thorny.

Before he lived at Gouvieux, Oise, France, Raspail had observed only the ordinary type of roofed nest. In that locality he found the nests in the deep woods to be of the common type (1888, p. 126), but all those in trees on open ground were without the canopy. His explanation of this difference in structure was that in the woods the roof served as a protection from surprise by enemies. In the open these surprises were less to be feared for the birds could see for long distances and might easily discover the danger. He supposed that in the latter situation the dome would be a disadvantage, for it would present a large surface to the strong winds which were frequent there, and which might dislodge the nests.

A possible explanation of the purpose of the domed roof on the nest was suggested by Kirkman (1910, p. 57) who wrote that "it is perhaps the singularly conspicuous plumage of the magpie that has led it to make a roof to its home." He suggests further

that the long tail of the magpie "must prove to be somewhat difficult to accommodate in the limited space available."

The same writer gave interesting comments on absence of domes on some nests, as follows. "Magpies' nests without domes are sometimes found. One such was placed in a low thorn bush, but the thorns made it impossible to reach it. Another was seen on the top of a spruce fir, and resembled a crow's nest. It was occupied for several successive seasons till 1904, when it was appropriated by a pair of kestrels. The magpies then built a new nest—with a dome."

At least two nests were found in northeastern France by Schuster (1923, p. 290), which had no domes. One of these was in the center of a thick hawthorn and the other was high in a poplar. Both were considered as temporary or incomplete structures by the observer.

The nests of Chinkiang in the lower Gangtse Basin, China, are not always domed, according to La Touche (1906, p. 433). That observer had eggs taken from a nest which the finders assured him was open, and he saw eggs taken in another instance from a nest that apparently was perfectly open.

Lilford (1895, p. 232) indicates that he has "met with more than one nest without any dome or covering, in these cases the dense thorn bushes, in the center of which the birds had built their nurseries, rendering such protection or concealment unnecessary."

Concerning the dome of nests in Lanarkshire, Scotland, Stewart (1928, p. 45) wrote as follows. "That it is an entirely separate structure, of quite different material from the nest proper, is a fact not so well known. That the piling of this huge heap of thorn twigs above the nest is a protective habit, acquired by this weaker member of the 'corvine' family against its enemies, there can be no doubt, and the distance which the Magpie will fly to procure these thorn twigs is amazing. About thirty-five years ago a pair of these birds nested in an isolated coniferous wood near the boundary of the parishes of Douglas and Crawfordjohn, and were observed carrying this part of the nesting material from the neighbourhood of Douglas village, three miles distant."

A nest without a canopy was found June 2, 1929, near Geneva, Switzerland. It was ten meters above the ground (Meylan, 1930, p. 101).

Ward (1775, p. 66) considered the dome on the top of a magpie's nest as a protection against the raids of other birds. He mentioned the kite, the sparrow hawk, and the crow as ones to be guarded against.

Several examples of roofless nests of the magpie that have been reported from Spain and in the south of France were cited by Mayaud (1933, p. 383) who discussed the cause of this phenomenon. He thought that in the majority of cases the lack of a roof resulted from absence of suitable support for it to which the material could be fastened. According to him Jourdain agreed with that notion but also thought that sometimes lack of material was responsible for the absence of a roof to a nest, and that in certain cases perhaps inexperience due to the youth of the constructors was the explanation for the absence of the roof.

MAURITANICA.—According to Koenig (1895, p. 211) the nests of this magpie are exactly like those of the birds in Europe. In western Algeria the nests found by Heim de Balsac (1926, p. 396) were built of branches without spines. All nests found by Lynes (1925, p. 35) in Morocco were domed.

MANNER OF CONSTRUCTION

NUTTALLII.—When I made observations at the magpie colony near Coyote, on March 8, 1931, an unexpected amount of activity on the part of the birds was noticed. At first no reason was apparent for all the excitement—calling and flying about—but after an hour a possible explanation became evident. All the rest of the happenings of the day tended to verify this supposition.

At first no magpies were in sight but in less than five minutes a commotion was heard near one of the trees which held a nest. Two birds were fighting on the ground. This lasted for only a few seconds, when they separated and flew to the tree. Within the next half hour there was an almost continuous stream of notes denoting excitement. On at least two more occasions fighting birds were seen to go to the ground together pecking at one another. However, these birds always separated after a few such pecks.

In the trees, apparently, two of the birds were on the defensive, and all the others (from two to ten individuals) were trying to drive away these two. The attackers would perch close to the defending birds, and there would be loud notes and darts at them. At frequent intervals a part or all the group would fly out and circle about the tops of the trees and return. On each of these flights there was an evident effort to drive away one or two birds. Sometimes two or three individuals, in turn, would dart at the same bird. At least once on one of these flights an actual blow landed—a feather floated away.

Finally, all the magpies moved away by pairs except four that stayed in the tree. Two of the remaining birds stayed near the nest mentioned above for much of the time during the remainder of the day. Often they were seen on the ground whence one would fly hurriedly to a limb near the nest. It would give a few notes, and the other one would immediately fly to its side. Many times, begging notes were heard, and one bird of this pair would posture and quiver its wings, but no transfer of food was seen. This nest was entered several times, but it seemed certain that no incubation was going on. Nor was any building activity noted. It is probable that a part of the set was already laid.

The center of interest of the other pair was in the same tree about twenty-five feet southwest from and slightly below the level of the completed nest. For the first hour of the morning it was thought that these birds were merely perching or possibly feeding at this place. Finally, it occurred to me that this was a pair beginning a nest, and that all the commotion was from the other pair protesting at the presence of these birds and trying to drive them away. For nearly the whole day one or both these birds was on one part of a small limb in the crown of this tree—in just such a place as might form the foundation for a nest. They continually went after and carried sticks to this site in a manner as follows. One bird would pull at a twig only a few inches from the site, carry it to the nest site, fit, and move it from place to place.

Several times, the two birds stood close together, and, facing one another, both held the same twig and "billed" it back and forth, tugging and working it through the two bills for more than a minute. Then one bird would take the twig and try to place it in the nest foundation. As nearly as could be seen, every stick so placed dropped below the limb on which the bird perched. Sometimes one bird appeared to go after and retrieve the twig where it lodged on another limb below. On the ground beneath

this part of the tree there were many freshly broken twigs such as might have been dropped by these birds. When one bird of the pair went to the site, the other usually hurried there too, even when it had no material in its bill. All the twigs were obtained from the tree and within fifteen or twenty feet of the nest. Some of the twigs brought were small ones only two or three inches long.

In the afternoon from 12 to 12:30 o'clock the two magpies were seen at the new nest site about one-fourth of the time. A part of the time they perched there together and preened, appearing to apply the bill to the preen gland and then on the contour feathers, but this was not plainly seen.

It seemed that this pair, beginning a nest so near to one just completed, attracted more attention from the birds already in the colony than it would have done when those birds were busy at their own nest. However, this pair seemed determined upon the one site for a new nest.

From the ground this site did not appear as an especially good one, for there was not sufficient support to hold the twigs placed there. Every twig placed on the limb slid off as soon as the bird released it. It could not be determined definitely whether any of them remained there after the seven hours of watching. Certainly there were not many loose twigs there. It was not possible to tell whether this site had been the center of attention of these birds for long, or whether this was their first day of building. Judging from their persistence in staying at the same spot it seemed a safe guess that the birds had been working there for several days at least. Whether they would persist and complete a nest seemed doubtful, for (1) the support was not suitable, (2) there was no available mud close by at that time, (3) disturbance by birds already settled in their nesting appeared to be an important distraction.

On another occasion, in the morning of March 6, 1932, a pair of magpies was watched as they worked at the early stages of a nest in this same grove. Only the basal part was in place, and that was open enough so that motions could be seen of any bird there. The two birds were at the nest together or singly. Usually after leaving the site each bird flew a short distance to another part of the same tree or to the top of a near-by tree and began searching for sticks. This it did by walking over the main limbs and grasping various twigs in the bill, giving each a pull. After several (up to 15 or 20) unsuccessful tries a twig would be found less solidly attached than most of them, and this one would be pulled loose. Then the bird ordinarily would return to the nest, but sometimes on the way it would stop once or twice to perch.

Periods at the nest usually were several minutes each. During this time the bird worked the sticks back and forth, pulling at some and pushing on others. Several times one or both birds flew directly to the ground upon leaving the nest. and once one was seen to pick up a stick from the ground and fly directly to the nest with it. For more than half an hour, before 9:30 a.m., no bird was seen at this nest, but the two carried sticks for a few minutes around 10 o'clock.

An observation of possible significance in interpreting the history of nest building in this species was made at the colony near Coyote, Santa Clara County, on January 25, 1931. When I first noticed one of the birds, it was carrying a long, dangling, branched twig upward toward the nest (designated as nest B). The nest had been there at least for one year and was in the end of a densely bushy branch of a valley

oak. The bird lit above the nest with its twig, and for a period of from thirty seconds to a minute it struggled to force its twig to the nest. However, the dense tangle of brush above prevented its getting nearer than about one foot from the nest. Finally the bird gave up and left that twig. It moved over a few inches and tugged at another stick in a similar position. Then it left both where they were and moved away from the nest.

This action may be a clue as to the origin of the habit of adding a roof to the magpie nest. When nests are being built in thorny or dense trees or bushes it is natural that many sticks might get stuck and have to be left above. These might thus accumulate, without intention on the part of the bird, or even in spite of its efforts, until a dome like the one ordinarily found on the nests would result. Then it is conceivable that its selective value might make this type of structure important to the species.

There is also the possible suggestion that this type of nest architecture, originating through circumstances connected with type of nest site chosen, might become fixed in the habits of the birds so that it results even where the immediate nest-surroundings do not require it. Many nests could not have had domes made in this way. They have to result from deliberate actions of the birds, for there are no intervening twigs above them to hold sticks and prevent their being added to the nest proper.

Finally, it seems necessary to think of the habit which results in a domed nest, in magpies, in connection with the characteristics of the nest site (position) over the whole range of the bird.

Characteristic procedure in nest construction was watched in the morning of January 18, 1931, at a magpie colony near Coyote in Santa Clara County. At 10 a.m. I saw a bird pulling at a twig in a bushy clump close to the top of a tree. It pulled off a short, smooth twig and flew directly to a nest, in the same tree. It stopped first on top of the roof where it apparently placed the stick, then moved to the side of and, finally, into the nest. During this time the mate was perched close to the nest.

Both birds of a pair were seen working at a nest in this colony on January 25. One bird was working inside the nest. The mate came, carrying sticks, and placed them on the roof. Thus both individuals were working on this nest at the same time.

At 9:15 a.m. I saw two magpies, evidently a pair, at a nest (fig. 17) that had been occupied the previous year. Both birds were in the nest at once. Then they moved outside and perched on limbs close to the nest. They moved into and out of the nest several times within a few minutes. After five minutes one of the pair left and flew about ten yards to a near-by tree and directly to the basal part of another nest—whether old or new was not certain. However, the bird went directly to and onto this foundation. There, it several times gave a long series of call notes. Next it turned, reached upward, and pulled at several twigs. After two minutes of this sort of action this individual rejoined the other bird at the first nest.

Further observations at this same nest (A) were made on the morning of February 1, 1931. At 9:30 o'clock one bird flew from this nest carrying a stick and lit in the next tree to the west. There it held down the stick on a branch and picked at it a few times. Another bird came from the opposite direction, perched facing the first one and picked up the stick. The first bird moved to a lower perch in the same tree. The second bird then carried the stick back to nest A.

Within the next few minutes two trips were made to this nest, the birds carrying mud. Each time the bird came from the west and went inside the nest where it stayed for five or ten minutes. After coming out each one went to the next tree and perched for about one minute and cleaned its bill with especially long, hard strokes. Next, both birds of the pair flew to and entered the nest, together. No objects could be seen in their bills on this trip. Then, one of them went to the ground close to the base of the tree, picked about twenty times, as if it were pulling up roots, and then went directly back to the nest.

On February 22, 1931, I saw magpies carrying sticks to at least three nests in the colony near Coyote. One bird went to a part of a nest where it pulled away a stick. This stick was carried and added to a nearly completed nest in the same tree. Individual magpies were seen about these two nests several times.

Magpies at the colony east of Madrone, Santa Clara County, were watched by me as they worked at nest-building about mid-day on March 13, 1932. The canopy had not yet been added to the nest. One bird remained in the cup of the nest and worked at the sticks, turning and pulling and replacing them. The other bird regularly went for, and carried in, fresh sticks, perched on the nest rim for a minute or so and then left for more material. After six or eight trips the two birds together flew off to the hills. At another nest close by both birds arrived, carrying sticks, at the same time.

Kaeding (1897, p. 16) has reported that a new nest is frequently built upon a foundation of an old broken down one. According to him the foundation is laid of coarse twigs averaging larger than a lead pencil which he has found in nests with freshly broken ends indicating that they had been obtained from living trees. Next, the structure is cupped with a solid, large cup of mud or horse-dung, with numerous twigs embedded in it. This cup was usually seven or eight inches in internal diameter and five or six deep, with walls one inch thick. A thick lining of hair-like stems and horsehair is added and then the whole structure is capped with the latticed dome of coarse twigs; the latter with its hole for entrance.

Townsend writes (1887, p. 211) that every nest which he examined had two openings, on opposite sides. His explanation was that such an arrangement was necessary in order to save for the birds the inconvenience of turning their long tails in crowded quarters.

Two yellow-billed magpies in the aviary of Mrs. Florence Eichwaldt, of Hayward, California, built a nest in an old nail keg in the spring of 1933. After they had placed a layer of sticks a pan of mud was supplied them, and they built a mud cup like the one ordinarily built in the wild. Afterward they lined the nest with a large amount of horsehair. When the nest was finished, the birds "began to fight fiercely for possession" of it (Vargas, 1934, p. 37).

HUDSONIA.—The procedure of nest-building as described by Averill (1895, p. 136) for one pair was somewhat as follows. First small twigs of thorn, seemingly the ones with the most spines on them, were laid and interlaced. As the nest proper was formed all spaces between the twigs were filled with mud. The nest was then lined with fine roots. The roof was added in the same manner and of like material. Thus a bulky structure was formed of dried mud and twigs, impervious to wind or rain. Finally pine needles were laid and arranged upon the roots, and long horsehairs were incorporated to complete the lining and the nest.

In the case of a pair of magpies which nested in captivity in the National Zoological Park in Washington, both birds took part in the construction. The nest was built of sticks put into the cage for that purpose (Davis, 1931, p. 604).

PICA.—In Cumberland, Brown (1924, p. 123) found that both birds of a pair help in nest building. The cup of mud was formed before the dome was added to the nest. He found usually one opening in the dome but sometimes two. Next the cup was lined usually with fibrous roots, the thicker ones next to the mud. This observer was unable to determine whether one or both birds worked at the nest lining. When nests were visited early in the morning, moist earth was found adhering to the roots, suggesting that living roots had been collected for the nest lining. When possible, the birds entwine branches of the nest tree into the dome.

Selous (1927, p. 118) observed nest-building by magpies in Brittany and concluded that both birds build "in equal degree, each bringing twigs and placing them, and each entering the nest. A great deal of trouble is taken in placing the sticks properly, the bird sometimes labouring mightily to extract one from the heap and replace it. Is it really necessary to make these alterations? 'That is for the birds to decide', would be the general pat answer—perhaps the correct one—but for my part I cannot help thinking it is more a matter of the strength of the nidificatory instinct. They *must* be building, just as a lady with clippers, in the garden, must be clipping."

Two magpies kept by Tomlinson (1896, p. 188) nested in captivity. The male did all or nearly all of the carrying of material. The site selected was so close to the roof of the cage that no room was left for a canopy, and none was built.

According to the experience of Graves (1884, p. 344) most of the actual work of nest building, at least in the case of one pair, was done "very early in the morning", and they seldom worked in the daytime.

Kirkman (1910, p. 8) wrote of the nest that "both sexes share in its construction, but, according to Mr. F. C. R. Jourdain, the cock confines himself to carrying material."

In the spring of 1916, Schuster (1923, p. 290) watched a pair of magpies during nest-building. He watched them first on April 3. On April 5, from 10 to 10:40 a.m. the birds carried nesting material twelve times. The birds entered the nest each time through the same opening and left always through the exit on the opposite side. After the nest was finished it appeared to be deserted, but on April 21 it held two whole eggs and a broken one.

On May 5, 1918, Schuster saw a pair of magpies working at a nest in the dim twilight at 9:30 p.m. In the same season he watched a pair build a nest and complete it within a few days. The birds worked with remarkable diligence, and every day they were busy at the nest until late twilight. All this time heavy fighting was going on at this place. Once at midnight on May 10, during a period of shelling, a piece of shrapnel hit a large limb near this nest. The birds at the nest were disturbed and gave loud calls, but next day the nest building was carried on much as usual. These particular birds survived many types of warfare, including gas attacks.

Stewart (1928, p. 49) has described a peculiar incident which occurred in the Blantyre district, Scotland. "A pair of nesting Magpies were dispossessed by a pair of Rooks, which in turn deserted a nest after a boy had climbed to it. About a week

later the Magpies returned and transferred the nest to a new site about fifty yards distant, working with such expedition that they completed it in two days."

FALSE NESTS

PICA.—Kleinschmidt (1892, p. 204) made the statement that usually many nests are built and only one used; this one being completed in a remarkably short time. Van Havre (1928, p. 52) wrote that in Belgium the magpie starts several nests but uses only one for rearing young.

Raspail (1888, p. 126) gave the evidence of two authorities on this question somewhat as follows. Vieillot has shown that the magpie constructs many nests at a time, but that it finishes only that one which ought to receive the eggs. This fact was confirmed by Nordmann; according to him, each of the pairs of magpie which he observed in the botanical garden of Odessa constructed three or four false nests intending to turn its attention to one upon which it would work secretly and in great silence. However, Raspail himself in work at several localities had never found a pair that built more than one nest at a time. He did not discredit the testimony of the other observers but concluded that the birds exhibited these different traits in different localities.

On this question Kirkman (1910, p. 58) wrote that the habit of magpies of commencing more than one nest at a time was not well understood. "This has been ascribed to cunning, the bird thus hoping to deceive its enemies as to position of the real nest. The practice may, however, be due, as in the case of other species, to the choice of an unsuitable site, or to desertion owing to discovery."

An observer in Bohemia (Peiter, 1899, p. 183) concluded that not every nest is a breeding nest; many pairs have also three to four reserve nests. In Hungary the nesting of a single pair of magpies was watched for several years by Rácz (1919, p. 145). Each year this pair started to build three nests, and it was not until the roof was started that the observer could determine which one would be occupied. The birds always placed a roof on only one nest, the one they used.

Boubier (1929, p. 37) considered this problem at length and concluded from a special study of a single pair that the birds started only one nest at a time.

In writing about the building of more than one nest by magpies. Comte (1930, p. 152) pointed out that the habit is noticed because the nest is so conspicuous, but that it is characteristic of other birds too, even small ones. He believes that if during construction of a nest the wind, by moving the branches, disarranges it or if two pairs dispute possession of the territory, then two or even three nests may be started. Another confusing habit is that when near the nest, during its construction, the birds will hide, but away from it they are less cautious.

Hamonville (1895, p. 270) thought that magpies built several nests at once. Also, Jaubert (1859, p. 102) approved the supposition of Nordmann that magpies ordinarily built many nests at a time, but actually finished only the one which was to hold the eggs.

TIME OCCUPIED IN BUILDING

NUTTALLII.—The period of nest-building is a long one. Nests that were found well under construction in early February contained no eggs before the first or second week of April (Kaeding, 1897, p. 16).

Magpies were seen about their nests in some cases in the vicinity of Colusa during

the period from March 1 to 6, 1923 (Grinnell, 1923, p. 173). However both field observations and dissection of specimens indicated that the breeding cycle had scarcely begun there at that time.

HUDSONIA.—A nest that was studied by Averill (1895, p. 136) in Whitman County, Washington, was started on March 22, and the first egg was laid on May 1. The roof was begun on April 10. On the plains and among the foothills of Colorado, nest building is reported to begin in March (Cooke, 1897, p. 89).

On the La Plata River, Colorado, Gilman (1907, p. 10) found the first nest of the season about half completed on March 28. Two others were at about the same stage of construction on March 31. The first nest was full of snow a week after it was found, but it was later completed and, on April 28, held a slightly incubated set of seven eggs. The frequent snowstorms interrupted the nest building activity in the early part of the season.

OTHER KINDS OF MAGPIES.—According to Brown (1924, p. 123) nest-building requires about three weeks, two weeks for the nest proper and one week for the lining. In Cumberland some pairs commence to build by the second week in March, but the majority commence in April. This was confirmed by the observations of Tomlinson (1896, p. 188) on captive birds.

A nest that appeared to be completed on April 5 contained seven fresh eggs on April 27 (Comte, 1926, p. 45). In France, Coursimault (1917, p. 103) noticed that magpies were heard infrequently between the middle of February and the beginning of April, for that was the time of nest construction. A nesting pair of magpies watched by Boubier (1929, p. 39) in France worked at the nest during the whole of each morning, rarely in the afternoon. They began to build on March 12, 1918, and completed the nest on April 3, after three weeks.

Vaughan and Jones (1913, p. 26) report that in southeastern China "at the end of December the flocks break up, and some pairs of birds begin to prepare for nesting before the new year; but, although they commence breaking off twigs early in January, they do not, as a rule, complete their nests until well on in February." La Touche, in eastern China (1925, p. 13) reported seeing magpies carrying nesting materials in December. Between Fuchow and Canton, Mell (1924, p. 287) saw magpies carrying sticks for nests and watched one carrying grass on January 7.

According to an observer quoted by Browne (1886, p. 17) a magpie in England ordinarily will begin to build at the end of March and take about a month to complete the nest, but if the eggs are taken, a second nest may be built within a week.

REPAIRING

NUTTALLII.—The habit of nesting pairs to return to the same tree each season often results in the use of the old nest as a foundation for a new structure. Such double nests are seen frequently, and Dawson mentions one (1923, p. 41) forming a huge pile and representing four seasons of work.

In the neighborhood of Red Bluff in the northern end of the Sacramento Valley, Townsend (1887, p. 211) observed magpies beginning to make repairs on several old nests about March 10. He inspected these nests regularly for a month or more but found no eggs. His conclusion was that the birds laid their eggs in some old nests that were inaccessible to him; that is, in nests that were not disturbed. It was thought that during that season no new nest was built in that colony.

Evermann (1886, p. 610) observed that in Wheeler Cañon, Ventura County, a few of the nests he examined were newly made, but that the majority were old nests that had been used in previous years.

HUDSONIA.—Gilman (1907, p. 11) observed a good-sized colony of nesting magpies, and he was unable to detect any repairing being done. Moreover all the nests occupied were new ones. The obvious conclusion was that, at least for that locality (La Plata River, Colorado), the birds built anew each year. In Okanagan Valley, British Columbia, Munro (1919, p. 72) thinks that the birds "return to the same locality every year and repair the old nests, if they are not too dilapidated." Warren (1907, p. 1) recorded one instance in which one nest was used, presumably by the same birds in Colorado, for three successive summers. During the winter following the third summer, the nest was partly destroyed by storms and the weight of snow. The following spring a new nest was built in an adjoining clump. A nest near Lake Tahoe, California, was known to have been used for at least six seasons (Wheelock, 1904, p. 384). This nest was exceptionally bulky and showed evidence of having been used for several broods. Dice (1917, p. 122) reported an instance in which a nest was used a second time by a pair of birds different from the first pair. In 1906, a brood of young was reared nearly to full size in this nest. Then the whole family, both parents and young, was destroyed. No observations were made in 1907, but, in 1908, the nest was occupied again by magpies.

Observations of my own in several seasons in Smoky Valley, Nevada, indicated that as a rule in that vicinity each pair of magpies built a new nest each year. This conclusion resulted largely from the facts that there were many old, unused nests each season, that the nests were in groups of three or four of different ages, and the general lack of evidence that repairing had taken place. For example, not one of the nests found to be occupied in 1932, had been in existence in 1930, and, conversely, all the nests that had been occupied in 1930, were unused even though still present in 1932.

OTHER KINDS OF MAGPIES.—Hudson (1921, p. 163) writes that a nest may be used for several years, ". . . a little repairing work being bestowed on it each spring." One nest mentioned by Jesse (1889, p. 184) was used certainly for three consecutive years.

After seeing "scores of new nests built spring after spring" and seeing only one case of an old nest being repaired, Pitt (1922, p. 249) concluded the latter practice to be the exception in England. Graves (1884, p. 344) reached the opinion after studying one nesting pair over a period of several years that they never repaired or reoccupied an old nest. "A new one is constructed every year, and always, each year, in a different tree." In an instance cited by MacGillivray (1837, p. 569) a nest was known definitely to have been repaired and used for six successive seasons. Another nest, in a gooseberry bush, was occupied for several years.

Kirkman (1910, p. 58) wrote that "the magpie may continue to occupy the same nest, repairing it year after year, or reconstructing it, if very much damaged by winter storms. But its nesting habits do not appear fixed, or, if they be so, are guided by circumstances of which we are yet ignorant. Mr. Ussher, writing of the magpie in Ireland, states that it builds a new nest each year, either in the same tree or in another, and this seems to be its usual habit elsewhere. In one case a new nest, containing eggs, was found placed on top of two old ones . . ."

Harington (1914, p. 2) observed that in Burma, the nest is "very conspicuous, and seems to be repaired from year to year, sometimes being very massive." He thought (1903, p. 596) that it was because the birds were undisturbed that they were able to add to the nests each year and make them such large structures.

A nest found on April 23, 1915, by Schuster (1923, p. 291) in northeastern France appeared to be one of a former season that had been rebuilt and a new roof added.

From his experiences in Lanarkshire, Scotland, Stewart (1928, p. 45) wrote that, "as the Magpie shows a decided aversion, except on rare occasions, to use a nest for more than one season, the result is sometimes an accumulation of old nests in varying stages of demolition which, viewed from a distance, looks like a small rookery. Indeed on one occasion, while taking our rookery census, we were caused to deviate several miles, only to find two pairs of magpies were nesting at the farm-steading, accompanied by six old nests."

Summary and comment.—Of all the features of a magpie nest ordinarily noted by an observer its position, or the type of site selected, is probably the one most likely to show geographic variation. This is the one characteristic of the nest which may be correlated with the separate ranges of the various races.

It already has been emphasized that the yellow-billed magpie in California nests in the tops of trees. Several kinds of trees are inhabited, in two major types of location, along streams and on dry hillsides. The black-billed magpie in North America nests sometimes in large trees but more often in tall bushes, especially in thorny ones. Other kinds of magpies select nesting sites which range between these two extremes. In some localities the birds are known to nest on buildings or even upon the ground. This latter site is used only where there is no need for protection from ground-prowling animals.

The nest of the magpie is noteworthy for the large amount of material contained in it. The structure seems to be rather uniform for the whole group. The base and outer walls are composed of coarse material, heavy sticks, often thorny ones. There is inside this a heavy cup of mud held together with some vegetable material. Inside this cup is the lining of rootlets or fine plant stems. Over the whole structure is a canopy which is nearly always made of thorny twigs. This canopy has one or more openings in its side for the birds to enter and leave. The materials vary greatly, depending mainly upon the nature of the available supply. Many or most of the twigs are broken from near-by trees or bushes. Sometimes the dome is not present, but this is rare. Apparently this dome serves as a protection against the raids of predatory birds.

Both birds of a pair take an active part in nest building; both carry materials and place them on the nest. However, one of the pair, probably the female, gives more attention to the actual shaping of the nest.

Many observers have concluded that magpies build a whole series of nests each season, of which they actually use only one. This impression possibly resulted from the tendency of the birds to desert a nest upon slight disturbance at an early stage of its construction. The conspicuous structures are more impressive than in the case of smaller species which often exhibit the same traits.

The period of nest construction is a rather long one, often lasting for more than

a month. The lining is installed after the construction of the dome and after the nest appears to be completed. This accounts in part for the long period after the apparent completion of the nest before any eggs are deposited. Nests built to replace destroyed ones are completed in much shorter time than the first one of the season.

In some localities magpies regularly use the same nests year after year. In this case the old one is repaired and material is added to it. Somtimes a remarkably large structure is thus built. In other localities the birds seem never to use a nest for a second brood, but always build an entirely new one or, at most, build upon an old one, using it mainly as a base. Repair of nests is not limited to reoccupation. The birds see to it that the nest is kept in repair during the incubation and brooding of the young. If a part of the canopy is torn away, it is likely to be replaced quickly.

Nests of magpies are substantial structures which ordinarily endure several seasons of weathering. They are useful as certain indicators of the nesting of the birds in any locality where they may be found. In some cases the nests remain after the birds have given up nesting in a place or have been driven out by human interference.

EGGS AND INCUBATION

COLOR OF EGGS

NUTTALLII.—Dawson's (1923, p. 38) account of the colors of the eggs, based on a large series, is as follows: yellowish glaucous or pale olive-buff, finely and rather uniformly speckled and spotted with buffy brown or citrine drab or grayish olive or deep grayish olive.

A considerable amount of variation in color was observed by Kaeding (1897, p. 16) in the thirty or more sets of eggs which he collected. Some were heavily blotched with lilac and buffy or purplish brown, while others were minutely dotted with lilac, buffy, and grayish brown.

According to Bailey (1902, p. 271) the eggs have a more greenish tinge than those of the black-billed form. This statement was based evidently upon the observation by Bendire (1895, p. 355) that eggs with a greenish tinge in the ground color appeared to him to be more frequently met with in this than in the black-billed magpie.

HUDSONIA.—The prevailing ground color, as given by Bendire (1895, p. 352) is "pale or dirty gray, less often a light drab, and occasionally a set is found of a decidedly greenish tinge . . . They are generally heavily blotched with different shades of brown and ecru drab, these markings being often confluent, almost hiding the ground color, and are usually evenly distributed over the entire egg. In some specimens the markings predominate at the upper end of the egg, more rarely on the lower end. Some also show lavender shell markings, and occasionally a specimen is found in which the markings are well defined, not confluent, and leaving the intervening ground color distinctly visible. The shells of these eggs are close grained, moderately strong, and show little or no gloss."

PICA.—Elms (1906, p. 93) gives the color as "pale bluish green, thickly spotted and speckled with olive-brown and blotched with faint ash-grey."

According to Witherby (1920, p. 22) eggs of this race "vary in ground-colour from greenish-blue to yellowish- and greyish-green, closely spotted and mottled brown and ash. Varieties almost unmarked or with heavy brown caps, and erythristic eggs have been recorded." Further explanation of the latter type of egg was given by Jourdain and Borrer (1914, p. 247). Erythristic eggs are ones in which the markings are of shades of red or reddish brown only, the coloring matter consists of öorhodein alone. Normally the range of color-variation in the species includes eggs which are also colored with biliverdin (bile pigment) either alone or with other coloring matter, to form the various shades of blue and green. Jourdain on May 4, 1900, near Ashburne, Derbyshire, took a set of six eggs in which two showed the reddish color distinctively. Other cases of this sort for this race were recorded by Kricheldorff (1903, p. 10).

"Mr. R. Ware [1931, p. 73] exhibited a remarkable series of 14 clutches of Magpie (*Pica p. pica*), all taken within a restricted area in Sussex, and comprising the following types: (a) pale blue, almost unmarked; (b) pale blue, thinly speckled with light brown; (c) pale greenish-blue, with few but large blotches of light and dark brown and violet-grey shellmarks; (d) greenish ground, heavily blotched with brown; and (e) olive-green, thickly marbled with olive brown."

Bunyard (1920, p. 127) once exhibited a series of eggs from England, "showing great variation. Among them a clutch of six from Yorkshire with heavily pigmented

caps, the remaining portion almost unmarked, a clutch of six from Radnorshire, very heavily and evenly marked."

MAURITANICA.—An erythristic type of egg for this magpie, one with pink ground and red spots, was recorded by Kricheldorff (1903, p. 10). Four sets of eggs of this form obtained from Algeria by Koenig (1895, p. 213) were colored as follows: (1) with greenish white ground color and dark brown and olive-colored spots; (2) bright colored, greenish white ground color spotted with olive green, similar to sets of *P. p. pica*, (3) with more or less bright ground covered with large, deep dark olive-brown spots, (4) covered and streaked with deep dark brown, darker than any ever seen in Europe.

SERICEA.—According to the Caldwells (1931, p. 5), writing on magpies' eggs in South China, the "ground color varies from a bluish-green to olive drab, the markings being spots and streaks of pale brown, gray to black." Harington (1909, p. 108) wrote that eggs of magpies in Burma "seem more boldly marked" than eggs of English birds. Jones (1911, p. 672) found that "the olive-green coloured eggs, so common at Hong Kong, were not met with at Wei Hai Wei, where they are of a bluish green."

BACTRIANA.—Osmaston (1925, p. 673) remarked that the eggs of magpies in Ladakh, "do not vary a great deal in colour, and all varieties could I [he] think be matched by eggs of the English Magpie."

Baker (1920, p. 124) remarked upon the ". . . four races of *Pica p. pica* of Europe, *P. p. bactriana* of Western Asia, *P. p. bottanensis* of Tibet and Chinese Tibet, and *P. p. sericea* of China, all laying eggs which can be discriminated by size, colour, and character from one another." However, in a book on nidification of birds in India the same writer (1932, p. 23) expressed the opinion that eggs of all the races of magpie are exactly alike, and except for the measurements a description of one suffices for all. He explains that they are very like small, dull and rather brownish eggs of crows and abnormally colored eggs of the two genera run into one another. It is rare, however, for a magpie's egg to have the ground-color either pure pale blue or blue-green, this being almost invariably an olive, brown or even yellowish tint. In most eggs the markings consist of primary small blotches of dark umber-green with secondary blotches few in number and pale lavender in color. The primary markings are generally numerous over the whole surface, sometimes less so at the smaller end, but rarely forming caps at the larger. In a minority of eggs the markings are more sparse and are bolder. But, he considers the eggs of *P. p. sericea* to average distinctly paler than those of *P. p. bactriana.*

SIZE OF EGGS

NUTTALLII.—Measurements of 195 eggs of this magpie were given by Dawson (1923, p. 39) as follows: Average 30.8 by 22.4 mm. (1.22 by .88 in.); index 72.1. Largest egg, 37 by 23.4 mm. (1.46 by .92 in.); smallest, 26.7 by 20.3 mm. (1.05 by .80 in.). Measurements of sixty-two eggs in the United States National Museum collection were as follows (Bendire, 1895, p. 356): average 31.54 by 22.54 mm.; largest 34.29 by 22.86; smallest 28.45 by 21.34. Kaeding (1897, p. 16) has commented on the diversity in shape shown in his collection of over thirty sets; some eggs were short and rounded while others were long and elliptical.

HUDSONIA.—According to Bendire (1895, p. 352) the majority of the eggs are ovate. Others are short ovate, rounded, elliptical, and elongate ovate. Measurements

given by him of 201 eggs in the United States National Museum are as follows: average 32.54 by 22.86 mm.; largest 37.84 by 26.42; smallest 27.94 by 21.59.

PICA.—Measurements of twenty-three eggs of five nests in the neighborhood of Hamburg were as follows. Length, 30.9 to 36, average 33; width, 20.7 to 24.6, average 23.08; minimum egg weight 7.905 grams, maximum 11.360; minimum shell weight 0.430, maximum 0.724 (Groebbels and Möbert, 1929, p. 235). This is almost the same as the average given by Witherby (1920, p. 22) for 100 eggs from England which measured 32.9 by 23 mm. An abnormal egg in the Tring Museum measured 44.9 by 26.5 mm. A dwarf from North Brabaut measured 22.4 by 16.2 mm. (Jourdain, 1906, p. 19).

Average dimensions of 65 eggs taken in northern Russia (Kiew) over a three-year period by Goebel (1870, p. 191) were 34 by 25 mm. The smallest egg in this lot measured 31 by 24 mm.; the largest 39 by 26 mm.

Schalow (1876, p. 120) gave measurements of twenty-one eggs from Brandenburg as follows: Maximum, 35 by 24; minimum, 32 by 22.5; average, 33.38 by 23.28.

One hundred normal eggs in the collection of Rey (1905, p. 375) averaged 32.9 by 23 mm. in measurements. The largest was 37 by 25 mm.; the smallest, 28 by 22.5 mm. The average weight was 0.565 gm. A dwarf measured 23.9 by 18.7 mm. and weighed 0.250 gm.

Average dimensions of a hundred eggs from Rumania were 33 by 23.1 mm.; maximum, 36.2 by 24.5; minimum, 31 by 22 mm. (Dombrowski, 1912, p. 37).

Two eggs (*leucoptera*) from Siberia measured 37.7 by 26.1 and 37 by 25.7 and their weights were 0.790 and 0.750 gm. (Rey, 1905, p. 375).

BACTRIANA.—One hundred and twelve eggs from Ladakh measured as follows: Length, average 36.5 mm.; minimum 32.4, maximum 43.1. Breadth, average 24.9 mm., minimum 23.1, maximum 27.1 (Osmaston, 1925, p. 673). Measurements of 200 eggs were summarized by Baker (1932, p. 23) as follows: Average, 36.1 by 24.6 mm.; maxima, 43.1 by 23.4 and 38.6 by 27.1 mm.; minima, 29.5 by 22.5; a pigmy egg, 22.7 by 19.1 mm.

BOTTANENSIS.—Measurements given by Baker (1932, p. 24) for seventy eggs were as follows: Average, 38.6 by 26.5 mm.; maxima, 42.1 by 26.6 and 39.7 by 27.4 mm.; minima, 33.4 by 26.2 and 37.2 by 25.1 mm.

SERICEA.—Forty-six eggs collected at Foochow by La Touche (1925, p. 13) measured as follows: Average, 35 by 25 mm.; largest, 38.5 by 26.5; smallest, 31 by 25. This is practically the same as the average given by the Caldwells (1931, p. 5). Seventy-five eggs measured by Baker (1932, p. 23) showed dimensions as follows: Average, 35.5 by 24.9 mm.; maxima, 43.4 by 24.7 and 37.1 by 27.0 mm.; minima, 30.6 by 24.0 and 34.0 by 23.0 mm.

MAURITANICA.—According to Whitaker (1905, p. 11) eggs of this form measure 31 to 35 mm. in length by 23 to 25 mm. in breadth. Dimensions of twenty-seven eggs of this race collected by Koenig (1895, p. 214) in Algeria were as follows: Average 33 by 23 mm.; minimum, 30 by 23 mm.; maximum, 33 by 24 mm. Twenty-six eggs of the form *mauritanica* found by Koenig in Algeria, averaged 32.15 by 23.23. The largest measurements were on two specimens—35 by 23 mm. and 33 by 24; the smallest, 30 by 23 and 31 by 22. Their average weight (of shells) was 0.542; they ranged in weight between 0.490 and 0.580 gm. (Rey, 1905, p. 375).

EGG WEIGHT

NUTTALLII.—A complete set of eight eggs taken on March 30, 1930, at two and one-half miles southwest of Coyote, Santa Clara County, weighed, in grams, as follows: 7.6, 8.1, 8.2, 8.2, 8.5, 8.6, 8.7, 8.8. The total weight of this set, in which incubation had just begun, was 66.7 grams. The average weight of the eggs was 8.3 grams (Miller, MS).

HUDSONIA.—The average weight of seventeen eggs of this form was given by Bergtold (1917, p. 34) as .34 ounces or 9.64 grams. Weights of thirteen eggs, in two sets, given by the same writer (p. 35) ranged from 132 to 155 grains (8.58 to 10.07 grams). The average for the whole lot of thirteen eggs was 9.39 grams. The smaller set of six eggs weighed 9.23 grams, in average. The average for the larger set (seven eggs) was 9.68 grams. An egg containing a well-developed embryo was taken by me in Smoky Valley, Nevada, on May 15, 1930. The egg measured 31 by 24 mm. and weighed 7.2 grams. Another one (incubation estimated at 14 days on May 16) measured 37 by 23 mm. and weighed 8.2 grams.

At another time, Bergtold (1929, p. 472) gave weights (in grams) of five eggs along with dimensions (in millimeters) and the specific gravity for each, as shown in the following tabulation.

Weight	Length	Breadth	Specific gravity
10.20	34.50	24.00	1.041
9.80	33.50	23.50	1.032
10.15	34.00	24.00	1.030
9.35	33.00	23.50	1.032
10.75	34.00	24.00	1.030

MAURITANICA.—Twenty-seven shells of eggs of this magpie averaged .56 grams in weight. The smallest eggshell weighed .49 grams and the largest, .58 grams (Koenig, 1895, p. 214).

PICA.—The empty shells of thirty-three eggs weighed by Foster (1917, p. 41) averaged .5958 grams. Heinroth (1922, p. 221) gives egg-weight for the magpie in Germany as 10 grams, or 5 per cent of the body-weight of the female. Jourdain (1906, p. 19) gives on authority of Foster the average weight of 13 unblown eggs as 10.517 grams. He points out that eggs from the northern part of the range are larger than those from farther south; 10 eggs from West Bothnia average 40 by 24.25 mm.

NUMBER OF EGGS IN SET AND TIME OF LAYING

NUTTALLII.—Mrs. Bailey gives the number for this species as about seven (1902, p. 271). This is the average as given by Bendire (1895, p. 355) who adds that sets of eight and nine are more rarely found than in the black-billed form. Most of the more than thirty sets taken by Kaeding (1897, p. 16) numbered six and seven; none contained more than eight, and none fewer than five. Two exceptional sets recorded by that author were one of nine eggs, April 21, 1896, and a single egg, two-thirds incubated and being brooded. It was thought that in the latter set "a Jay" had gotten the other eggs.

On May 13, 1906, in Yuba County, four nests near one another were examined (Bolander, 1907, p. 25). One contained five fresh eggs and the others held young birds. Each of the three nests containing young also held a single addled egg. Such

a situation might be considered as indicating some sort of weakness in this particular breeding colony of birds.

Two exceptional sets have been reported by Barlow (1894, p. 111): one of four eggs, incubated, and one of ten. This latter case was, however, not well authenticated.

In Wheeler Cañon, Ventura County, Evermann (1886, p. 608) collected eggs on April 2, 1881. Nine sets were obtained. Sets of three, four, and six were not yet completed. Incubation was barely started in the two sets of seven, in three sets of eight, and one of nine.

SETS OF EGGS OF YELLOW-BILLED MAGPIE IN THE MUSEUM OF VERTEBRATE ZOOLOGY

Number	Locality	Date	Number of eggs	Stage of incubation	Kind of tree	Distance from ground
790	5 mi. N. Sacramento	Apr. 21, 1901	8	begun	oak	35′
792	do.	Apr. 20, 1901	6	fresh	oak	35′
793	do.	Apr. 15, 1899	7	medium	oak	40′
794	do.	Apr. 20, 1901	7	begun	oak	45′
795	do.	Apr. 21, 1901	6	one-half	oak	30′
796	do.	Apr. 13, 1900	8	medium	oak	50′
797	do.	Apr. 21, 1901	7	one-half	oak	40′
799	do.	Apr. 21, 1901	7	begun	oak	25′
800	do.	Apr. 20, 1899	6	fresh	oak	40′
801	do.	Apr. 7, 1900	5	begun	oak	40′
802	do.	Apr. 20, 1899	7	begun	oak	50′
803	do.	Apr. 25, 1900	6	fresh	oak	35′
804	do.	Apr. 15, 1899	6	far adv.	oak	45′
805	do.	Apr. 6, 1901	8	fresh	oak	35′
806	do.	Apr. 20, 1901	5	begun	oak	50′
807	do.	Apr. 20, 1901	6	fresh	oak	30′
808	do.	Apr. 13, 1900	7	adv.	oak	35′
809	do.	Apr. 13, 1900	6	medium	oak	25′
810	do.	Apr. 21, 1901	5	adv.	oak	40′
812	do	Apr. 21, 1901	7	one-fourth	oak	50′
813	do.	Apr. 15, 1899	5	medium	oak	45′
814	do.	Apr. 6, 1901	7	fresh	oak	30′
815	do.	Apr. 13, 1900	7	fresh	oak	45′
816	do.	May 8, 1901	7	adv.	oak	45′
817	do.	Apr. 20, 1901	7	begun	oak	40′
819	do.	Apr. 15, 1899	6	medium	oak	45′
820	do.	Apr. 7, 1900	6	fresh	oak	30′
821	do.	Apr. 7, 1900	7	fresh	oak	45′
791	Cosumnes River, Sacramento County	Apr. 27, 1901	7	one-half	oak	50′
798	do.	Apr. 26, 1901	6	fresh	oak	40′
818	do.	Apr. 26, 1901	5	fresh	oak	30′
822	do.	Apr. 26, 1901	7	fresh	oak	25′
1239	Mocho, Alameda Co.	June 2, 1904	7	begun	oak	40′
1421	Sheep dip, near Hammon City, Yuba Co.	May 13, 1906	5		oak	30′
1860	18 mi. from San Jose, Santa Clara Co.	Apr. 21, 1891	7	fresh	willow	20′
2207	Berryessa, Santa Clara Co.	Apr. 7, 1896	7	one-half	sycamore	70′
2208	do.	Apr. 20, 1896	7	begun	oak	15′

SETS OF EGGS OF YELLOW-BILLED MAGPIE COLLECTED BY W. B. DAVIS

Number	Locality	Date	Number of eggs	Stage of incubation	Kind of tree	Distance from ground
1	Palermo	Apr. 9, 1929	8	fresh	valley oak	40′
2	Palermo	Apr. 9, 1929	6	fresh	valley oak	40′
3	Palermo	Apr. 11, 1929	7	fresh	valley oak	50′
4	Palermo	Apr. 11, 1929	5	fresh	valley oak	30′
5	Palermo	Apr. 17, 1929	7	fresh	valley oak	30′
6	Oroville	Apr. 20, 1929	8	slight	blue oak	25′
7	Oroville	Apr. 22, 1929	6	slight	digger pine	30′
8	Oroville	Mar. 30, 1928	7	begun	blue oak	30′
9	Palermo	Apr. 8, 1928	7	begun	valley oak	40′
10	Palermo	Apr. 9, 1928	8	slight	valley oak	50′
11	Palermo	Apr. 17, 1928	7	fresh	valley oak	30′
12	Oroville	Apr. 28, 1928	7	one-third	valley oak	50′
13	Palermo	Apr. 29, 1928	7	fresh	valley oak	40′
14	Palermo	Apr. 30, 1928	7	begun	valley oak	30′
15	Oroville	May 6, 1928	5	fresh	blue oak	30′
16	Oroville	May 6, 1928	5	fresh	blue oak	30′
17	Palermo	Apr. 1, 1930	7	fresh	blue oak	25′
18	Palermo	Apr. 8, 1930	6	fresh	blue oak	30′
19	Palermo	Apr. 15, 1930	5	fresh	cottonwood	25′
20	Palermo	Apr. 15, 1930	6	one-third	blue oak	35′
21	Palermo	Apr. 16, 1930	6	one-third	blue oak	25′
22	Palermo	Apr. 16, 1930	7	fresh	blue oak	25′
23	Oroville	Apr. 19, 1930	8	slight	blue oak	30′
24	Oroville	Apr. 21, 1930	6	slight	blue oak	25′
25	Oroville	Apr. 21, 1930	7	slight	blue oak	25′
26	Oroville	Apr. 21, 1930	8	slight	blue oak	35′
27	Oroville	Apr. 21, 1930	6	slight	blue oak	30′
28	Oroville	Apr. 21, 1930	5	slight	blue oak	35′
29	Oroville	Apr. 21, 1930	7	slight	blue oak	35′
30	Oroville	Apr. 21, 1930	7	slight	blue oak	25′
31	Oroville	Apr. 21, 1930	5	slight	blue oak	25′
32	Oroville	Apr. 21, 1930	7	slight	blue oak	30′
33	Oroville	Apr. 21, 1930	5	slight	blue oak	25′

SUMMARY OF PRECEDING TABLES

Number eggs in set	5	6	7	8	9
Total sets	13	17	32	8	0

Total sets	70
Total eggs	455
Average per set	6.5
Mode	7

HUDSONIA.—A complete set of four eggs was reported for Washington (Averill, 1895, p. 136). The first egg was laid on May 1, and one was added on each alternate day until May 7. Incubation began on the next day, May 8. Breeding dates for the magpie, in Washington, recorded by Bowles (1921, p. 10) are as follows: Earliest record for fresh complete set, March 29; mean date for sets of eggs, April 15; latest record for fresh complete set, May 15.

Dille (1888, p. 23) records the average number of eggs in Colorado as seven with the ordinary limits as five and nine. He records one set of eleven. The usual time for eggs in that state is given as May 1 on the plains and May 25 in the mountains. In

the vicinity of Golden, Colorado, many nests contain full sets of eggs by the second week in April, and at higher altitudes by May 1, according to Rockwell and Wetmore (1914, p. 319). An exceptionally early date for eggs in this state is March 31, in Mesa County (Rockwell, 1908, p. 168). Cooke (1897, p. 89) gives the first week in April as the time for the earliest eggs in the foothills and on the plains in Colorado.

Saunders (1914, p. 135) gives April 7 and May 26, 1912, as extreme dates for finding fresh sets of eggs in Montana. He reports (1921, p. 94) that incubation has started in most nests before May 1.

The earliest nest found by Gilman (1907, p. 10) in La Plata County, Colorado, held one egg on April 8 and a complete set of eight eggs on April 15. The early sets in that locality were largest; most of them contained eight eggs. Five out of seven had eight; the other two, seven each. Most of the sets laid in the first half of May contained seven eggs. Of complete sets found after May 15, several were of six, two of five, and one of four eggs.

Near Williams Butte, Mono County, California, a set of six eggs was found on April 27, 1916, and one with seven eggs, one-third incubated, on May 1 (Grinnell and Storer, 1924, p. 378).

The average number of eggs through the whole range of this bird is given by Bendire (1895, p. 351) as seven. At Fort Lapwai, Idaho, he found sets of nine frequently, and twice he took sets of ten. The earliest record for a full set of eggs at Okanagan Valley, British Columbia, is April 22 (Munro, 1919, p. 72). The earliest completed set of eggs recorded by Ransom (1929, p. 34) for Washington was one of six found, March 27, 1928, in Grant County. An especially large number of eggs, thirteen found in a nest in Montana, makes up the biggest recorded set for this subspecies (Silloway, 1904, p. 148). Two recently built nests in the vicinity of Carcross, British Columbia, were without eggs in the last week of May (Swarth, 1926, p. 119). For the neighborhood of Carson City, in western Nevada, the time for finding fresh sets of eggs in the nest is given by Henshaw (1879, p. 306) as between March 1 and May 12. Out of twelve full sets of eggs reported by Dice (1917, p. 124) from Walla Walla County, Washington, one contained 4 eggs, one 5, three 6, four 7, one 8, and two 9. The earliest date for a complete set was March 26, 1905. Nests with eggs were found as late as April 22.

Concerning the time of egg laying Kalmbach (1927, p. 4) writes that "in Colorado, Utah, California, and southern Oregon, egg laying begins before the middle of April, in Washington and Montana about two weeks later, while in the extreme northern part of the magpie's range it does not begin before June or even July." In his experience seven is the usual number of eggs in a set, sets of eight and nine are not uncommon, and he found one set of ten.

RECORD OF NESTS OF BLACK-BILLED MAGPIE FOUND 5 MI. SE. MILLETT P. O., SMOKY VALLEY, NYE COUNTY, NEVADA (LINSDALE, MS)

Date	Content	Stage	Kind of Plant	Distance Up
Apr. 22, 1930	8 eggs		Shepherdia	7'
Apr. 26, 1930	7 eggs		Shepherdia	
Apr. 27, 1930	1 egg	6 on May 13	Shepherdia	
May 16, 1930	1 egg, 3 yg.	just hatched	Shepherdia	7'
May 16, 1930	6 eggs		Shepherdia	6'

May 15, 1932	3 yg.	week old	Shepherdia	5′
May 19, 1933	6± yg.	2–3 days old	Rose-willow	7′
May 20, 1933	3 eggs		Shepherdia	6′
May 20, 1933	1 yg.	wt. 130+ gm.	Shepherdia	6′
May 21, 1933	3 eggs	5 on May 31	Rose-willow	6′
May 21, 1933	6± yg.	small	Shepherdia	5′
May 22, 1933	4 eggs		Shepherdia	5′
May 22, 1933	4 yg.	wt. 100± gm.	Shepherdia-rose	5′
May 22, 1933	1 yg.	well-feathered	Shepherdia	5½′
May 22, 1933	5 eggs		Shepherdia	6½′
May 22, 1933	2 eggs		Shepherdia-rose	6′
May 22, 1933	2+ yg.		Shepherdia	6′
May 27, 1933	4 yg.		Shepherdia	5½′
May 27, 1933	1 yg.	nearly grown	Shepherdia	5′
May 29, 1933	6 yg.	wt. 45 gm.	Shepherdia	5½′
May 30, 1933	5 yg.	feathers showing	Shepherdia	5½′
May 30, 1933	4 yg.	wt. 130± gm.	Shepherdia	5′
May 30, 1933	5 yg.		Shepherdia	9′
May 31, 1933	2 yg.	feathers showing	Shepherdia	5½′
May 31, 1933	3 yg., 1 egg	hatching	Shepherdia	5½′
May 24, 1932	3 yg.	feathers showing	Shepherdia	5′
May 19, 1933	6 eggs		Shepherdia	
May 21, 1933	6 yg.	110 mm. long	Willow	8′
May 21, 1933	5 eggs		Shepherdia	5′
May 22, 1933	7 eggs		Shepherdia	4½′
May 22, 1933	4 eggs		Shepherdia	5′
May 23, 1933	5 eggs		Shepherdia	6′
May 23, 1933	6 eggs		Shepherdia	8′
May 24, 1933	4 yg.		Shepherdia	4′
May 24, 1933	3 yg.	feathered	Shepherdia	4½′
May 25, 1933	1 yg.	half-grown	Willow	10′
May 25, 1933	4 yg.	ready to leave	Willow	10′
May 27, 1933	5 eggs		Shepherdia	4½′

OTHER KINDS OF MAGPIES.—Brown (1924, p. 124) writes that in Cumberland, England, "the clutch varies from three to eight eggs, but the latter I have found only once and, curiously, all the eggs were infertile. . . . One egg is laid each day, the female covering the eggs at night. In 1924, ten nests were visited daily during the laying-period to discover when incubation commenced, and it was found that with a clutch of three or four eggs incubation did not commence until after the full clutch was laid, but with a larger clutch incubation usually commenced after the fourth or fifth egg. In the case of an early nest, a period, sometimes as long as three weeks, intervenes between the completion of the nest and the laying of the first egg.

April 26 is given by Cordeaux (1876, p. 4984) as the earliest date, in 1876, for a complete set of five eggs in North Lincolnshire, England. Witherby (1920, p. 22) gives the number of eggs per set for England as usually 5 or 6 to 8, rarely 9 or 10, and he reports the season as beginning in April, rarely March. Dunlop (1910, p. 138) wrote that the magpie normally does not commence incubation until all of the eggs have been laid but that he had known of an instance where incubation began with the laying of the first egg. Brown (1867, p. 894) recorded the taking of several sets of eight eggs in Stirlingshire, England. Sets of eggs are found in April in Germany

(Friderich, 1923, p. 17) and number from five to eight, seldom nine. Elms (1906, p. 53) gives six to nine as the number for England. In Essex the clutches range from five to seven (Glegg, 1929, p. 10). In Cornwall, a nest containing a set of ten eggs heavily incubated was found on April 10, 1889 (Jesse, 1889, p. 184).

Nests with sets of five or more are found in the Island of Cyprus from April 15 to May 20 (Bucknill, 1910, p. 20).

In Norway, Mitchell (1877, p. 200) records a completed set of seven eggs on May 14, at Nervig, and another in which the last of seven eggs was laid on June 10, at Foktuen. The number for a set given by Van Havre (1928, p. 52) for Belgium is 5 to 8 or even 10. Noble (1902, p. 74) found most nests in southern Spain with full sets of eggs on April 24. Some sets had as many as eight eggs.

Four sets obtained by Koenig (1895, p. 211) in Algeria numbered 6, 6, 7, and 8. They were collected on May 7 and 9, 1892. Zedlitz (1914, p. 227) recorded the finding of two nests of this bird in Algeria, each containing a single fresh egg on May 13. The number given by Menegaux (1919, p. 41) for a set is 5 or 6 and the time of laying as the end of April and in May. This agrees with the experience of Heim de Balsac (1926, p. 396) in western Algeria. He knew of one set containing as many as seven eggs.

Whitaker (1905, p. 11) gives the number of eggs as six although there are occasionally seven or even eight. According to Salvin (1859, p. 312) they are laid the third week of May or earlier in the Eastern Atlas. Jourdain (1921, p. 129) found eggs in Morocco in the first week of April.

In Kamchatka, Stegneger (1885, p. 242) recorded the finding of a newly built nest, on May 18, 1883, which was nearly ready for eggs although two feet of snow still lay on the ground. Buxton found eggs by the last week of May. Sets contained five or six eggs (Allen, 1905, p. 247).

Vaughan and Jones (1913, p. 26), working in southeastern China, found that "in some years, as late as the middle of March, about seventy-five per cent. of the nests examined contain no eggs, whereas in others the end of February sees most of them with full clutches. Fresh eggs were found, however, from February 5th to May 6th; and of thirty-one nests, three had eight eggs, seven had seven, seventeen had six, and four had five—six therefore is the usual clutch."

Osmaston (1925, p. 673) in Ladakh, examined twenty-eight nests. "Two of these contained 7 eggs, three with 6 eggs, five with 5 eggs, eight with 4, six with 3, one with 2, and three singletons." In Shantung, China, Jones (1911, p. 672) gives the earliest date for eggs as May 6 and the latest June 1. The usual number in a set was four or five; more than seven were not found. Harington (1914, p. 2) wrote that in Burma, magpies lay in February and March, "five and six being the usual complement of eggs."

For three years the earliest and latest sets of eggs found by Goebel (1870, p. 191) in northern Russia (Kiew) were as follows: 1867, April 28 (7 fresh), May 19 (6 fresh); 1868, April 16 (3 fresh), June 11 (5 incubated); 1869, April 14 (8 fresh), May 22 (4 strongly incubated). In Eastern Siberia, Dörries (1888, p. 77) reported finding sets of 7 or 8 eggs in mid-April.

In the lower Yangtse Basin, China, LaTouche (1906, p. 433) noted that although

magpies began to build early in the year, fresh eggs were to be found throughout April. In the neighborhood of Quetta, India, Meinertzhagen (1920, p. 136) found fresh eggs of magpies on April 10, April 27, and May 3. The birds had not yet laid in nests found in early May by Betham (1906, p. 830) at Ziarat, India. The season for eggs in South China is considered by the Caldwells (1931, p. 5) to be from February onward. In Tibet, Ludlow (1928, p. 53) reports that the form *bottanensis* builds nests towards the end of March, and eggs are to be found in April, May, and June. Sets of eggs usually numbered four or five, but sometimes six, and occasionally only three, were found.

According to Schalow (1919, p. 339) magpies in Brandenburg, Germany, begin nesting as early as the end of March, but most of the nesting activity comes from the middle of April to the end of May. Nests were sometimes found in June.

Concerning the number of eggs in a set Jourdain (1906, p. 19) reports the usual number as 6 or 7, but sometimes it is 5, 8, or 9. He cites Hager as reporting an instance where 10 were laid. From April 24 to May 1 is the best time for eggs in the midlands.

An instance has been cited by Gordon (1934) in which a magpie was once inveigled into depositing as many as thirteen eggs by simply removing the third egg each day, leaving two in the nest.

LENGTH OF INCUBATION PERIOD

NUTTALLII.—Length of incubation period for the yellow-billed magpie has not yet been determined.

HUDSONIA.—Bendire (1895, p. 352) gives the length of the incubation period as from sixteen to eighteen days. He observed that one egg is deposited daily, and that incubation does not begin until the full set is nearly completed. Wheelock states apparently on the basis of original observations (1904, p. 384) that the female incubates for eighteen days. Davis (1931, p. 604) reported the incubation period to be seventeen days for a set of eggs hatched in captivity in Washington.

PICA.—Brown (1924, p. 125) determined the incubation period in Cumberland, England, to average seventeen to eighteen days. Two eggs in an incubator hatched at the end of the eighteenth day (Evans, 1891, p. 63). Brock (1910, p. 118) records the incubation period as 17 to 18 days.

In the case of a pair of magpies which bred in captivity (Tomlinson, 1896, p. 188) five eggs were laid, one each day beginning April 21. The first young bird hatched on May 11, sixteen days after the last egg was laid. The last one hatched on May 13, thus showing the period to be eighteen days.

Raspail (1896, p. 145) studied a nest containing eight eggs in France. The first egg was laid on March 27, and one was deposited daily, the last on April 3. At eight o'clock in the morning of April 20, two had hatched. Two others hatched between 12:30 and 1:15 p.m. The fifth was pipped at 5 and hatched at 7:30 p.m. Another egg had just hatched at 8 a.m. on the 21st, and the seventh hatched between 7 and 8 o'clock in the evening. The eighth egg was not fertile. The elapsed time between the hatching of the first and last eggs was 37 hours. The incubation time then from the laying of the last egg was for 2 eggs, 17 days; for 2 eggs, 17 days and 6 hours; for one egg, 17 days and 12 hours; for one egg, 18 days; for one egg, 18 days and 13 hours.

In northeastern France a nest found by Schuster (1923, p. 291) contained two eggs on April 23; 4 eggs on April 25; 6 eggs on April 27; and just hatched young on

May 16, the nineteenth day after completion of the set. Schinz (1854, p. 41) wrote that the five or six eggs are brooded for eighteen days.

SEX PERFORMING INCUBATION

NUTTALLII.—Although no specific observations are available to show which bird of a pair incubates, the general impression from hundreds of hours of watching at nesting colonies is strong that the female alone incubates. All observations made at this season tend to confirm the conclusions of people who have studied other kinds of magpies and have testified that the female does all or nearly all the incubating.

HUDSONIA.—Bendire (1895, p. 352) wrote that incubation is performed by the female almost exclusively, and that he "rarely saw the male on the nest." Henshaw (1879, p. 306) states that the incubating female is "relieved now and then" by its partner. However, he does not give detailed observation to substantiate the assertion. Observations of Wheelock (1904, p. 384) indicate that the female alone incubates the eggs. This was confirmed by Davis (1931, p. 604) who observed a pair of magpies nesting in captivity. In this case the female "appeared to do all the incubating."

PICA.—Brown (1924, p. 124) in England, supposed that the female alone incubated for when he frightened a magpie from a nest it always flew away quietly, but if, as was often the case, the mate was near it would start chattering. He supposed the noisier bird to be the male. With Tomlinson's (1896, p. 188) captive birds the male was never seen on the nest during the incubation period; the female did all the sitting. Kirkman (1910, p. 8) makes the statement that "both sexes incubate." No mention is made of the observations which might have formed the basis for this statement. Since it wholly contradicts the experiences of nearly all other observers it must be doubted at least until the nature of the supporting evidence, if there be any, is known. Another English author (Seebohm, 1883, p. 566) wrote that "both birds sit upon the eggs, although the female performs the greater part of the duties of incubation." In Butler's account of the magpie (1896, p. 152) occurs the statement that "the male takes his share in the duties of incubation." However, no evidence is given to show that the male actually ever broods the eggs in the nest.

MAURITANICA.—In Algeria, according to Koenig (1895, p. 211) the female broods industriously. He could not say that the male never brooded but when he saw a bird fly from the nest it was always a female, never a male.

ACTIVITIES OF MAGPIES DURING THE INCUBATION PERIOD

Activities of magpies during the eighteen days of the incubation period are, of course, only a small segment of the whole cycle of activities for a year. This segment, however, comes at a time of great excitement, when actions of the birds are most diverse. At this season the ordinary foraging and resting are minimized in importance for the sake of actions having to do with reproduction. Nevertheless, the actual time of incubation seems to be one in which there is less strain upon the birds than in earlier or later periods. This circumstance simplifies to some extent the task of analyzing magpie behavior of the period of incubation.

NUTTALLII.—A series of actions which amount almost to preparation for the behavior of the incubation period are to be observed before, through and after, the period of nest building. Even though the birds are seen most often in small groups or flocks,

it is probable that the units in the organization are pairs which remain together throughout the year. During and after the long period of nest building or reconstruction, a large share of the time is spent at or near the nest. The two birds of each pair spend several hours of each day perched side by side on some limb close to the site. At such times one of the birds regularly utters a song which I have been able to hear up to 100 yards away. There are other indications that during this pre-incubation time a magpie's attention is largely centered about its nest and its mate.

The time of the period of incubation varies somewhat from year to year. In the 1930 season, my several hours of watching on March 23, near Coyote, Santa Clara County, indicated that nest building had been practically finished, but that incubation had not started. No bird was seen carrying nest material; birds were seen to enter a nest only once; the birds seen were mostly in pairs, and all became quiet before noon and remained so for most of the afternoon, which indicated that foraging for food was the chief activity at that time. In 1931 corresponding stages were reached more than a month earlier, for on February 22, at least one pair of magpies had started incubation at the Coyote colony.

In late afternoon of March 29, 1930, at the Coyote colony, I saw several pairs of magpies foraging on the ground in the field in which the nesting trees stood. Once two birds of a pair were together on the ground near the base of a tree. One was walking about in the normal manner of a foraging bird. The other one held its wings wide open, waved them slowly, and it continually made an effort to get in front of the first bird. The male (?) apparently paid no attention to this begging. I was unable to determine the final result in this, my first opportunity to watch behavior peculiar to an incubating bird.

A tree containing two nests in this colony was climbed on the same day. From the ground the two nests appeared equally old. The first one contained nothing. The second held four eggs. A magpie flew out from the tree as it was approached. The bird chattered only a little as the first nest was being climbed to, but when the other nest was approached it came nearer and showed much more concern than it had at first.

Mr. W. B. Davis of Oroville tells me that in the two seasons 1930–31, he examined more than fifty occupied nests of the yellow-billed magpie. Usually when he climbed to a nest the brooding bird left when he was part way up the tree. About six of the birds came back to the close vicinity of the nest while he was there. These birds gave loud alarm notes and pounded with their bills on the limbs on which they were perched. He has seen them pound so hard that chips of wood were loosened and knocked from the limbs. Evidently this is a frequent mode of expression of "anger" with this species as well as with some other members of this family.

By half past five on the morning of March 30, at the Coyote colony, the magpies had been chattering in the oak grove for fully fifteen minutes. Although during that time it was too dark to see the birds, they seemed to be scattered and in the tops of the trees. It is fairly certain that the birds spent the night in these trees, where they were heard first in the morning. At 5:45 the first pair was seen to fly to the ground.

Within ten minutes after the first magpies became active one flew to a tree containing a nest which a bird had entered the previous evening. The female (?) came out and perched in front of the new arrival (male?). The female spread its wings and

waved them slowly. It opened its mouth widely and the other bird poked its bill into the opening, evidently giving food to the female. The female begged a little more, without result, then returned to the nest, but left it again after a short time. Within two minutes the feeding was repeated, and the brooding bird returned to its nest where it stayed. Half an hour later the tree was climbed. When the climber was a little over half way to the nest the bird flew out silently to a nearby orchard, out of sight, and did not return while persons were at the tree. The nest held eight eggs, a complete set, in which incubation had just commenced.

About an hour after the eggs were taken, both birds of the pair were back at the nest. They perched close together on limbs in the tree top; then hopped to the nest, and, in turn, each moved to the entrance, looked inside and then moved to another limb. After staying there for about one minute they flew away. Calls signifying alarm were given during nearly the whole of this visit. It is possible that the birds had discovered previously that the nest was empty. They had not been watched closely.

Later in the morning the pair returned to the nest many times. At first, one bird would start to enter the nest, and then it would quickly withdraw. This was repeated several times. Afterwards, both birds entered and stayed inside, sometimes for several minutes. After each visit the birds flew in the same direction to an orchard near the grove.

Another pair, watched by me on the morning of March 30, 1930, demonstrated the early stages in the establishment of the mate-feeding behavior. These two birds were foraging in a grain field where the ground was nearly bare. The one which was thought to be the male walked about, paying little attention to its mate. The female (?) at first ran after and put herself in front of the male, facing him with bill open, head lowered and wings quivering. This bird seemed to hold its wings less widely opened and to move them more rapidly than did other individuals noted.

The response of the male was merely to turn and walk in another direction. Once the female picked at some object on the ground, and immediately the wing-quivering reaction was aroused, and the bird hurried over to its mate, but again the response was negative. After 10± fruitless beggings the female began to pick up objects, presumably food, and for the next three or four minutes she was picking almost continuously, with only an occasional tendency to flutter the wings slightly. Next the male flew to the top of a fence post. The female flew to the next post, and immediately upon alighting her wings were opened slightly. When the birds were on the ground the female picked at objects much more often than did the male. Many hours of watching at this season tended to confirm the supposition that these actions were preliminary to actual incubation which was to begin shortly.

Behavior that I consider typical for early stages of brooding was watched in this same colony on February 22, 1931. At this early date the actions of the birds indicated that only one nest contained eggs. Both magpies flew at a California woodpecker near the nest and drove it from its perch. Later, when four or five woodpeckers were moving about near the nest, a magpie flew out from it and drove one of the woodpeckers from the tree.

The male of this pair at intervals of only a few minutes would fly to and enter the nest and a series of feeding calls would be given. Then the male would leave. Twice,

immediately after the male left, the female flew out, but she shortly returned to the nest. At 10:35 a.m. the male flew from the ground 100 yards from the tree and perched at the opening on the west side of the nest. After fifteen or twenty notes were given, apparently by both birds, the male left. The female followed out onto a limb and continued the begging, giving calls and moving her wings.

This general type of behavior continued through the time this nest was watched, from 9 a.m. to 1 p.m. Twice the brooding bird left the nest and did some foraging for itself, but each time it was away for only a few minutes. All trips to the ground or to other trees were made toward the west—away from the main grove. As far as I could determine, this pair paid no attention to other magpies on this date and the others paid no attention to it.

Two weeks later, on March 8, brooding was still the chief occupation at this nest. On this date birds at this colony were watched for eight hours without seeing the brooding bird receive food at the nest one single time. The female was fed by its mate but the procedure was entirely different from that of the early stages of incubation.

In the middle of the afternoon the brooding female flew from a nest and toward another magpie in flight about 75 yards away. It followed this second bird a short distance, then turned and lit on the plowed ground of the field where it foraged for a minute or so. Upon the approach of its mate the female spread its wings and gave begging calls. The mate lit in a tree whereupon the first bird flew to it and was fed. Both birds wiped their bills on the limb, and the female returned directly to the nest. This is in agreement with observations on other pairs during late stages of the incubation period, all of which indicate that the brooding bird is restless and leaves the nest often during the latter part of the period. Then the feeding usually takes place in a tree but away from the nest itself. Usually the female flies out to meet the male on some nearby perch. It is possible also that the impulse to feed the female latterly grows weaker in the male.

The forage range of individual male magpies during the incubation period varies from the near neighborhood of the nest to a place more than half a mile distant. Sometimes the bird hunts for food on the limbs and among the foliage of a tree, but usually the foraging is done on the surface of the ground. A male from one nest usually flies off in the same direction on all trips each day, but this direction may vary through the whole period. All the birds of a colony may forage over the same ground, or they may go in different directions, but, as near as I can determine, they ordinarily pay little attention to any magpie other than the brooding mate.

Several observations indicate that in the brooding time magpies do not tolerate the close presence of other birds about the nest. They often drive away woodpeckers, sparrow hawks, orioles, and even magpies from the immediate vicinity of the nest. Satisfactory understanding of this phase of nesting behavior awaits an opportunity to watch a nest more continuously than has been possible.

Bathing and care of the plumage are activities especially important during the brooding season, for the soft plumage of a magpie becomes damaged quickly in the roofed nest. I have had only one chance to observe this part of the routine action which probably occurs daily. At noon on April 5, 1931, at the colony near Madrone, Santa Clara County, about six magpies were at a pool in a creek, about fifty feet

from where I was watching, but they were hidden from my sight by the creek bank. One bird, perched above the pool, was leaning forward, with tail pointed vertically, and looking downward. After several minutes the birds flew to low trees close to the creek. Their plumages were wet, making it certain that the birds had been bathing. They dried their feathers by preening and shaking their bodies, wings and tails. When they were disturbed by persons walking along the creek, the birds flew off with the whistling sounds made by birds flying with wet plumage. At least some of these birds had short tails, indicating that they were females from nearby nests. Apparently, judging from begging notes heard, every pair in the vicinity had sets of eggs.

The behavior of brooding yellow-billed magpies is referred to in publications I have been able to find as follows. Bendire (1895, p. 355) credits Mr. Rollo H. Beck with making the observation that the male sometimes feeds its mate while incubating, and that the latter then flaps her wings and calls like a young bird. This observer gives the usual call note as *quē-quē-quē* or *quēēk, quēēk.*

The experience of Dawson leads him to say (1923, p. 41) that the sitting bird usually stays on the nest, when approached, until the climber is within a few feet. Then the bird leaves on the opposite side and is careful to keep the nest and the tree or both between itself and the disturber.

While Mr. Tyler (1913, p. 65) was examining two nests, one empty and the other containing one fresh egg, the owners were exceedingly shy. The birds scolded from a distance, but they would not approach nearer than one hundred yards. Two weeks later a visit to the nests showed them abandoned and the one egg gone. It appears likely that the disturbance incident to climbing to the nests at this early stage was sufficient to cause the birds to desert. On May 13, 1906, two parent magpies were "very noisy" about a nest while a set of fresh eggs was being taken from it (Bolander, 1907, p. 25).

HUDSONIA.—According to Bendire (1895, p. 352) the male is quite attentive to the brooding female and is generally on the lookout in the vicinity of the nest. It is also stated by him that the male feeds the brooding female. The tail of the bird on the nest is reported to be held at right angles to the body. Except when the eggs are on the point of hatching, Bendire found it was difficult to approach the nest closely enough to see the brooding bird. At the slightest sign of danger the female would slip away on the opposite side of the nest from the intruder. The sides of the nest were usually loosely enough woven to permit the birds to go through at any point.

Taylor (1912, p. 377) mentions finding a nest in Nevada, which contained six eggs, but which had "considerable fecal matter about and on it, and it consequently had a very disagreeable odor."

At least one nest of this magpie has been watched under circumstances which made it possibly to follow closely the home life of the birds (Wheelock, 1904, p. 384). The side of this nest had two openings. The tail of the brooding bird usually extended through the opening used as an entrance. During practically the whole incubation time the head of the bird could be seen at the nest exit. Practically the only times the bird was absent from the nest were when it went to bathe, which it did always once and sometimes twice each day. The male brought and fed to its mate a great variety of objects including crayfish, dead minnows, young squirrels, and small snakes or lizards, crickets, and the eggs and young of tree swallows.

Dawson (1909, p. 30) reported upon his visits to a magpie nest near Wallula, Washington. At each visit the birds protested vigorously. Each time "when mere utterance became inadequate, the male bird fell to hewing at the end of a broken branch in most eloquent indignation. He wore this down four inches in the course of my three visits. Once, when my attention was diverted, he took a sly crack at my outstretched fingers, which were hastily withdrawn . . ."

One magpie which I observed fed another on April 25, 1930, in Smoky Valley, Nye County, Nevada. The two birds were seen at a distance and on top of a buffalo berry bush. One flapped its wings and calls were given similar to those of the yellow-billed magpie under similar circumstances. These calls had been heard earlier in Smoky Valley, but, always, the birds were out of sight.

In this same valley on April 27, a nest was examined that contained only one egg. A magpie came to a thicket near by and gave loud notes of alarm, but, all the time, it kept down out of sight in the brush. On other occasions in this neighborhood magpies came and called when intruders were near their nests, but they always quickly retreated and kept hidden as much as possible. Brooding birds invariably left before the nest was approached within fifty yards.

PICA.—One writer's observations in England suggest that the female broods closely and will not leave at any slight alarm (Pitt, 1922, p. 249). In certain instances even heavy blows on the base of the supporting tree would not drive the bird from the nest.

Selous (1927, p. 108) records hearing a magpie on its nest utter a long continuous note which he, at first, mistook for that of a cock. "Though not a crow, it had that quality of sound." The sound was broken from time to time by the ordinary chatter.

A female nesting in captivity (Tomlinson, 1896, p. 188) was in the nest most of the time after laying the first egg, but she began to sit closely after the laying of the fifth egg. During the latter part of the second week the bird was off the nest often, and it seemed restless.

Raspail (1896, p. 145) visited a magpie's nest twice daily during the latter part of the incubation period. The brooding bird was always on the alert, and it slipped off long before the observers reached the base of the tree. They were never able to see the actual leaving of the nest, but the warmth of the eggs indicated, each time, that the bird had just left.

An observation made by Schuster (1923, p. 291) in northeastern France, appears to indicate that brooding takes place sometimes before any eggs are laid. On April 23, a nest was found upon which a bird was sitting so closely that a strongly brooded set of eggs was expected. On the contrary the nest was empty. The first egg in this nest was found on April 25.

Stonham (1907, p. 239) reports "both birds taking part in incubation and tending their young with great solicitude."

MAURITANICA.—Jourdain (1915, p. 135) noted in Algeria that the incubating magpie sits very closely, "and is sometimes caught on the nest by the Arab herdboys."

Finally, the material just presented provides a basis for the following provisional statements.

The time of incubation of the eggs involves more than merely maintaining a high temperature in the nest.

There is a fine adjustment between the actions of members of each pair, enabling the female to spend nearly the whole time on the nest and requiring the male to provide sufficient food for both birds.

These actions develop gradually and change through the whole time of brooding.

Habits peculiar to this time of year are probably common to all kinds of magpies.

Local influences (relations to man and other animals and to weather) appear to have a greater effect in modifying these actions than differences in hereditary make-up of the birds.

YOUNG

BEHAVIOR AND DEVELOPMENT OF YOUNG

NUTTALLII.—At one of the nests in the colony near Coyote where incubation had not yet begun on March 8, 1931, the behavior of the adults on April 5 indicated that there were young in the nest then (Linsdale, MS). Many times one of the parents was seen to fly directly to this nest and enter it or go to it after perching on a nearby limb for a few seconds. On this second date no bird was seen leaving this nest to be fed. Both of the birds of the pair were always silent when observed that day near the nest. Once both flew to the nest at about the same time. Nearly always when one of them left the nest, it flew directly to the ground and immediately began to search for food.

On April 12, between 9 and 9:40 a.m., this nest was visited by parent magpies carrying food, at least ten times, the visits thus averaging about four minutes apart. Usually, it was not possible to distinguish any objects in the bill, but once or twice objects were seen that were supposed to be large insects projecting from the bill. The birds always entered the nest from the west side and left from the east side. Usually they flew directly toward the nest, but they perched, on some limb from three to ten feet to the westward and toward the main crown of the tree, for a few seconds before going into the nest.

On every visit to the nest by a parent the young birds made calls that could be heard by a person sixty to seventy-five yards distant. These calls began when the parent entered the nest, and they ceased as soon as it left. Once, two adults arrived at, and entered, the nest at about the same time. They flew away together a few seconds later, and when they were about fifty yards from the nest the observer distinctly saw a fecal sac drop from the bill of one of the birds. This point was in the open and was within twenty-five yards of the observer.

These adults nearly always flew to a nearby orchard to do their foraging, and usually (80 per cent of the time) their course was toward the northwest, toward some freshly disked ground. On several trips one of the parents perched in the top of one of the orchard trees before commencing to forage on the ground. The parents were usually silent. Once or twice a short series of notes was heard at the nest. The time spent at the nest on each visit averaged between ten and twenty seconds.

On April 28, 1931, observations were begun at 7:45 a.m. at the colony near Coyote. Judging from the many direct flights of the magpies from the oak grove to the orchard on the north, all the adult magpies in the grove were carrying food to broods of young. At nest A both adults were making trips to the nest, but not often. No sounds were heard from the nest, but it was thought to contain small young.

At nest B the young were out of the nest, but they were still being fed by their parents. There were at least six young. Three of them spent most of the first hour they were watched in the top of an oak tree thirty yards to the northeast of the nest. Later, there were four young in this tree and two in the nest.

The usual procedure in feeding on this day was for the young birds to keep a sharp lookout and, whenever an adult magpie came within sight, to start up a series of loud calls, higher in pitch than those ordinarily given by adults. If the approaching adult were not the parent of this brood it continued on its way, and, as soon as it had passed,

the cries would cease. If the approaching bird happened to be one of the parents of the brood, it would direct its flight toward the group of young birds, and the cries would be continued until a young one had been fed and the old one had left.

The cries of the young birds were accompanied by energetic flapping of the wings. The white on the wings helped to make the birds conspicuous while thus flapping, so that chances for the attention of the approaching bird being directed to them were increased. This may be an important function of this set of white markings. Whether developed because of its adaptive value or not, it certainly operates to disclose the locations of the young birds to the human observer and presumably likewise to the parent birds when they are approaching with food.

The brood of young magpies, being separated and in different trees, gave a good opportunity to see additional features of the response of parents to begging young. The destination of the approaching parent seemed to be controlled entirely by the amount of commotion made by the young. The group which began calling first and kept it up with greatest vigor was the one finally approached. Two or three times a parent was seen abruptly to change its course when headed for one group and go to the other, apparently because of a greater persistence in the begging there. Once, an adult started to leave one group, but it was attracted by calls at the other group so that it turned back and went to the second group. It was not possible to determine whether any food was given to the young in this second group.

The young magpies showed little ability to distinguish their own parents. Any magpie flying toward them aroused the cries and wing flapping. However, these ceased as soon as the flying bird passed and continued away from the young birds. Once, the young birds begged when a California woodpecker flew over them. The amount of begging seemed to be a direct expression of the degree of hunger. Apparently the two young which stayed at the nest were not yet able to fly. The other four young could fly, hence they probably were larger and possibly required more food than the ones at the nest. At least more trips were made to them by the parents. But the two birds at the nest were not neglected. For a few trips after the young at the nest were fed they would remain almost quiet giving only one or two notes.

When a parent would fly to the other tree, all the young would fly to the place, flap wings, make loud calls, and attempt to get in front of the adult. The latter did not remain long after food was placed in the widely opened mouth of some one of the young. Each parent, in turn, left and went to the nearby orchard to obtain another supply of food. Once food could be seen projecting from the bill of a parent that was flying to the young. Only one parent was seen here at one time, but it was presumed that both were making trips. The trips were about five minutes apart. The adults were generally quiet, but occasionally they gave series of alarm notes, usually when away from the young.

Between feedings the young magpies moved about on the limbs of the tree by walking, hopping and making short flights. Their legs appeared to be long, and they were the chief means of keeping hold on the bark. When alighting they had difficulty in regaining a balance. Their tails were only three or four inches long. Not once was one seen on the ground. Their time was spent in picking at limbs, in preening their feathers, or just drowsing. At frequent intervals a young magpie would raise both wings and stretch them over its back, partly folded, but would not extend them.

The young birds were usually quiet except when some flying object approached them or they were being fed. During each feeding all the young kept their mouths open widely while calling. Once, one kept its bill widely opened as it flew from one tree to another. On another occasion a young bird flew out fifteen or twenty feet to meet an approaching parent which, however, paid no attention to it but continued on to the tree and fed another one.

At 10:15 a.m. I walked over to the tree where the young magpies were perched, to test their response to this manner of disturbance. At first all the young gave warning notes, but after a few minutes they became quiet, and the ones at the nest withdrew into it. One of the other young ones flew to another part of the grove. Adults came and gave alarm notes and then left. They returned in half an hour and again gave alarm notes.

In the morning of May 11, 1929, a rather small nest with only a meager canopy was being watched near Llagas school in Santa Clara County. A bird which I thought from the length of its tail to be a male flew to and perched on the top of this nest and behaved as though attending young birds there. This bird moved to another perch, and a second bird (female?) came to a nearby limb and gave several calls. The male (?) flew off for about half a mile, and the second bird went to the top of the nest where it repeated the movements of the first one and then flew away.

Parents of a brood of small young observed by Barlow (1895, p. 20) did not appear at the nest, although several adult birds were feeding on a bog a short distance away.

Six young magpies, apparently just hatched, were found, March 31, 1895, in southern Santa Clara County by Barlow (1895, p. 20). Three weeks later when the tree was climbed, this nest was empty. The family of young birds finally was discovered perched together in a group in one of the high branches of the tree. No sound or movement had been detected while the observer was climbing the tree. However, all the birds were alert, and when pursued they fluttered out of reach.

HUDSONIA.—According to Henshaw (1879, p. 306) the parents share equally the task of feeding the nestling magpies. This was confirmed by the observations of Wheelock (1904, p. 384). She watched adults feeding a brood of young at close range. On one occasion "crickets, other insects, and larvae were crammed down their throats at the rate of forty-three in thirty minutes. . . Each one was carefully crushed, the crickets being deprived of their wings and legs before being given to the nestling. To watch these industrious hunters pursue their game in the wet grass near the lake or the dryer woodlots where near the rotting logs they found the huge black crickets, was fully as interesting as to see them feed the young. Though so dignified and stately when walking leisurely on the ground, they became ludicrously excited when in a hurry. . . ."

Kalmbach (1927, p. 18) after examining 234 stomachs of nestling magpies concluded that food of nestlings differed from that of adults at the same time of year, and that it was decidedly different from that of adults at other times of the year. More than 94 per cent of the food of these young magpies was animal matter. This contrasted with 82 per cent for the parent birds. Insects made up the greater part of the animal matter fed to nestlings, and of these groups best represented were caterpillars (nearly 18%), grasshoppers (more than 11%), and flies (more than 11%). This latter group

consisted chiefly of larvae and pupae of flesh flies that the parents obtained from carrion. The indications then are that the adults visited the carrion for the "purpose of procuring this insect food for their young, even in preference to the carrion itself." Kalmbach also pointed out that "the magpie's depredations on wild birds and domestic poultry may be attributed mainly to a desire to satisfy the appetites of its young."

The experiences of Henshaw (1875, p. 334) in examining a nest full of young in Colorado show a type of response to be expected at this late stage of the nesting cycle. When the observer was climbing to the nest, the seven young clambered out and after clinging to the sides of the nest until the intruder had nearly reached them, each launched out and soon tumbled to the ground. Meanwhile the parent birds appeared, and their cries soon brought at least a dozen birds. The whole group flew around the man's head, screaming, scolding and exhibiting great rage. The birds kept up the outcries until the intruder had withdrawn, and they even accompanied him well away from the neighborhood.

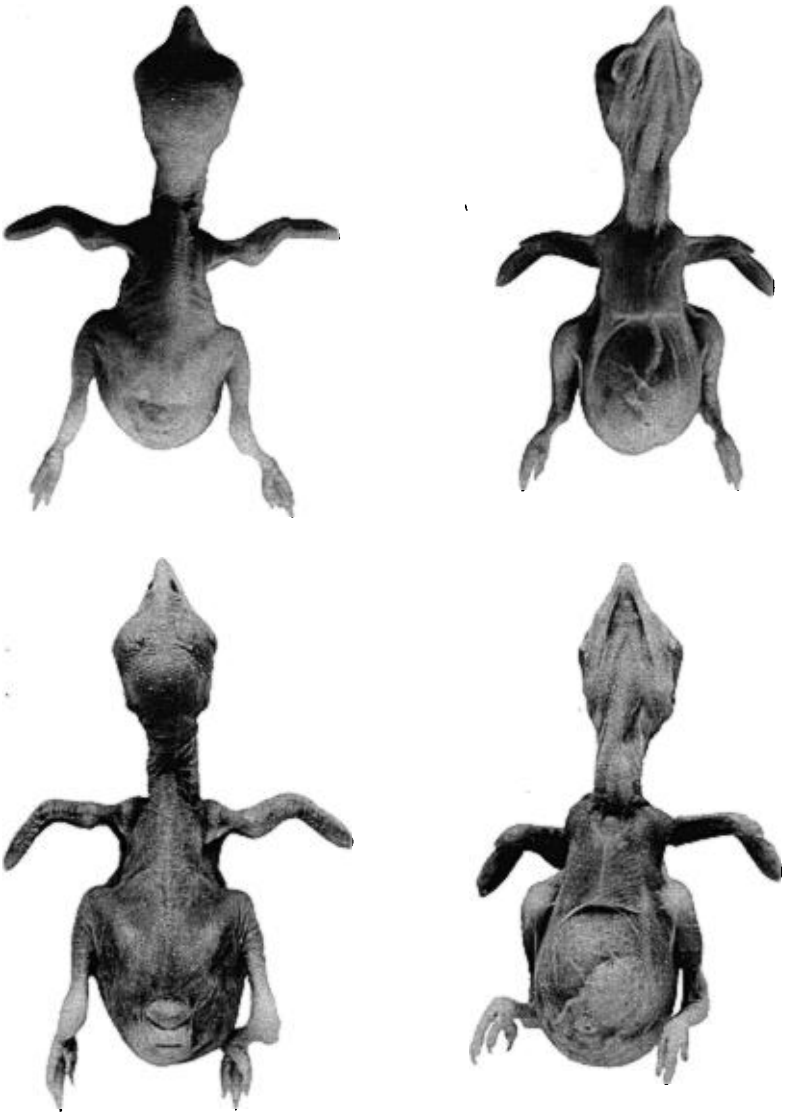
Saunders (1910, p. 196) remarks that when he climbed to one nest in which nearly full-grown young had just died, the parent birds became very excited and often approached him closely. They called loudly and nervously pecked at branches of the tree, breaking off and throwing down fir needles.

In the case of a pair of magpies nesting in captivity in Washington both parent birds scolded in the typical jay manner whenever their nest containing young was approached (Davis, 1931, p. 604).

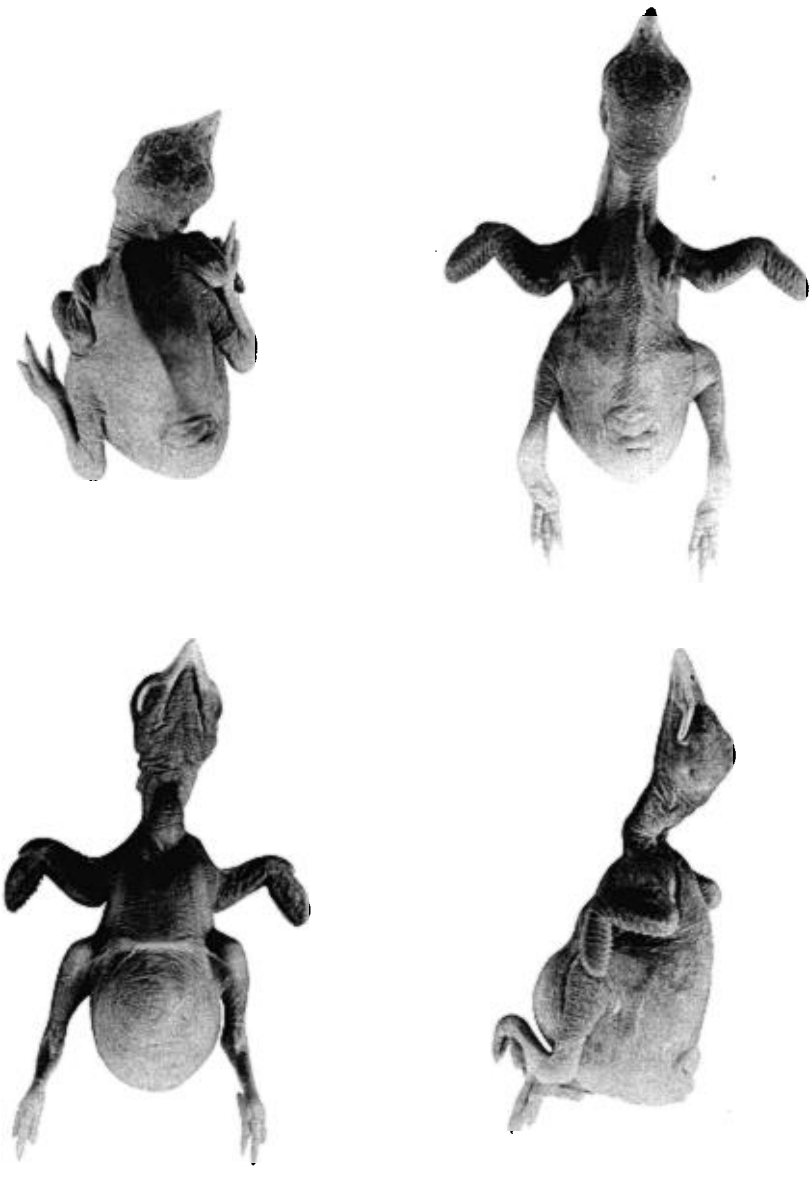
Young magpies in various stages of development have been examined by me in Smoky Valley, central Nevada (see pls. 1–6). On May 16, 1930, a nest was found which contained three young that had just hatched and one egg. The young birds had colorless skins which appeared pinkish because of the blood showing through. Each one was weak and could barely raise its head and open its bill. When first taken from the nest, they made a few weak squeaks. When approached within fifty yards, the brooding bird left, uttering a series of about eight loud, harsh calls. It did not return although it or another one continued to give alarm notes, one hundred and fifty yards away. At another nest close by which contained young the brooding bird flew off silently when approached to within seventy-five yards. This was nearly the same response this bird had given three weeks earlier when the nest contained eggs.

On May 15, 1930, two young magpies which weighed close to one hundred grams each were removed from a nest. At first they loudly gave food calls and opened their bills. Soon one adult came and gave sharp calls, the young became quiet, and the parent moved away. Later the young again gave food calls. When placed in a cardboard box, they worked their legs rather violently and grasped with their claws, apparently in an attempt to raise their bodies—at the same time they opened their bills and gave cries. They were unable to support their bodies above the flat surface, but they raised their heads the full length of their necks.

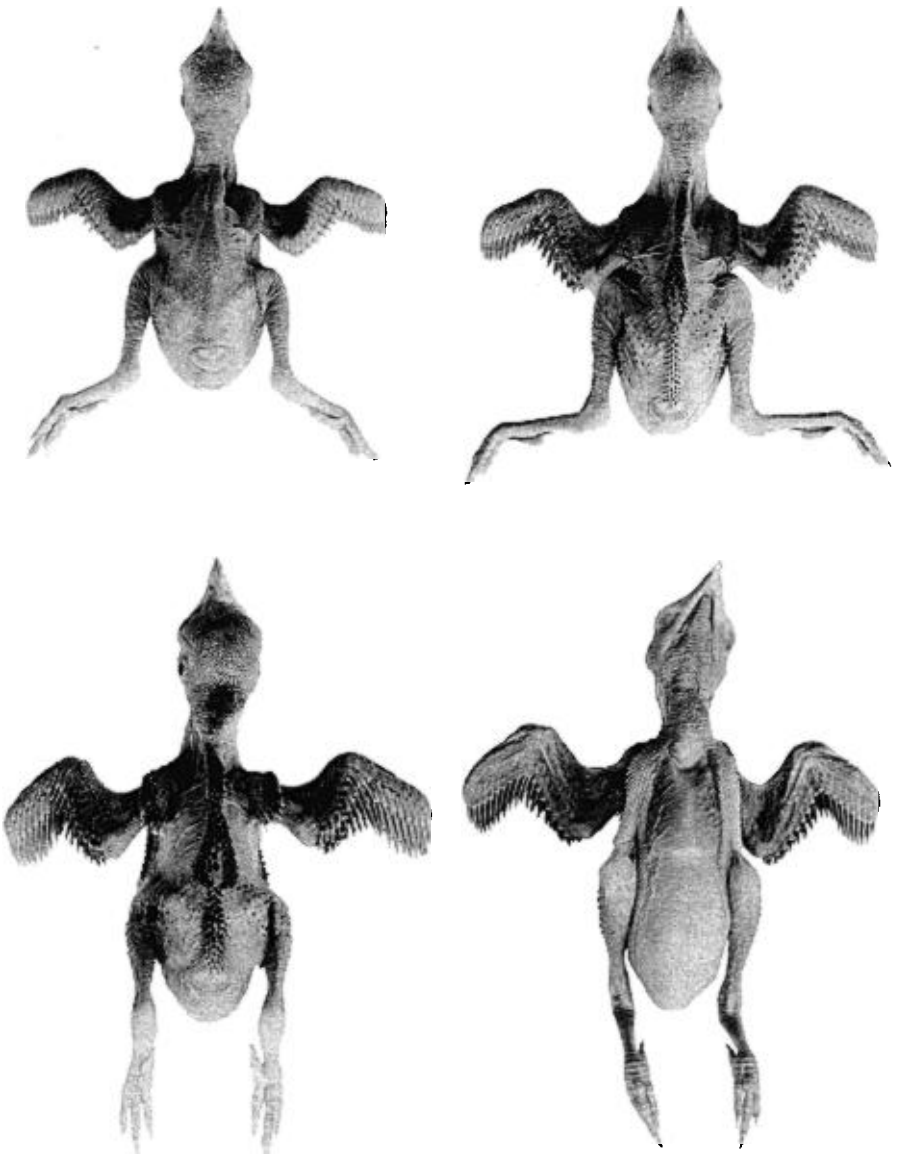
On May 19, a young bird weighing 133 grams was taken from a nest. It was able to support itself on its tarsi, and, when placed on the ground, it immediately began to move off through the brush. This bird was kept for most of the day. It was generally silent but gave calls in the afternoon when it became hungry. Young birds of about this size which were examined on May 29, 1932, kept perfectly quiet, making no sound or move during the whole time.



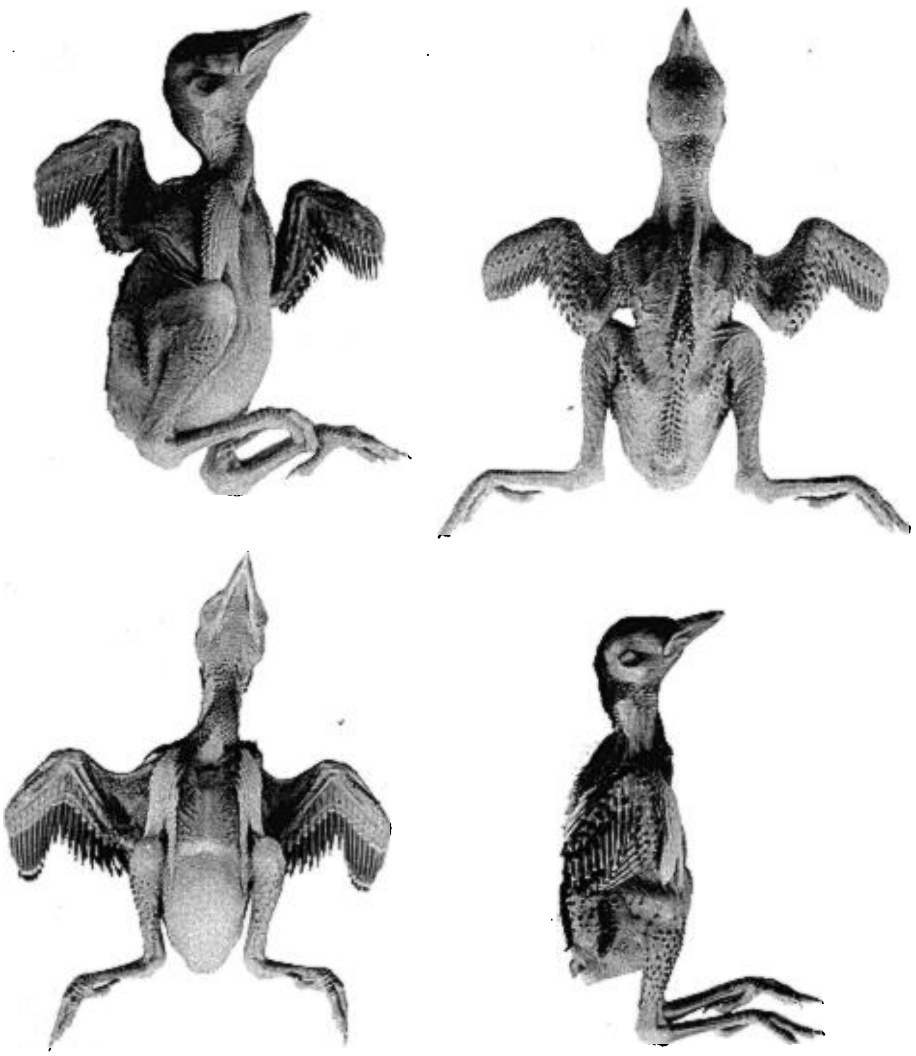
Nestling Black-billed Magpies. Upper, Linsdale no. 4628, weight 11.1 gm.; lower, no. 4631, weight 25 gm.



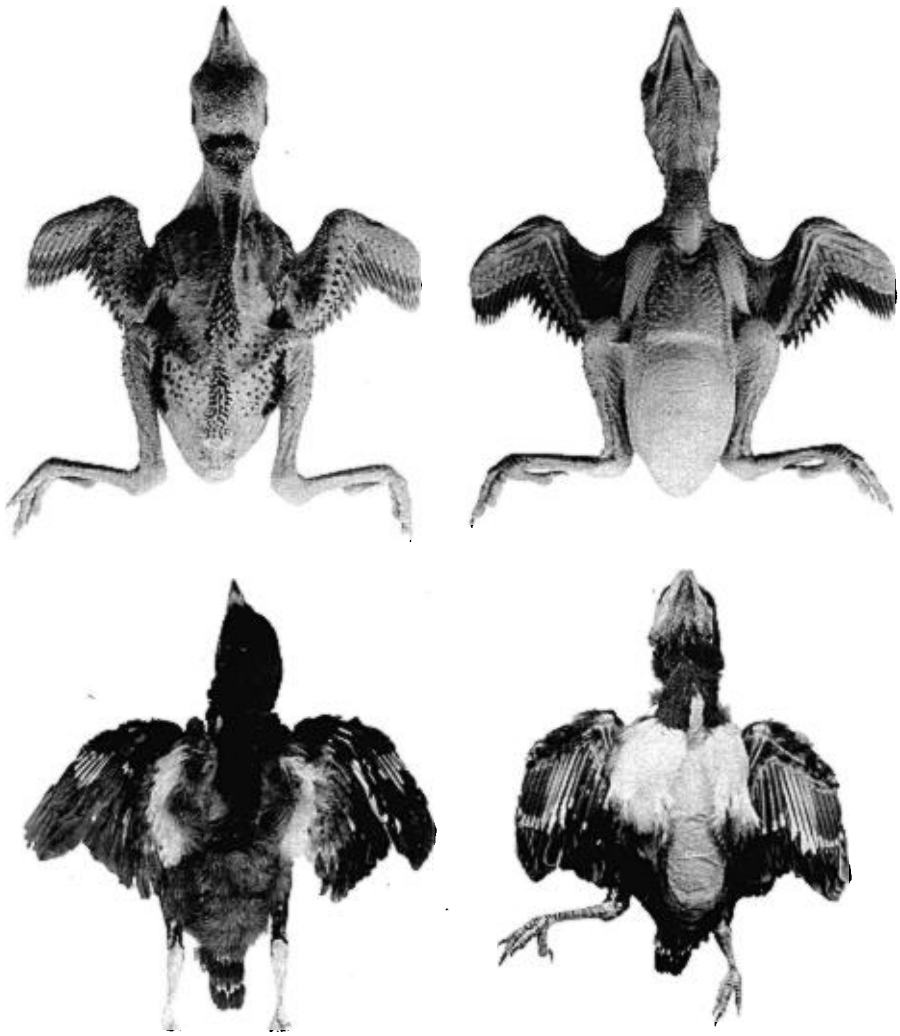
Nestling Black-billed Magpie, Linsdale no. 4621, weight 46 gm.



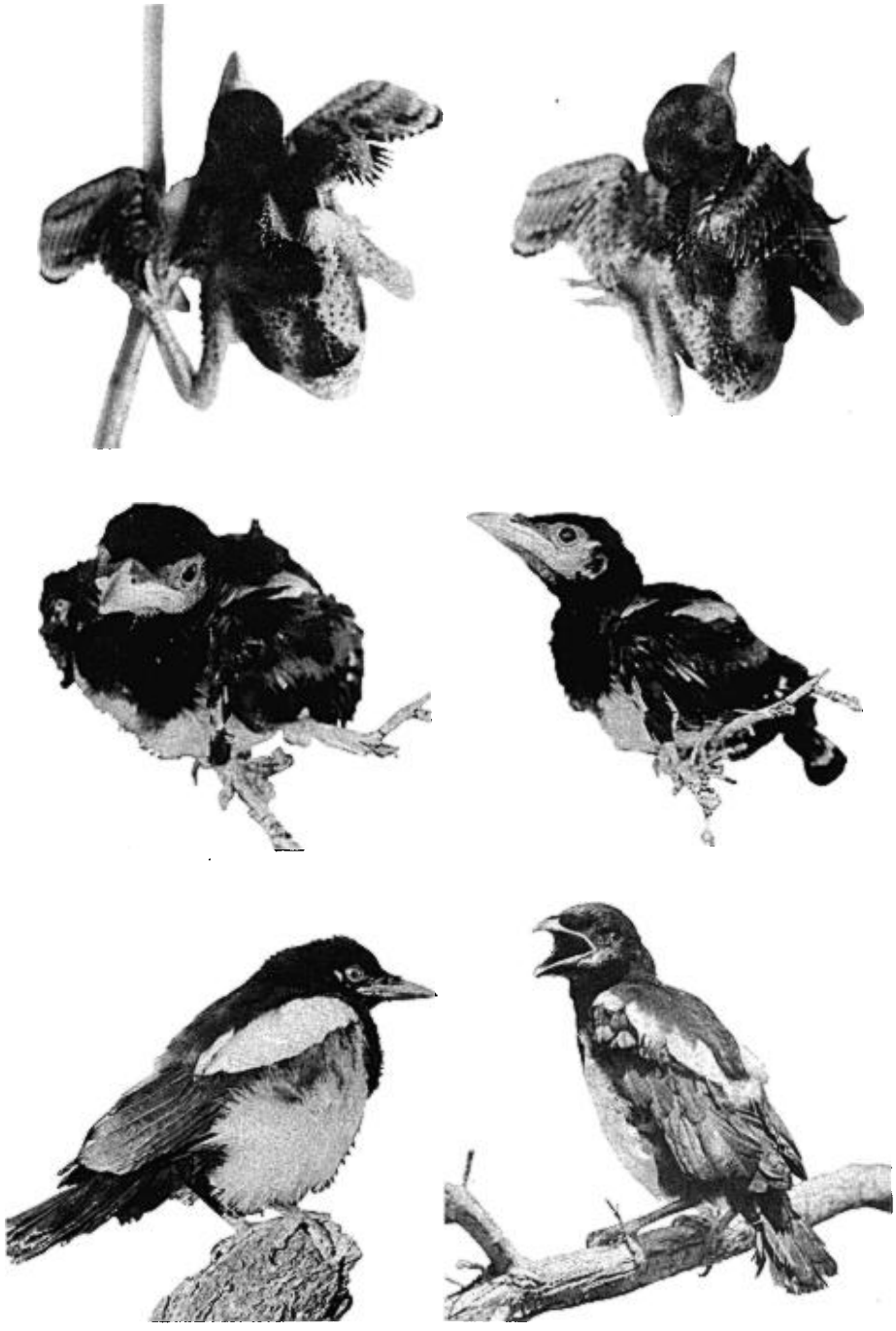
Nestling Black-billed Magpies. Upper, Linsdale no. 4627, left, weight 64 gm., no. 4626, right, weight 75 gm.; lower, no. 4622, weight 75 gm.



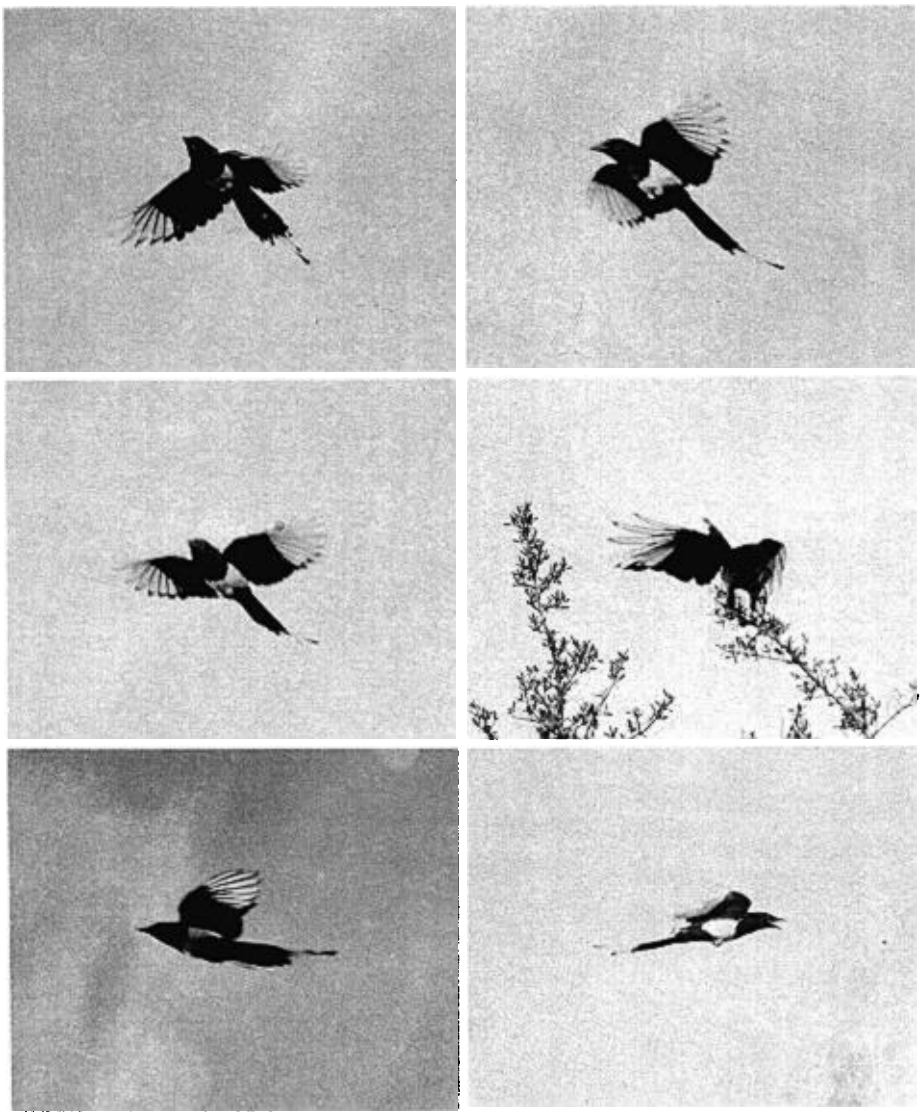
Nestling Black-billed Magpies. Upper, Linsdale no. 4622, left, weight 75 gm.; no. 4625, right, weight 88 gm.; lower, no. 4623, weight 96 gm.



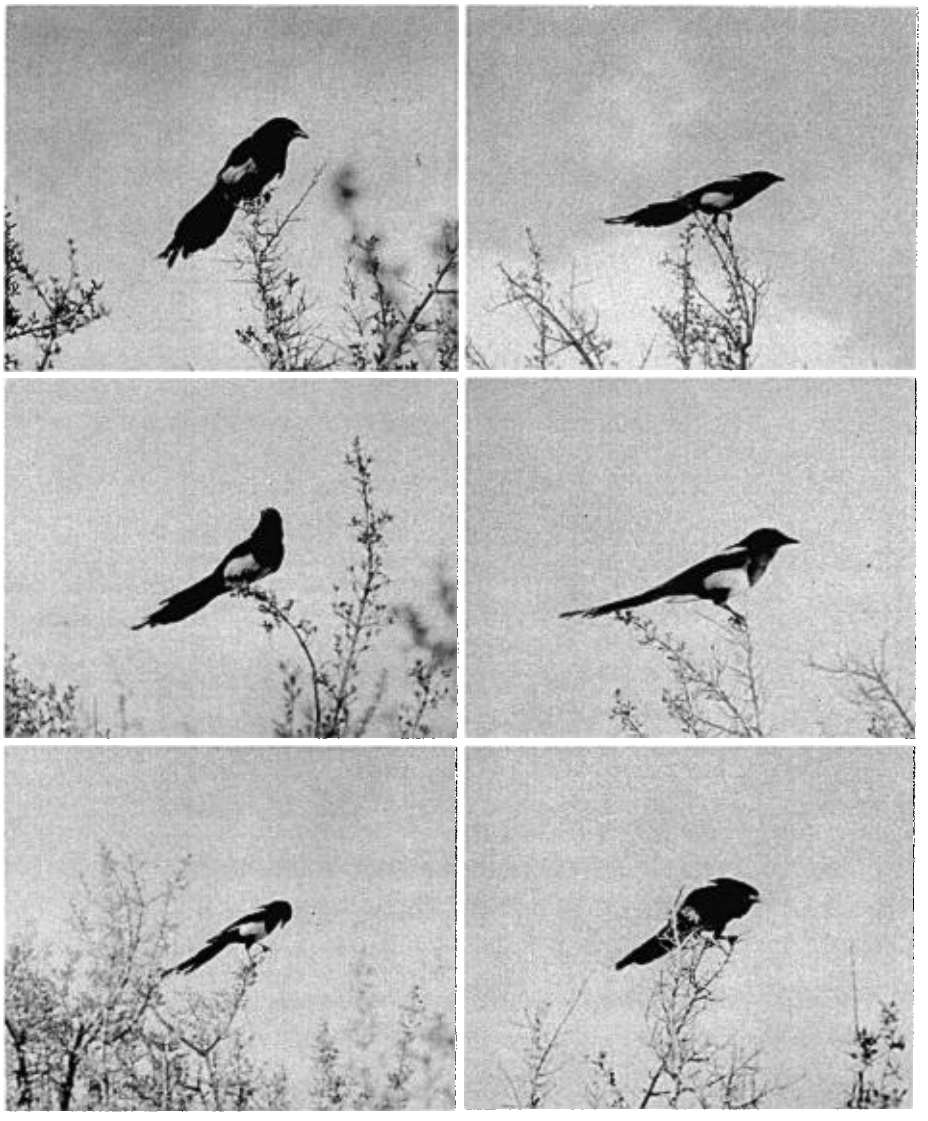
Nestling Black-billed Magpies. Upper, Linsdale no. 4624, weight 112 gm.; lower, no. 4619, weight 200 gm.



Young Black-billed Magpies. Top, still in nest; middle, just out of nest; bottom, out of nest several days.



Views of a Black-billed Magpie in flight.



Views of a Black-billed Magpie perched in the top of a bush.

In a colony of magpies studied in Colorado by Gilman (1907, p. 11), the birds "did not seem very shy while building, and were rather in evidence when the nest contained eggs." After the young were hatched the birds became much more bold. Individuals would often perch within four feet of the head of an intruder, savagely peck at the branch on which it sat, and call threateningly. The excitement was greatly intensified if a person picked up one of the young. At such times all the adult magpies within half a mile would come to join in the excited gathering at the nest.

On May 11, 1916, in one nest near Mono Lake, California, all the young had hatched, and the oldest had its eyes open and wing quills started. Within eight days, on May 19, the largest one of the young was able to perch on a limb. By June 1, the entire brood left the nest (Grinnell and Storer, 1924, p. 378). Bendire (1895, p. 352) gives the length of the period of time spent in the nest as three weeks. A nest of young was watched in Gunnison County, Colorado, by Warren (1916, p. 305). In this nest, at 9000 feet altitude, the young had just hatched on May 27, 1900. These young were out of the nest and perching in the branches of the tree when four weeks old, although still unable to fly. They could fly a little when five weeks old and quite well when six weeks old. In a brood of young studied near Lake Tahoe by Wheelock (1904, p. 384), the first young one to crawl out of the nest came out on the twenty-second day after hatching. Rockwell (1909, p. 91) records a nest which he watched from the time the first platform of sticks was laid "early in March" until the brood of eight young left it in early May. This was at Barr, Colorado.

The full-feathered young sit in the nest tree for several days, where they are said to have a habit of incessantly bobbing or bowing (Cameron, 1907, p. 393). The same observer reports that when the parents are away too long from the nest, the young keep up a monotonous clamor upon one note, "precisely like a young piñon jay's shriek." By mid-June in the vicinity of Golden, Colorado, the young magpies were following the adults about or sitting in the trees near nests, still unable to fly. The old birds at that season kept well beyond gun-range when collectors approached the nest (Rockwell and Wetmore, 1914, p. 319).

During the last week of June, 1912, magpies were studied by Warren (1912, p. 329) in Costilla County, Colorado. At that time, the young were beginning to come out of the nests and they were crawling about in the trees, scarcely able to use their wings. They kept up a continual squawking when in the trees. When a person was near, the noise was louder, and sometimes the parents joined in, but the latter took good care to keep at a safe distance. The older of the young birds showed more fear than the younger ones did.

A brood of young magpies was watched by Wheelock (1904, p. 384) through the period of nest-leaving. For several days before time to come out of the nest the heads of the four young ones were seen poking out of the doorways. On the 22nd day one of the young hopped out and perched on a branch. The parents, meanwhile, showed great excitement. When the young bird was approached closely, it jumped off its perch and flew or was blown out of the tree. It could not control its long tail which opened and acted as a sail in the wind. One parent followed this bird while the other one remained with the rest of the brood in the nest.

Family groups of young were observed in California, by Mailliard (1927, p. 309).

He found that it did not take the young birds long after leaving the nest to learn to keep out of range of persons who came near them.

On May 18, 1932, near Millett P. O., Nye County, Nevada, I watched a family group of five young magpies out of the nest and able to fly a little, at noon in a thicket of buffalo berry. Four of the birds were in one thicket and the other one in another bush about fifty feet away. All of them had difficulty in maintaining a balance even though they were well feathered. Except for their tails being only four or five inches long, I probably could not have distinguished them in the field from adults as far as feathering was concerned. When approached closely the birds moved off with short flights and by hopping through the thicket, and they kept up a series of harsh notes of alarm. No adult was seen while I was near the young, but when I was still one hundred yards off I saw one fly away quietly. As soon as I left I heard feeding calls. Probably one of the parents had arrived.

At noon on May 22, this brood was seen at the same place. The birds were closer to the ground than they had been before. They were a little more scattered. When they moved, they were more sure in gaining a footing. One of them allowed me to approach to within ten feet before it flew.

In this same vicinity, on June 7, I watched about twenty-five magpies in late afternoon about a spring. The birds were in brush clumps and willows and they were doing much chattering. Evidently they were mostly young and represented three or four families. They did not fly off as quickly or as well as adults would have. Most of them permitted approach to within a few feet while adults at the same time remained as shy as ever and kept well out of sight. When I approached them these young birds scattered in several directions through the buffalo berry thickets. They had evident difficulty in gaining and retaining a perch when alighting. This was the first group noted (in the 1932 season) that was made up of more than one family. Judging from the numbers of young that were seen about that time, nearly all were out of the nest and had left their home surroundings. Calls were heard much more frequently than they had been early in May.

In Smoky Valley, Nye County, Nevada, five large young in a nest were watched by me on June 6, 1933. When disturbed, the young birds crawled upward, inside the tall dome of the nest and clung to sticks in its wall. One went through to the outside but later it returned. Several times they gave alarm notes nearly as loud and as harsh as those of the parent birds. The next day at noon when this nest was approached the young birds crawled out of it and perched among the branches of the surrounding *Shepherdia* thicket.

Out of close to fifty nests examined in 1933 in Smoky Valley, Nye County, Nevada, the birds at only three were so bold as to return to the nest, even on repeated visits by persons, and to give alarm notes. Usually these pairs kept close to the nest while it was examined. At one nest especially, which contained large young, the female would come within three or four feet of an intruder, and, giving alarm notes, would stay as long as the person remained. The male came within fifteen or twenty feet but did not stay so long. At the time for the young birds to leave, the parent often picked at branches of *Shepherdia* on which it perched, breaking off thorns and pieces of bark in its beak.

PICA.—The changes which the young magpies undergo in the nest have been summarized by Brown (1924, p. 125) as follows. "The nestlings have flesh-coloured skins, free of any down, their mouths colored inside deep flesh-colour, the external flanges pinkish-flesh. The skins rapidly assume a yellow tinge and when the nestlings begin to fledge, a greyish tinge. The coloration of the mouth inside changes first to pink, then to a deeper pink, and finally to purple, but the young may have left the nest before this final phase of mouth coloration is assumed. The nestlings are blind until seven or eight days old. When fledged the young have the iris pale grey. When they leave the nest their tails are not more than five inches long. . . ."

In northeastern France young magpies that were just hatched on May 16, were half fledged on June 1 (Schuster, 1923, p. 291). The tails of these birds were three centimeters long. By June 7, these birds were completely feathered and the tail and wing feathers were half grown out. The voices which up to that time had been sharp *peeps,* had begun to break. By July 5, these young birds were entirely grown.

Brown (1924, p. 126) determined by watching two nests in Cumberland, that both parents feed the young in the nest, and they often arrive at the nest together. The adults approach the nest by a circuitous route and on reaching the nest-tree they were greeted by chirping of the young, which was continued until the parents had left. Occasionally while feeding young the adults were heard to utter a "crooning-like noise." No food could be detected in the beaks of the adults when they arrived at the nest. The first nest contained four young. When they were seven days old, food was brought to the nest five times in three hours (2 to 5 p.m.). They were fed three times in a two-hour period (7 to 9 p.m.) when twelve days old. In the second nest were five young. Food was brought to them four times in two hours (9:30 to 11:30 a.m.) at nine days of age. At seventeen days, food was brought twelve times in two hours (1:15 to 3:15 p.m.).

In the series of observations on magpies in Cumberland, Brown (1924, p. 126) saw no feces ever carried away from the nest, but the insides of the nests were always kept clean. He presumed that the feces were swallowed by the adults or dropped outside the nest. The branches below were sometimes much splashed with droppings. The young were brooded during the day until they were ten or eleven days old. If an egg failed to hatch it was left in the nest.

Brown (1924, p. 126) states that as the nestlings become fledged they are apt to be noisy and the nest may be found by hearing the calls of the young. Also they are usually very noisy when being handled. Chattering of the young often brings the parents to the nest-tree.

Changes in the behavior of adults about the nest were outlined by Seebohm (1883, p. 56) as follows. "When the nest of the Magpie is approached, should it only contain fresh eggs, the bird slips quietly off them; should she, however, be sitting, it often requires repeated blows on the trunk of the tree to dislodge her; and when the young birds are hatched, both the parents will fly round the tree at some considerable elevation uttering cries of alarm; and their actions become still more uneasy and troubled should the notes of the young birds be imitated by the observer."

In five broods watched by Brown (1924, p. 125) the fledging periods were 24, 24, 24, 26, and 27 days. Brock (1910, p. 118) gives the fledging period as 29 to 30 days.

Raspail (1896, p. 145) in France studied young magpies which hatched on April 20 and 21. Two weeks later on May 4, the feathers extended a centimeter beyond their sheaths. On May 14, two young were perched at the entrance to the nest and in the evening of the next day they all left quickly when the site was approached. All but one of the young fell to the ground where they were easily captured. The time between the hatching of the first egg and the leaving of the nest was 25 days and 12 hours, but Raspail thought that if the brood had not been disturbed the young would have remained in the nest for a full 26 days. At the time of leaving the nest one young one weighed 210 grams, a second 198, and the three others 190 each.

Finn and Robinson (1922–23, p. 186) make the comment that young magpies have "grey instead of dark-brown eyes."

A case was recited by Stanley (1857, p. 209) in which a magpie was supposed to have carried food to four young ravens that had been taken from their nest in Essex, England. The young of the magpie had been destroyed and the cries of the young ravens which were kept in a wagon in a shed were supposedly responded to by the magpie.

The Heinroths (1927, p. 237) gave weights of two developing nestling magpies as follows.

Date	Weights in grams	
June 17	36.5 (3 days old)	16 (1 day old)
June 18	48	22.5
June 20	78	40
June 21	102	55
June 23	125	78
June 24	130	95
June 25	140	100
June 26	153	115
June 27	165	130
June 28	177	140
June 30	188	158
July 2	200	170
Aug. 16	220	180

The chief weight increases, of about fifteen grams daily, come at the age between 6 and 14 days. The longest primary grows, on the average, 6⅓ mm. per day, from the eighth to the eighteenth days, but the middle tail feathers grow only 2.1 mm. and from then on to the sixty-fourth day about 5 mm. each day. The development of the feathers for flight, then, goes on much faster than that of the long tail which would be out of place in the nest. These young left the nest on July 7, when they were a little over three weeks old, in spite of the fact that they still could not fly.

MAURITANICA.—In southern Tunisia, Whitaker (1905, p. 11) found nests containing nearly grown young as early as the first week in April. The earliest young abroad in Morocco was observed by Lynes (1925, p. 35) on May 10. On June 11, he saw a "squab" on top of a nest.

NUMBER OF BROODS OF YOUNG

NUTTALLII.—All observations on the yellow-billed magpie point to the conclusion that it rears only one brood in each year. A study of climatic conditions in the area

inhabited by this form suggests that conditions would not favor a second nesting even if the birds should attempt it.

HUDSONIA.—Saunders (1921, p. 94) expresses the opinion that in Montana, "there is evidently no second brood." Likewise Bendire (1895, p. 352) found that only a single brood is reared in a season. Whenever a set of eggs was destroyed he found that a second and, sometimes, even a third set would be laid. These were frequently in the same nest or in one close by. The second set usually contained a smaller number of eggs, five or six.

KAMTSCHATICA.—Stejneger (1885, p. 242) stated that birds of this race "breed at least twice during the summer." He shot young, not completely feathered, on October 8, which he suspected belonged to a third brood.

PICA.—This race, each season, rears one brood only (Kirkman, 1910, p. 8). One case of repeated efforts to replace nests and eggs that were destroyed by people was reported by Rundle (1885, p. 28). After the fourth nest and set of eggs of the same pair were destroyed, on May 15, the two magpies were found the next morning under the tree in which they had last built. Not a feather was ruffled or displaced and there was no assignable cause for death. The observer who reported the incident thought the deaths were caused by "broken hearts." It seems more likely that the true cause was exhaustion.

NEST AND EGG REPLACEMENT

PICA.—Brown (1924, p. 124) observed that in Cumberland if the "first laying of eggs is taken or destroyed, another nest is built and a second clutch laid, but if this clutch is destroyed the birds do not lay again that season. The second nest is usually not so well built as the first, and is often found within fifty yards of the first. A second laying may be looked for about a month after the first had been taken."

Two cases were recorded in England (Prior, 1876, p. 5081) in which a set of magpies' eggs was taken from a nest and within a short time a second set was laid in the same nest.

Three nests which were deserted or robbed on April 17, May 1, and April 29 were replaced with second nests and sets of eggs in 31, 24+, and 25 days, respectively (Brown, 1924, p. 170). Numbers of eggs in the first and second sets in each case were as follows: first, 5 and 7; second, 5 and 6; third, 4 and 4. In at least two of the instances the first set of eggs was removed when fresh.

A case of persistent nesting after the destruction of early eggs was reported in England by Ryves (1930, p. 248). In North Cornwall on November 12, 1929, a brood of seven young magpies was seen in company of both parents. The tails of the young birds were only about two inches long and they could fly only a few yards. It was thought that they had been out of the nest only about two days. This was on a farm where it is the practice to destroy every magpie's nest found.

Two examples have been given by Meiklejohn (1931, p. 9) to show that laying magpies will sometimes use a "ready made" nest in which to deposit eggs. On April 27, 1917, he found a nest with five fresh eggs and two addled ones of a different type, half buried in the lining. On June 8, 1928, he found a nest with six eggs, all similar, but with four quite fresh and the remaining two "most unpleasantly addled."

MORTALITY OF YOUNG

HUDSONIA.—Only four eggs hatched, out of six that were laid by a bird in captivity in Washington, D. C. (Davis, 1931, p. 604). Observations on the mortality of nestlings have been discussed by Saunders (1910, p. 196). He was watching a nest containing four nearly grown young. On the day following a late snowstorm, on June 8, the nest contained two dead birds and one live one. Other similar instances had been noted in the same region. That writer further pointed out that although at that place sets of eggs commonly numbered six or seven, he had never seen a brood of young magpies out of the nest that numbered more than three. His conclusion was that late spring snowstorms possibly produced a high mortality among young magpies.

Families of young observed leaving their nests in a region where the birds nested abundantly (Colorado) numbered from three to six (Warren, 1912, p. 329). Out of a great number of eggs examined in one colony in Colorado, Gilman (1907, p. 11) found only one that was infertile. In a nest examined by Taylor (1912, p. 377) in Nevada, there were three living young, with juvenal feathers just appearing, one dead young bird on the edge of the nest, and three unhatched eggs.

A brood of six nestlings in Washington was attacked by some animal which took away two of the young and left another with a lacerated wing (Dice, 1917, p. 122). In that neighborhood it was regular for one or two eggs to fail to hatch. The average number of young in eight nests was less than five (4.75) while the average number of eggs in thirteen full sets was nearly seven (6.85).

PICA.—Brown (1924, p. 125) writes that he has "never known all the young to be reared, and usually one nestling, sometimes two or three, disappear. . . . Five young reared out of six hatched is a good average and one has known only two to be reared out of five hatched and four out of seven. Food probably plays an important part in the matter as most Magpies appear to collect all their food within a half-mile radius of the nesting-site, and with a large family to support, no doubt the supply is not always equal to the demand, and the last-born nestlings die of starvation or are killed by their stronger brethren. I am convinced they do not fall out of the nest, for occasionally a fledged youngster is found dead at the base of a nest-tree, but never, in my experience, an unfledged one. Besides, the shape of the nest is against a nestling falling out." Numbers of eggs in full sets along with numbers of young reared in each case were as follows: 7 eggs, 5 young; 3, 1; 7, 4; 6, 5; 6, 5.

Out of five young hatched in captivity, only two were alive at the end of nineteen days (Tomlinson, 1896, p. 189). These two were the ones first hatched and they were always larger and stronger than the others. Raspail (1896, p. 145) reported upon a nest of eight eggs, of which only seven hatched, and one of the young died during the first two weeks.

ANATOMY

Any inquiry into the significance of an animal's behavior naturally must be based upon a consideration of structure. As a rule, for passerine birds, the major features of structure are sufficiently well known as not to require repetition. For example, it is scarcely justifiable to describe here in detail the myology of the magpies although it might be worth while to verify Shufeldt's (1890) findings on the raven by a careful dissection and comparison of a magpie.

Some points in the structure of magpies, many of which have been described already, seem worthy of repetition here. Particular attention is given to those features which seem to have adaptive value and to those concerning which comparison can be made with related birds. The anatomical study which I originally intended to make of magpies has not been accomplished. Many observations of morphological nature have been included elsewhere in this report along with discussion of the phase of life history which they concern.

The descriptions of birds in MacGillivray's (1837) history of British birds are so complete and so seldom noticed, now, by American workers that it seems appropriate to quote rather fully from his treatment of the magpie. MacGillivray (p. 559) wrote concerning external features of birds in the genus *Pica* as follows:

"Bill about the length of the head, straight, strong, tapering, of nearly equal height and breadth at the base, compressed towards the end. Upper mandible having the dorsal outline slightly arched, towards the end declinate, the ridge narrow, the sides sloping at the base, convex towards the end, the edges direct, sharp, with a slight notch or sinus close to the tip, which is declinate, rather sharp, and projects a little; lower mandible with the angle medial, of moderate width, rather acute, the dorsal outline slightly arched and ascending, the edges sharp and slightly inflected, the tip rather acute. The gape-line straight, towards the end declinato-decurvate.

"Mouth of moderate width; upper mandible concave within, and grooved; lower mandible deeply concave, with a prominent central line; palate flat; aperture of the posterior nares edged with small papillae directed backwards; aperture of the glottis similarly margined, and with numerous papillae behind. Tongue oblong, narrow, emarginate and papillate at the base, flat above, horny on both surfaces, thin-edged, the point slit. The intestinal canal of the common species is in all respects precisely similar to that of the Crows.

"Nostrils in the fore part of the short nasal groove, which is filled up by a membrane, roundish, open, but concealed by the narrow reversed feathers, which cover a large portion of the bill. Eyes of moderate size; eyelids feathered, having a narrow crenate bare margin. Aperture of the ear roundish, of moderate size.

"Head large, oblong, rather convex above; neck rather short, strong; body ovate, compact. Legs of moderate length, strong; tarsi of ordinary length, compressed behind, covered anteriorly with eight scutella, posteriorly with two longitudinal plates meeting behind with a sharp edge; toes of moderate size, the outer adherent as far as the second joint; hind toe comparatively large, lateral toes nearly equal, third considerably longer; all covered above with a few large scutella, beneath padded, granulate, and transversely sulcate; claws strong, arched, compressed, sharp, generally with an obscure groove on each side, the third with the inner groove considerably dilated.

"Plumage generally full, soft, more or less blended, and glossed; the feathers of the body ovate, rounded, with longish plumules composed of a few downy filaments. Feathers on the head short; those at the base of the upper mandible linear, stiff with short discrete barbs, directed forward and adpressed; there is also a series of decurved bristles at the base of the rictus. Wings of moderate length, much rounded, the outer primaries separated when extended; primary quills ten, the first very short, extremely narrow, and falciform, the fourth and fifth longest, the sixth longer than the third; the first five having both webs narrowed towards the end; secondary quills twelve, long, broad, rounded with a minute tip. Tail very long, graduated, of twelve broad, rounded feathers."

The following descriptive paragraphs dealing with the skeleton of the black-billed magpie are condensed from the account by Shufeldt (1888, pp. 309–350) in which the skeletons of North American Icteridae and Corvidae are compared in detail.

In a magpie the superior osseous mandible is rather broad at its base, tapering gradually to its apex, and is somewhat decurved, with sloping sides, cultrate infero-external edges, a gracefully downwardly curved culmen, and with large subelliptical external narial apertures, which have smoothly-rounded margins.

Viewed from above the peripheral borders of the orbits are sharp and clean cut, while the shortest transverse distance between them is not inconsiderable. The vault of the cranium is smooth, rounded, and ample, indicating a capacious brain cavity.

In lateral aspect it possesses a free lacrimal bone. The pars plana is a roughly quadrate plate, having an open slit above it, which separates it from the nether side of the frontal bone above. It is, however, joined at its supero-external angle.

The quadrate is notable for its long orbital process with its expanded extremity. Both sphenotic and squamosal apophyses are fairly well developed, with a moderate concavity between them to pass the temporal muscle in the living bird. The external aperture of the ear in the dried skull is large and flaring.

At the base of the skull anteriorly between the outer sharp edges of the premaxillary, the osseous roof of the mouth is entire, and composed of a firm, somewhat concave bony plate. The hinder margin of this plate is sharp, but in some specimens of crows and ravens is rough and jagged. As in the Corvinae, the anterior limbs of the palatines are wide apart here, as their extremities merge with this bony roof of the mouth at its sides.

Posteriorly, the upper and lower lamina of the palatines curve towards each other, the lower terminating in a free edge with pointed anterior extremity, the two being separated by some little interval mesially, while the upper molds itself on the under side of the basi-sphenoidal rostrum, and it, too is separated from the corresponding edge of the palatine of the opposite side by a slight interval. These bones, however, usually meet at their pterygoidal heads in this situation. The postero-external angle of either palatine is bluntly extended backwards for a short distance, and in each case, at the under side, an oblong facet is to be seen, intended for muscular insertion.

In *Pica* the pterygoids are slender in so far as their shafts are concerned, but their palatine heads are much dilated, and are tangent to each other beneath the rostrum of the sphenoid, while at its sides their expanded portions are spread out upon its surface, the rounded basi-sphenoidal rostrum being closely held between their grasp.

The occipital area is rounded, with the bounding occipital ridge but faintly marking its natural confines.

All Corvidae possess that little osseous tube known as the siphonium, which gives passage to the air from the tympanum to the pneumatic cavity in the end of either limb of the mandible.

The hyoid arches are thoroughly ossified, and in them the basi-branchials are fused into one stout median rod, terminated behind by an unusually long piece of cartilage. The thyro-hyals are long and slender rods, and also completely formed in bone. The anterior end of the basi-branchial is enlarged and seized between the cerato-hyals, offering to each one a facet for articulation on either side. For the most part, too, the glosso-hyal is ossified, being fused together in front, but diverging backwards, leaving a long triangular median vacuity just in front of the basi-branchial.

The mandible is a V-shaped bone, with moderately high ramal walls, which are perforated on either side in their proximal thirds by an elliptical vacuity of no very great size. The posterior articular processes are not very powerfully developed, while the inturned ones are a conspicuous feature of this bone. These latter have the usual single pneumatic foramen at their upper sides and near the base in each case.

Ravens and crows have, of course, much larger skulls than a magpie, being in proportion to their general size, but these skulls repeat, in their structure and the arrangements of their parts in almost every detail the skull in *Pica*. This statement applies with equal truth, too, to the associated ossifications of the skull, as the mandible, the hyoidean apparatus, the siphonium, the sclerotals of the eyeballs, and other structures.

Shufeldt (*loc. cit.*) continues: "Difficult as it is to put your finger on any particular character, or set of characters, which would enable one to say that the skull of the Magpie is more like the skull of a Crow or Raven than it is like the skull of a Jay, yet upon careful comparison I find that, in addition to the similarity of their general facies, the osseous superior mandible in a Magpie much more closely resembles the corresponding part in a Crow than it does that of the Jay—any American Jay. Moreover, the palatine bones in a Magpie are actually more Corvine in form than they are Garruline. Passing through a series of skulls, however, headed by the skull of an old Raven and including a Crow, a Magpie (*Pica*), several typical Jays, and a *Sturnella,* I can only say that the gradual differential shading of the entire structure from one form into another is quite as beautiful as it is perplexing. Performing this feat carefully it still leaves the impression strongly upon my mind that *Pica* is nearer *Corvus* in its skull-structure than it is to *Cyanocitta,* or *Aphelocoma,* or the rest."

For the rest of the skeleton Shufeldt summarized his observations as follows. *Pica* has precisely the same arrangement of its cervico-dorsal vertebrae and ribs as a raven and crow. Moreover, the forms of the vertebrae in the magpie, although smaller of course, are wonderfully like the corresponding ones in any typical crow. It has a pelvis which is in all particulars the perfect miniature of that bone in *Corvus corax.* It has a sternum which is like that bone in *Corvus americanus.*

The coracoids and os furcula are always pneumatic, the scapula is often not so, and its posterior extremity is always found to be abruptly and obliquely truncated. In the os furcula, the limbs are rounded and comparatively more slender than they

are in crows and ravens, and the hypocleidium more prominent, while the tuberous summit of each coracoid presents anteriorly a peculiar little down-turned process which appears to be quite as characteristic as it is constant for this bone in the girdle of the magpie. Were it possible to reduce a lot of humeri of ravens to the similar dimensions of a lot of humeri of magpies, it would be difficult to distinguish them.

SKELETAL MEASUREMENTS (IN MILLIMETERS) OF MAGPIES FROM WESTERN UNITED STATES

Black-billed Magpie (*Pica pica hudsonia*)

No. M.V.Z.	Sex	Width lacrimal	Width skull	Length ramus	Height ramus	Length sternum	Width sternum	Length pelvis	Length femur	Length tibia	Length tarsus	Length humerus	Length radius	Length ulna	Length coracoid	Length scapula	Length furcula
54578	♂	16.0	29.9	55.8	7.8	39.0	18.1	28.7	42.7	72.5	50.4	48.0	51.5	57.2	31.6	39.7	31.3
54582	♂	15.8	29.3	50.7	7.4	35.7	18.8	28.6	36.9	65.1	46.8	42.7	45.2	50.8	28.9	37.3	30.8
54584	♂	15.4	30.5	55.7	7.8	40.4	19.6	29.8	42.3	67.4	48.2	46.0	48.1	53.9	31.1	42.6	33.6
54585	♂	16.4	28.1	54.7	7.6	39.2	18.1	27.8	40.5	66.4	47.9	45.2	47.8	53.5	29.6	38.6	30.0
54587	♂	16.5	29.2	52.8	8.2	41.0	19.1	28.8	39.4	65.6	46.9	44.3	46.6	52.4	30.2	39.7	30.7
54588	♂	15.8	29.9	53.7	7.9	37.9	18.9	28.4	40.7	66.5	47.3	44.8	46.5	51.6	29.3	38.2	30.8
Average		16.0	29.5	53.9	7.8	38.9	18.8	28.7	40.4	67.2	47.9	45.1	47.6	53.2	30.1	39.3	31.2
43333	♀	16.4	28.7	50.1	7.4	38.1	18.3	30.3	39.4	63.7	45.7	43.0	44.7	50.4	27.5	36.8	28.2
54576	♀	15.6	28.3	52.1	7.0	37.3	18.5	25.0	38.0	.....	45.2	42.1	44.5	50.0	28.1	37.2	29.5
54577	♀	16.1	28.6	50.4	7.7	34.7	17.7	28.5	39.3	65.5	47.7	44.0	46.9	52.0	29.1	37.5	29.4
54579	♀	15.1	28.5	51.3	6.6	34.9	18.3	26.8	37.6	63.7	45.0	42.3	43.7	49.0	27.9	36.0	28.9
54580	♀	15.4	29.6	53.0	7.3	35.5	17.8	27.1	38.2	64.3	46.1	43.2	47.0	52.3	28.5	37.9	28.5
54581	♀	14.4	27.5	48.4	7.1	34.8	17.2	27.2	37.8	63.9	45.3	42.5	45.5	51.4	27.8	35.9	27.8
54583	♀	15.7	27.6	50.3	7.9	37.6	18.3	26.7	39.0	64.9	47.1	43.5	46.5	51.8	29.7	38.2	29.8
54586	♀	15.4	28.1	52.0	7.9	37.2	18.2	28.2	39.2	64.2	46.7	43.1	46.1	51.5	28.8	39.2	29.8
54589	♀	15.9	28.5	49.6	7.6	36.8	17.7	25.0	38.2	62.9	45.1	41.9	44.2	49.3	28.2	36.3	29.1
54590	♀	15.4	28.8	50.7	7.3	36.2	17.0	27.5	38.9	64.1	46.0	43.4	45.6	51.0	28.8	37.6	29.1
Average		15.5	28.4	50.8	7.4	36.3	17.9	27.2	38.6	64.1	46.0	42.9	45.5	50.9	28.4	37.3	29.0

Yellow-billed Magpie (*Pica nuttallii*)

23161	♂	16.3	28.4	51.0	7.3	39.8	19.3	28.8	39.3	69.0	50.4	43.9	47.6	53.3	29.8	39.3	31.9
44359	♂	16.1	29.2	55.6	8.2	39.7	19.4	27.3	37.8	64.8	47.3	42.6	45.8	51.1	29.1	37.9	31.1
53846	♂	15.2	28.5	52.0	7.4	38.4	17.3	28.2	38.6	66.5	50.0	42.4	45.4	50.3	29.5	37.8	30.7
54389	♂	15.7	28.6	51.6	7.7	38.1	19.0	29.6	39.2	67.7	49.7	43.7	46.8	51.9	29.3	38.1	31.2
54391	♂	15.3	28.6	53.7	6.9	39.0	18.1	27.4	38.5	66.4	49.3	42.2	45.7	50.8	28.8	36.8	28.5
Average		15.7	28.6	52.7	7.5	39.0	18.6	28.2	38.7	66.9	49.3	43.0	46.3	51.5	29.3	37.9	30.7
49603	♀	14.2	28.3	49.3	7.0	36.3	17.7	27.7	36.5	63.2	48.1	41.6	44.7	50.0	27.3	35.8	28.1
53762	♀	15.2	27.3	50.3	6.7	36.6	17.7	27.1	36.5	63.4	46.6	41.4	44.7	50.0	27.9	35.2	29.0
54388	♀	14.9	27.1	50.0	6.9	38.2	18.6	29.9	37.9	66.0	48.8	.....	46.5	51.8	28.4	37.1	29.3
44390	♀	14.5	28.3	49.2	7.5	36.3	16.8	26.3	36.8	62.7	45.5	41.7	44.4	.....	28.2	35.8	29.4
Average		14.7	27.7	49.7	7.0	36.8	17.7	27.7	36.9	63.8	47.2	41.5	45.1	50.6	27.9	35.9	28.9

WEIGHT

NUTTALLII.—Weights of fifteen males and thirteen females are shown below, arranged according to month. The average of all the males is 176 grams, of females 145.5. Thus, in this series the females are 83 per cent as heavy as males. The lightest and heaviest males were weighed in March, and weighed 162.5 and 188.6 grams. The lightest female (126 gm.) was a March one, but the heaviest one (169.6 gm.) was weighed in January.

Weights, in grams, of California-taken *Pica nuttallii*

	Male	Female
January	168.6	140.9
	185	153.5
		155.1
		169.6
February	167	141
	182	
	184	
March	162.5	126
	166.8	128.5
	168.4	140.9
	172	145.4
	175	145.5
	175.4	152.3
	181.5	153.2
	188.6	
October		132.5
November	160.0	144.0
	166.5	
	177.7	
December	188.1	162.7

HUDSONIA.—Bergtold (1917, p. 24) records the weight of a magpie in May as 5.34 ounces (151.4 grams). Judging from the weights given below this one must have been a female.

Weights, in grams, of *Pica pica hudsonia* taken in Nevada, Oregon, and California

	Male	Female
January	200	166.5
	190.5	160.0
	169	152.5
		165
		147
February	195	172
	188.5	156
	191.5	172.5
		180.4
March	184.4	170.2
May		163.3
July	174	150
August		144.4
		150.6
September	186.5	138.3
		153.5
		172
October	186.7	171

The ten males averaged 186.6 grams; the lightest (169 gm.) was weighed in January, and also the heaviest (200 gm.). Eighteen females averaged nearly 86 per cent as heavy as the males, the average of the females being 160.3 grams. The lightest female (138.3 gm.) was weighed in September, and the heaviest (180.4 gm.) in February. The only clue apparent from the lists of individual weights to explain the greater difference in average for the sexes in the yellow-billed form is that in that one

the greater number was weighed in the breeding season. Females may lose more weight than males at that time of year.

PICA.—Average weights, in grams, were given for the two sexes of magpies by months, as follows by Zedlitz (1926, p. 299).

MALES		FEMALES	
December	150	October	222
January	235	November	194
March	243	February	198
April	233	March	220
May	236	April	180
June	245	May	200
August (molting)	242	July (juv.)	195
July (juv.)	225		

Zedlitz states that young males just leaving the nest weigh 25 to 30 grams more than females of the same nest brood. He says that both sexes become lean in winter on account of hard forage conditions and that the minimum weight is reached in April due to lessened appetite resulting from breeding excitement and egg production.

Weights of magpies from France were given by Bacmeister and Kleinschmidt (1920, p. 9) as follows.

Sex	Locality	Date	Weight in grams
♂ ad.	Juniville	December 12, 1916	258
♀ ad.	Juniville	January 15, 1917	214
♀ ad.	Aussonce	January 13, 1917	268
♀ ad.	Aussonce	February 2, 1917	190
♂ juv.	Aussonce	November 21, 1916	275
♂ juv.	Juniville	January 21, 1917	225
juv.	Aussonce	February 1, 1917	220
♂ juv.	Pont Faverger	February 7, 1917	248
♂ juv.	Aussonce	December 1, 1916	223
♂ juv.	Biermes	January 29, 1917	220
juv.	Biermes	January 29, 1917	175

The following tabulation taken from a work by Hesse (1921, p. 304) shows weights of fifteen magpies collected in Europe and also heart weight for the same birds.

No. and Sex	Weight	Wt. of Heart	Per Cent	Locality	Date
1 male	220.9 g.	2.215 g.	10.02	Bonn	Sept. 30, 1918
2 male	226.2	2.873+	12.70+	Berlin	Jan. 30, 1912
3 male	231.8	2.745	11.84	Bonn	Feb. 27, 1919
4 male	235.0	2.420	10.30	Bonn	Jan. 22, 1917
5 male	243.4	2.030	8.34	Berlin	Jan. 15, 1914
Average, males	231.5	2.457	10.61		
6 female	165.0	1.730	10.48	Bonn	Nov. 6, 1917
7 female	180.0	1.870	10.39	Bonn	Dec. 21, 1917
8 female	188.4	1.965+	10.43+	Guben	Nov. 11, 1913
9 female	189.0	2.215	11.72	Bonn	Oct. 24, 1917
10 female	196.6	2.195	11.16	Bonn	Oct. 10, 1918
11 female	198.1	2.070	10.43	Bonn	Oct. 19, 1918
12 female	199.4	2.250	11.28	Berlin	Oct. 11, 1911
13 female	200.0	2.150	10.75	Bonn	Feb. 23, 1917
14 female	214.0	2.375	11.10	Bonn	Jan. 13, 1917
15 female	226.0	2.275	10.06	Berlin	Jan. 5, 1910
Average, females	195.7	2.110	10.78		

Boetticher (1915, p. 12) has pointed out that magpies in Spain (*Pica p. melanotos*) and in northern Africa (*P. mauritanica*) are smaller than those in middle and northern

Europe, and the species becomes larger in northern Asia (*bactriana*) in the high mountains of Sikkhim, Bhutan, and eastern Tibet (*bottanensis*) and in northern North America (*hudsonia*). The latter is larger than the California form (*nuttallii*), just as the magpie of Korea, south Japan, Formosa, Hainan and Burma (*sericea*) is smaller than the one in the high mountains of Tibet (*bottanensis*).

TEMPERATURE

Internal temperatures of birds fluctuate so greatly for a given individual and within such restricted limits for birds as a class that single readings without record of circumstances under which they were made are not very significant.

A considerable number of readings taken interthoracically were given by Wetmore (1921, p. 40), as follows, in degrees Fahrenheit.

	Records	Average	Minimum	Maximum
hudsonia; male	9	107.3	106.4	108.6
hudsonia; female	9	107.1	106.2	108.8
nuttallii; male	1	108.1		
nuttallii; female	2	107.7	107.6	107.8
Corvidae; 14 sp.	66	107.9	106.6	110.3

Average temperature of five young magpies taken at 4 p.m. on a July day by Bergtold (1917, p. 56) was 106.5° F.

PLUMAGES AND MOLTING

Adults may be distinguished from young birds up to the time of their second molt by differences in the coloration of the primaries and in the form of the outer primary. The white area is less extensive on the inner web of the primaries in the young than in the adults, and the black terminal borders are larger. Often also the delimitation of the white and black is not sharp in the young where it is distinct in the adult.

The outer (reduced) primary is shorter in the adults than in the young. All the primaries are more pointed in the young than in the adults.

The rectrices, especially the outer, vary according to age. The lateral one is narrow and rounded at the end in the young; it is large and square at the end in the adults.

MEASUREMENTS (IN MILLIMETERS AND GRAMS) OF TWO BLACK-BILLED MAGPIES COLLECTED MARCH 25, 1931, AT THE NORTH END OF KLAMATH LAKE, OREGON

	Male	Female
Total length with feathers	503	450
Total length without feathers	213	205
Length of exposed culmen	33.6	32.6
Length of bill from gape	43.4	39.4
Length of bill from nostril	29	24.8
Height of bill at base	14.7	14.0
Height of bill at nostrils	14.3	13.9
Width of bill at base	17.5	17.8
Length of gonys	22.8	20
Length of rictal bristles	9.6	.....
Length of tongue	22.6	.....
Length of frontal antiae	14.4	15.8
Extent of wings with feathers	600	600
Extent of wings without feathers	310	289
Length of closed wing	205	196
Length of open wing	265	271
Greatest breadth of wing	155	152
Length of wing-tip	37	36
Length of tail	292	240
Width of expanded tail	220	212
Graduation of tail	160	116
Length of leg	182	172
Length of tarsus	47.4	46
Length of middle toe	26	21.2
Length of foot	61.3	58.5
Length of hind toe	13.2	10.2
Weight	184.42	170.15

Lengths of dark border at end and white area of each primary for two black-billed magpies (*Pica pica hudsonia*) collected, March 25, 1931, at the north end of Klamath Lake, Oregon:

	Male		Female	
Primary	Dark	White	Dark	White
I	9.5	43	22.3	31.8
II	8.7	102.6	13.7	95
III	10.6	123	13.0	117.2
IV	8.9	131.2	10.6	125
V	7.9	130.3	10.7	127
VI	22.8	109.6	13.6	120
VII	26.9	92.1	18.0	100
VIII	27.5	75.6	20.0	84
IX	27.0	59.6	20.2	65.6
X	27.8	41.7	21.0	46.8

PICA.—Witherby (1920, p. 22) has given the following detailed description of the plumage of adult male and female in winter.

"Whole head, neck, mantle, inner scapulars, upper tail-coverts, throat, upper breast, tibial feathers, vent, under tail-coverts, axillaries, and under wing-coverts velvety-black with blue-purple tinge; crown and scapulars slightly glossed greenish; chin and throat feathers with whitish shaft lines; rump varying from white or brownish-white to brown (in British specimens never very white and often nearly black); rest of scapulars and breast, flanks and belly, pure white; tail below black, above both webs of central pair and outer webs of rest brilliant bronze-green with band of red-purple near tip, merging into blue-purple and green-purple at tip; primaries: outer webs and tips glossed blue-green, inner webs mostly white except at base and tip; in outer primaries white goes to a point near shaft, in inner ones it is squarer at tip and extends less towards base (extent of white in primaries varies slightly individually); secondaries: outer webs glossed bright blue with inner line of bronze-green on basal half of outer feathers, tips bluish-green, inner webs black except those of innermost feathers which are bluish-green; primary-coverts, greater and median coverts, bronze bluish-green; lesser wing-coverts black with little gloss. This plumage is acquired by complete molt in autumn."

The juvenile is described as "like adult, but with all black parts sooty blackish-brown; rump blackish-brown; scapulars brownish or buffish-white; belly buffish-white; wing coverts much less brilliantly glossed; wing and tail-feathers like adult but slightly less brilliant."

The first winter and summer plumage is "scarcely distinguishable from adults but slightly less brilliant wings and tail, especially noticeable on central tail-feathers, primary-coverts, and primaries, which become brownish in summer."

SEQUENCE OF PLUMAGES

HUDSONIA.—Chapman (1918, p. 416) gave a short résumé of the plumages and molts of this bird, which agrees in every particular with the more complete account cited under the race *pica*.

PICA.—In reporting upon a careful study of the molts of passerine birds in England, Witherby (1915, p. 149) treated all members of the Corvidae together because, except for the rook which has a special molt on the face, all the British species are so similar in their molts and sequence of plumages that they do not require separate treatment. "The adults of all the species have only one annual moult, viz. a complete one in early autumn. . . . The effect of abrasion and fading, even by the middle of the summer, is scarcely noticeable, except that the wings and tail become brownish and lose some gloss.

"The sexes of all the species are alike in plumage.

"Juveniles are very much like the adults except for the loose texture of the body-feathers; . . . in the magpie . . . the black portions of the body-plumage are browner and the white portions more creamy, while the wings and tail are less brilliantly glossed. . . .

"First Winter and Summer.—The wing- and tail-feathers and primary-coverts of the juveniles are not moulted in the first autumn in any of the species. The body-

feathers are moulted in fall. The lesser and median wing coverts are also moulted, but in some species the moult of these feathers is not complete. The greater wing-coverts are moulted entirely only in the Magpie. . . . after the moult the first winter bird is like the adult, except that the wings and tail are browner and less glossy, a distinction which, although scarcely noticeable in the autumn, becomes marked in the following spring and summer. After the moult of the second autumn they are indistinguishable from the adults."

From Mayaud's (1933, p. 370–372) accounts of the molt of magpies in France the following summary gives some of the details of the time and order of replacement of the feathers.

The juvenal molt takes place from July to October in western France. The juvenal molt includes all the body plumage. The annual molt commences at the beginning of July, or the end of June; it reaches its height in the month of August and ends from the 15th of September to the end of October. It is complete. The molt of the body plumage is very rapid. The molt of the tail commences early and ends sooner than that of the remiges. The two median rectrices fall first and the replacement proceeds regularly to the lateral ones. The upper and lower caudals fall a little after the beginning of the molt of the rectrices. The molt of the primaries begins very soon and ends very late. Its direction is from the inside out, from the first to the tenth (and eleventh). The secondary remiges molt in three series: the two posterior series with the ninth and tenth falling in the external-internal direction and the eighth and seventh in the internal-external direction, and a third series, the first to sixth, falling in the external-internal direction. The molt of the secondaries commences after that of the primaries and that of the anterior series ends a little after that time.

NUTTALLII.—On at least several of the birds I noted, October 9, 1929, in the Sacramento Valley, bright yellow of the exposed skin could be seen extending back from the bill, below and nearly around the eye. On some if not all of the magpies observed on November 11, 1930, the yellow, bare area around the eye could be seen distinctly.

Four freshly killed birds from near Gilroy, Santa Clara County, were examined by me on October 10, 1929. All were in molt. In one, a female, the molt was nearly completed; the sheaths still showed on the contour feathers on the breast and around the head. The skin was yellowish, especially around the head, the base of the tail, and on the body at the bases of the feathers. The yellow, bare space behind the eye was 10x10 mm. in size. A male in the same stage of molt as the first bird showed more yellow on the skin, especially on the under sides of the wings. Another female was further along in its molt; it showed scarcely any yellow on the skin except around the head. All but the feathers of the throat and chin were free from sheaths. The fourth bird showed sheaths on the feathers about the head, those on the chin and throat being least far developed.

HUDSONIA.—Bishop (1900, p. 80) reports the capture of two young individuals on July 26, at Fort Selkirk, Alaska, which "had just assumed first winter plumage."

An adult male (*P. p. amurensis*) taken on September 14, 1928, near Blagowestschensk, Amurland, was in the midst of its molt (Stegmann, 1931, p. 141).

In the neighborhood of Quetta in India, Meinertzhagen (1920, p. 136) found magpies (*P. p. sericea*) in full molt at the end of July.

HEMILEUCOPTERA.—A male collected in Tekes Valley, Chinese Turkestan, on September 3, 1925, was in final stages of the [post] juvenal molt (Hellmayr, 1929, p. 35).

MAURITANICA.—An adult female collected on June 11, in Morocco was halfway through a complete molt (Lynes, 1925, p. 35).

ABNORMAL PLUMAGES AND FREAKS OF STRUCTURE

No special search has been made for records of freak magpie plumages, but most of the examples found have been cited in this account. The large number of such specimens, even for a well-known bird, might possibly indicate an exceptional propensity for the magpie to develop abnormalities. But, it might mean merely that more attention has been paid to this bird than to other kinds.

Abnormal plumages in the magpie attract more than ordinary interest because of the possibility, which seems almost probability, that some of the existing geographic forms arose by the preservation of this kind of character. This preservation might have been accomplished by means of the kind of geographic isolation which now characterizes the forms *nuttallii* and *mauritanica,* the ones whose distinguishing characters seem most likely to be explainable by some hypothesis like the one here mentioned.

It is interesting, if not significant, that the yellow bill which is the conspicuous mark of the Californian kind of magpie has been discovered as an abnormality in other parts of the range of the genus.

HUDSONIA.—Near Collins, Montana, on July 20, 1918, an abnormally plumaged magpie was seen by Du Bois (1918, p. 189). The bird was "entirely of a grayish-white, or very pale gray color, and did not exhibit any definite markings . . ."

Rockwell (1910, p. 45) reported finding two albino magpies in a brood, the balance of which appeared to be normal. Both birds were pure white except for a slight creamy tint which might have been due to soiled plumage.

A magpie abnormal in another way was reported by Bailey (1926, p. 175) who shot an adult female at Tonsina, Alaska, December 25, 1919, "which had half the upper mandible missing."

An abnormally colored magpie in the collection of the State College of Washington, was collected about February 15, 1927, by J. D. Logan, near Nampa, Idaho (Svihla, 1933, p. 44). The pattern was normal but the feathers, bill, tarsus, and claws which are usually black are rusty brown in this specimen.

PICA.—In the experience of MacGillivray (1837, p. 564) "white individuals" were rarely met with in the British Isles. One abnormal individual he described in detail as follows: "The bill, feet, and claws were reddish-brown; the head, neck, fore part of the breast, the upper tail-coverts, the abdomen, and the legs, dull reddish-brown, the back yellowish-brown, with a white band across; the scapulars, and middle and posterior part of the thorax, white; the quills nearly white, the wing coverts brown; the tail with the outer webs white, the inner webs and lower surface brown."

An abnormally colored young bird, just out of the nest, as examined by Aplin (1885, p. 349). The head, neck and upper breast were a smoky dun color; the back and wings and tail silvery gray; primaries were marked with white, as usual; white of the scapulars strongly tipped with buff. Aplin had seen three other "varieties"; one with the normal black everywhere replaced with cinnamon-brown; one somewhat similar, but with the brown much paler; and a white bird.

True albino magpies were reported in England by Carroll (1904, p. 313) who saw three whose plumage was pure white; the feet, legs and beak were also white and the eyes pink. Kempen (1897, p. 151) recorded the killing of a young male magpie in France that was albino. The same writer (1888, p. 105) listed three more abnormally plumaged magpies from France. One was entirely white, one was white with some black feathers, and one was a drab color. Bonjour (1888, p. 194) reported an albino magpie from France in which there was a faint trace of pigment. Another bird was colored a pale brownish gray on those areas which were ordinarily black.

Two freakish magpies were killed in England as late as 1921 (Forrest, 1921, p. 41). In one all the parts of the plumage which are normally black are pale gray and, in addition, the primaries are entirely gray, with no white. In the second bird the parts of the plumage normally black are dull fawn color on the neck, breast, rump, and legs, but the rest was purely white. It had more white than the first. The top of the head was gray. An added peculiarity was that in both birds all the primaries and rectrices were of hair-like texture. The two birds were killed within six miles of each other and both in the month of April.

Possibly the most interesting single example of an abnormal magpie yet reported is the one with a yellow beak concerning which a detailed account was given by Mathew (1867, p. 1016). The bird was seen in the neighborhood of Buckfastleigh. Two observers watched as it "walked deliberately into the middle of the road before taking wing. While here it was in the full glare of the sun, and I then observed, to my astonishment, that it possessed a bill of bright lemon colour at the base, but of a darker hue towards the tip. I uttered an exclamation of surprise, and called my companion's attention to it, and he agreed with me that he had never seen or heard of a magpie with a beak so coloured. . . . this bird's beak was of a much lighter tint than it would have been had the bird been feeding on egg, as in that case it would have been of a dull gamboge colour and destitute of gloss. I do not imagine for a moment that this bird was any other than our common species. . . . The only conclusion I can arrive at to account for this abnormal appearance is that the bird was affected with some disease of the organs which secrete the horny matter of the beak, and in this, as in other cases, may be attributable to the extreme old age of the bird." There is no mention in the account that any other part of the bird appeared at all unusual. Another yellow-billed one was reported earlier in the same year in Scotland, by Brown (1867, p. 706).

Mosley (1885, p. 437) sketched a specimen which showed peculiarities as follows. ". . . head, breast, and back sooty brown, primaries and tail grey, scapulars and underparts dull white, bill inclined to yellowish, legs normal. I have also in my possession another having all the parts usually black, of a very pale grey."

A white magpie, reported by Macpherson (1883, p. 258) had the forehead and both primaries and secondaries tinged with black. The beak and irides were normal; the legs were flesh-colored. Ten pure white magpies were known at one time by Leverkühn (1890 p. 177). At least one of these birds had the iris dark. The same writer (1887, p. 80) recorded color varieties of magpies as follows: Entirely Isabella color, gray, pure white, tail and wing feathers bright brown, white in place of all blues with tail bright brown. Van Kempen (1908, p. 91) reported cream colored, light chestnut, and dark chestnut magpies from France.

Recently Mayaud (1933, p. 373) reported that the yellow pigmentation of the skin, normal for *nuttallii,* is probably accidental for other races. On October 1, 1933, he obtained at Maine-et-Loire, France, an adult female on which the skin of the throat and the vicinity of the eye and especially the eyelids was clearly yellow, a little greenish. He asks whether this yellow coloration is due to an abnormal production of lipochromes or to an absence of melanins.

Magpies sometimes furnish freaks of structure as well as of color. One killed in France on November 18, 1858, was an adult male with a crossed beak (Van Kempen, 1908, p. 84). The bird had been able to keep alive until late in the fall in spite of its malformation. A magpie freakish in still another way was killed in Cumberland, England, on November 3, 1880 (Parker, 1880, p. 71). This bird had three legs. The third leg was perfectly formed, but was smaller than the others and grew close to the normal right leg. It was white in color as were also the claws.

An Isabella-colored magpie killed in France in 1917 had yellow claws, tarsi bluish, the bill slightly rose with the point of the upper mandible clear yellow, the iris a clear pearl gray which reflected slightly rose when viewed from some angles (Costrel, 1917, p. 153). Another abnormal magpie killed in France was a pure albino. It had the bill and feet whitish pink; the iris pale bluish (Anfrie, 1917, p. 137).

Browne (1889, p. 92) gave a record of a pure white magpie that "frequented the neighborhood of Shearsby [England] for a long time in the winter of 1881–2, and was noted by many people . . ."

Abnormally colored magpies collected in Germany have been listed and described by Leverkühn (1889, pp. 126 and 251). Main features of each of the seven individuals were as follows. (1) Pure white, somewhat dark on the bill; (2) pure white, *bill* and *feet yellow;* (3) a typical albino, bill and feet dark; (4) albino with traces of yellowish brown, *bill* and *feet yellow;* (5) white without any dark; (6) all dark parts dark bister; (7) albino with grayish on head and breast, bill and feet normal. That writer observed that it is usual for albinos of this species to have the tail worn off, sometimes for half its length.

Paris (1910, p. 103) recorded two pure white magpies in France and one which had the parts ordinarily black a clear chocolate, the wings and tail being almost white and the iris red.

Naumann (1905, p. 77) remarked upon a magpie with a white head which nested in Goritz and was observed three different years. He wrote that albino magpies at times have an especially slashed tail.

Bessenyey (1919, p. 146) reported that in Hungary he had observed, over a long period, an abnormally plumaged magpie in which the feathers ordinarily dark and metallic colored were cinnamon colored. An editorial footnote adds that a similar specimen had been kept in the animal gardens at Budapest and that each year (with the molt) it became darker until it was a coffee brown.

Browne (1886, p. 17) noted that a brother of J. W. Whitaker shot a cream-colored variety in 1880 and purchased a snuff colored variety said by the man who sold it to have been taken at Stoughton.

After mentioning the blue coloring about the head which characterizes the form *mauritanica* Finn and Robinson (1922–23, p. 188) comment that they have "seen a tame bird with this peculiarity in England."

Jaubert (1859, p. 101) owned two magpies of freakish plumage, one an Isabella color and the other an ashy white. He also reported having seen, in the same nest, four young that were completely white but which lived only a few days.

An adult female killed in 1846 at Bletterans (Jura) had whitish plumage (Kempen, 1891, p. 147). The same writer (1894, p. 78) reported that an adult male with entirely white plumage was taken, October 30, 1893, at the village of Ouve-Wirquin, Canton of Lumbres (Pas-de-Calais), France.

Kempen (1891, p. 144) reported an adult male magpie with a crossed beak in his collection, killed November 18, 1885, at Château d'Arques, near Saint-Omer, France.

Magpies showing abnormalities of plumage were described by Rothschild (1929, p. 4) as follows. One with unknown history had the usually black parts coffee-brown ("cafe-au-lait"). Another, from Holland had the black portions of the body-plumage pale russet-brown, the back palest, wings and tail creamy-whitish. In both these birds the bill was brown. An adult male (race *bactriana*) from Turkestan, was brown with breast and abdomen white, head and hind neck pale brown, exposed parts of quills, tail, and lesser upper wing-coverts silvery creamy-white, scapulars snow-white and bill brown. Abnormality in each instance was considered due to the suppression of the melanin in the pigmentary matter.

A cream-colored magpie observed near Manchester, England, was reported by Hamel (1870, p. 2344).

Strand (1932, p. 42) reported upon an albino magpie found in Lettsland in October, 1929. The bill was brown with a somewhat yellowish tone. All the parts ordinarily black were brown or brownish and slightly yellowish. There was no metallic color. The white portions were not so clear as in normal birds. In addition, many other references dealing with abnormal plumages were given by this author.

A magpie in the museum at Copenhagen whose tail and wing feathers were bright brown was reported by Marshall (1901, p. 207). Pax (1925) wrote of a partially albinotic example in the Hedrick collection, and a second albinoid one in which all the normally dark-colored feathers appeared light gray and which was in the Görlitz Naturalists' Society collection. Pelzeln (1865) described an albino magpie from Austria which was entirely white, bill and claws light, and legs dark yellow. Another had all the white parts normal, all the dark parts uniformly light woodbrown, bill, legs, and claws dark yellow. Schuster (1908, p. 107) observed the "white variety" of magpie in Biebrich. Springer (1913, p. 479) listed a partial albino magpie received in 1907 in Agram by Dr. Rössler. Another of the same sort was killed about the end of August, 1909, in Moravia (Tschusi, 1910, p. 278). The same author (1900, p. 60) mentioned a magpie from the region of Innsbruck that was wheat-bread yellow in color.

According to Shaw (1809, p. 369) "the varieties of the Magpie are white, pied, and buff colour." That the albinos could reproduce and transmit their characteristic color was not to be doubted, in the opinion of Jäger (1864). Blake-Knox (1866, p. 454) mentioned a cream colored magpie from England. Talsky (1898, p. 68) listed a magpie from Moravia which in place of the dark feathers was colored coffee brown.

Individuals partly, or even entirely, white, with the iris red, are not very rare in Switzerland. Sometimes the parts ordinarily black are gray, Isabella color, or clear russet brown. A gray and white magpie and a russet and white one are contained in the collection of the Museum at Berne (Fatio, 1899, p. 746).

Dzieduszycki (1880, p. 37) reported two abnormal specimens in his collection, one entirely white and another, killed in 1866, in Poland, white with a yellow bill.

"Sir William Jardine records a pair of Magpies, 'entirely of a cream colour, hatched at a farm-steading in Eskdale, and being much thought of by the tenant, were strictly preserved and continued near the spot for many years.' " (Gladstone, 1910, p. 115.)

Dombrowski (1912, p. 36) reported a specimen killed on November 16, 1900 in Mirceavoda, Rumania, which was colored light coffee brown on the tail and tips of the wings.

Christy (1890, p. 133) cites Sackett as authority that one was shot near Grays, Essex, England, "having a deformed beak, the upper mandible being curved to the right like that of the Crossbill."

Willemoes-Suhm (1865, p. 409) mentioned a pure albino specimen of magpie that was in a private collection of birds in Hamburg and showed a figure of an incomplete albino in which the normal design was a yellowish gray color. The same author wrote (1867, p. 315) of a live completely albino magpie that was kept captive and paired with a normally colored male for two consecutive years. The first year was without result, but in the second year (1866) normally colored progeny were brought forth.

Zollikofer (1900, p. 170) wrote of two magpies probably from the same brood in which all the parts normally dark were bright ashy gray.

Accidental varieties of the magpie, which were not often found, were listed by Naumann (1905, p. 123) as follows: The white magpie, entirely white with red eyes, or yellowish white. The wheat-bread yellow magpie in which the dark color is replaced with Isabella color. The ashy gray and white-spotted magpie, with all the dark parts ashy gray. The rust colored and white spotted magpie, with the dark portions brown or rust colored. The variegated magpie, with the dark portions interspersed with white feathers and spots.

GENERAL HABITS

Some of the preceding topics have dealt mainly with sequent phases of the annual breeding cycle in the magpie. But many habits and activities have a more or less continuous part in the life of the bird. These make up the daily routine of behavior regardless of season, although they may be modified and shifted in importance to allow for cyclical behavior. In order to avoid duplication it is probably best to give separate treatment to these general habits. At the same time it must be kept in mind that these habits and activities are the chief ones concerned in the breeding cycle. They constitute the materials which are recurrently modified and ordered for the special purpose of reproduction. The aim now is to examine them at stages when the birds are least stimulated.

General habits of magpies will be considered in the following order: Perching and locomotion, roosting, bathing, voice, flocking, daily activity, and miscellaneous responses. Such a treatment of the habits of a bird tends to detract from the notion of unity which should predominate in this type of analysis. However, effort is made constantly to emphasize the close interdependence of all these habits and the way in which they all contribute to make a coherent life-story. A similar problem arises with respect to considering composite accounts of many individual birds as contrasted with the continuous story of a single individual. However desirable the second type of treatment may be, the first is, of course, necessary.

PERCHING AND LOCOMOTION

NUTTALLII.—Manner when perching was observed by me especially in magpies in the Sacramento Valley in October, 1929. The types of perching places most often used when the birds were not on the ground were the larger-sized limbs of big trees. One bird lit on a telephone wire and appeared to have no difficulty in balancing itself. Another stopped on the top of a telephone pole. It jerked its tail upward four or five times, then maintained its balance with the tail held close to forty-five degrees below the horizontal.

On October 6, in a foraging group of magpies each bird at intervals twitched its tail upwards independently of need for balance. Nearly always when a note was given by a bird its tail was also jerked slightly. One that perched on a telephone wire (November 11, 1930) used its tail as an aid in balancing, and continually worked that member up and down. One bird was watched as it perched alone in the top of a dead tree, and then on a telephone pole. Most of the time its tail hung nearly straight downward. A magpie that was watched on October 7, as it stood in the middle of the road allowed the tip of its tail to rest on the ground.

When starting to fly away after being disturbed, the birds did not flap evenly. Several "spurts" could be distinguished. Magpies, watched as they came to the ground to alight, sailed with set wings. Upon alighting, the birds usually made one or two short hops before coming to a full stop. Also, the tail was thrown upward and forward. When walking the birds nodded their heads forward and backward.

When returning to the ground from a post-top a magpie (March 30, 1930) merely spread its wings and sailed off into the wind and planed to the ground without flapping. When alighting, the customary uptilting of the tail and body was preliminary to gaining balance.

To Kaeding (1897, p. 16) the flight of this bird resembled that of a jay. He observed that the birds' appearance on the ground was "rather hideous. They hold the tail at an angle above the horizontal and strut about with a pompous air."

The grace of the flight of these birds has impressed some observers. They proceed with easy unhurried flaps, normally in a direct course, like a crow. When they have occasion to change direction they swerve evenly, and when descending to an alighting place, they go down with a slow, looping glide. The long tail adds to, if it does not constitute, the bird's grace as a flyer (Hunt, MS).

The unique silhouette of a magpie in flight has been pointed out. The long tail, in side view gives an effect of a rudder. Major Allan Brooks has explained (Grinnell, 1923, p. 173) the special construction of the central pair of tail feathers which makes for this appearance. "These do not lie flatly side by side in the spread tail, but are rolled down at their edges and superimposed or, in cross-section, concentric. A conspicuous terminal streamer is thus formed, in side view somewhat like that of a Pomarine Jaeger, only, in the case of the latter bird, it is by a twisting of the feather that the effect is accomplished."

Tyler (1913, p. 65) has remarked that "at a distance an adult magpie, as it floats along from one oak tree to another, bears a really striking resemblance to a Phainopepla, except for size."

HUDSONIA.—Small droves of magpies were watched by Fisher (1902, p. 6) as they caught grasshoppers every morning in a field near Mono Lake, California. The agility of the birds in dodging and circling showed how mistaken persons are likely to be in forming an estimate of a bird under ordinary conditions. "Usually nonchalant and absurdly dignified in their demeanor, these birds could at times assume the utmost interest in their occupation, and dart with surprising speed here and there. They used their tail about as much as their wings in flying."

Bendire (1895, p. 349) characterized the flight of the magpie as "slow and wavering, and in windy weather evidently laborious. The long, wedge-shaped tail seems to be decidedly in the way and a positive disadvantage, causing it no little trouble in flying from point to point, and in such weather it will only leave through necessity the sheltered bottom lands it usually frequents." Also the flight is never very protracted.

Much of a magpie's time is spent on the ground in search of food. The walk is somewhat jerky, but it has been characterized as being graceful. The tail is slightly elevated and is constantly twitched. When the bird is in a hurry the ordinary walk is sometimes varied to a series of hops (Bendire, 1895, p. 351).

Taverner (1926, p. 255) writes of the magpie that it is "more often seen retreating up the coulée, chattering as it glides from bush to bush. . . At other times, a small flock or family party will be seen passing noisily along the tops of the hills, from brush clump to brush clump. Again they steal silently into camp or about the farm buildings intent on any mischief that may present itself, but flee away in consternation when disturbed. . ."

However, on many occasions, as has been indicated by Goss (1891, p. 376), magpies, when pursued, do not fly away wildly, but will tempt the pursuer by fussing about just out of reach. That observer also pointed out that although the birds sustain themselves by rapid strokes of the wings, the effort is too great for extended flight.

Tullsen (1911, p. 90) noticed that magpies were considerably inconvenienced in high winds, by having such long tails.

In central Nevada, I noted in May, 1932, that in a strong wind the magpies flew low, just over the tops of the bushes, and that they raised and lowered their flight

Fig. 20. Black-billed magpie in flight, near Millett P. O., Nye County, Nevada. Photographed on June 7, 1933.

according to variation in level of the bush tops. They probably avoided much of the force of the wind by doing this.

When a magpie flies from a mountain side to the depths of a cañon it makes a succession of oblique dives (Taylor and Shaw, 1927, p. 180).

PICA.—Habits of locomotion have been summarized for this race in England as follows: "In the open country it commands attention as one, two, three or more birds, with rapidly moving, apparently short wings, fly in succession, chattering as they pass. When the bird alights the long tail is at once elevated and is carefully carried clear of the ground. Like other crows its usual gait is a walk, but when attracted by food or any special object it hops quickly sideways with wings just open." (Coward, 1920, p. 30.)

Dresser (1902, p. 417) has observed that this bird has a labored and weak flight and that it seldom flies far before seeking shelter. Its locomotion is further characterized by Elms (1906, p. 53) as being "skimming, arrowy flight, and quick beatings of its short wings. On the ground it runs and, at intervals, takes surprisingly long hops."

In writing of the flight of the magpie, Hudson (1915, p. 99) has noted that "the quickness of the wing-beats causes the black and white on the quills to mingle and appear a misty grey; but at short intervals the bird glides and the wings appear black and white again." In another place (1921, p. 161) he adds that "the flight is slow and

somewhat wavering, and at every three or four yards there is an interval of violent wing-beats. . . . High in the air he has a most curious appearance; as a rule he flies low, passing from tree to tree, or along the side of a hedge. . . . His manner of running and hopping about, flinging up his tail; his antics and little, excited dashes, now to this side, now to that, give the idea that he is amusing himself with some solitary game rather than seeking food." This further characterization is taken from Jefferies (Hudson, 1921, p. 162): ". . . His rather excitable nature betrays itself in every motion: he walks, now to the right a couple of yards, now to the left in quick zigzag, so working across the field towards you; then, with a long rush, he makes a lengthy traverse at the top of his speed; turns and darts away again at right angles; and presently up goes his tail, and he throws his head down with a jerk of the whole body, as if he would thrust his beak deep into the earth."

Chasen (1921, p. 195) noticed in Macedonia that "the peculiar habit that the Magpie has of jerking its tail upwards when alighting served the species in good stead on the muddy Struma levels." He thought that the movement was accentuated when the bird lit on wet or dirty ground, and that possibly this might furnish a clue to the origin of the habit.

It has been pointed out (Pitt, 1922, p. 243) that although the magpie makes an impression of being a slow and feeble flier it really flies better than it appears to. In further characterization she writes that "it hops about with a swing of the tail and a roll of its body."

Yarrell (1873, p. 316) added that "the bird is nearly always on the move, flying from its prey to its perch and thence back again. In pastures it continues longer on the ground, by turns walking, running or hopping, halting to pick over the cattle droppings in search of grubs . . ."

The characterization by Butler (1896–98, p. 151) gives added insight into the behavior and manner of locomotion of the magpie. He writes as follows: "Although half afraid to trust one, and ever on the alert, the Magpie often keeps but a short distance ahead as one passes through its haunts, either in the trees above, or on the ground; at one moment it will be peering and chattering from a branch, the tail rising and falling, or opening and shutting, after the manner of the South American Jays; now it will drop buoyantly down to the scrub, whence it will appear upon the path, and then for a short space flit down the same to rise again to a branch and repeat the whole performance."

In writing about the magpie, Finn and Robinson (1922–23, p. 186) have mentioned that "it spends a good deal of its time in trees and bushes . . . , and can dodge about very actively in cover."

Harrisson (1931, p. 88) found that a magpie in flying from one tree to the next, a distance of forty yards, moved at the rate of nineteen miles per hour. A magpie that was "chased" in England flew at 38 miles per hour as recorded by a speedometer (Roberts, 1932, p. 220).

On a calm, clear day, in September, 1917, Flemyng (1918, p. 96) reported surprise at seeing a magpie in a long flight in the upper air. He watched the bird until it flew out of sight and considered the flight to be more than two miles long, at least. This was at a place in Ireland where the bird was common and where "it finds perching facilities everywhere."

A magpie watched flying off the Cornish coast by Booth (1881) "was evidently somewhat incommoded by the length of his tail, which was carried by the wind right underneath the body. The length of the caudal feathers, and the upright manner in which he was forced to proceed, rendered his appearance exceedingly strange."

On the Isle of Wight, Hadfield (1866, p. 177) saw a magpie carried away by a heavy wind, the bird's "long tail doubled under the body and protruding beyond the beak."

ROOSTING

NUTTALLII.—Large numbers of yellow-billed magpies were found to be using a well-established roost in the neighborhood of Colusa when that vicinity was visited in early March, 1923 (Grinnell, 1923, p. 173). Attention was first directed to the roost by seeing the birds flying over in the evening toward a dense willow patch surrounded by open fields. These congregating flocks were noted during the last half hour before sunset. Three representative flocks that were counted contained 78, 23, and 102 individuals. The account of one evening spent in watching the assembling birds is in part as follows:

"A flock would arrive with every appearance of being about to settle in the willows; just short of actually alighting the whole lot would swerve off and settle on the open ground or in the top of one or two oak trees that stood apart in a field near-by. Other magpies would arrive and either join those on the ground, below the horizon line, or alight in the oak tree, or else make an independent feint at entering the willows. Presently the whole aggregation would take wing toward the willows only to veer off at the last moment—save for two or three very bold birds which did alight on the taller willow tips; and presently these few would drop down out of sight. Subsequently, after another period of quiescence on the ground and in the oak trees, possibly to see what would happen to the first adventurers, further feints and milling about took place; only now more and more of the birds would disappear in the willows. Meanwhile other parties were arriving from afar. At about 'half dusk' no more birds came, and all had vanished into the willows. There had been some noise intermittently, but now all was perfectly quiet . . ."

Later in the evening an unsuccessful attempt was made to shoot some of the birds at the roost. However, after they were settled the birds would not be routed. "When a bird was disturbed it would abruptly fly up far enough to clear the willow tips and immediately drop down again into the tangle. Even when a gun was fired all the birds sat tight."

The flight formation of these congregating magpies was a loose one, the birds stringing out, and individuals lagging behind or leaving the group. The companies were slow-moving and scattered.

On a later evening several specimens were collected from this roost by making a small blind and shooting the birds as they stopped in an isolated tree in the line of flight to the roost.

Further observations on the roosting habits of yellow-billed magpies were reported to me by Loren Bryan (MS). Near Paicines, at 5 p.m. on December 27, 1936, he saw several magpies flying to the north side of a hill covered with scrub oaks and live oaks. He followed them and watched from beneath a live oak where they were gathering.

Single birds flew into the tree and called loudly when they discovered a person nearby, thus attracting more magpies which joined the group and made a considerable racket. When it began to get dark the magpies flew away from this tree and lit one hundred yards away in another live oak. This tree was about twenty-five feet tall and was at the edge of a field on the north slope of the hill. After the entire group of about fifty magpies had settled and it was dark, Bryan went to the tree. His approach disturbed the birds which flew out and fluttered into the neighboring live oaks. Some had been perched within five feet of the ground.

HUDSONIA.—In the winter of 1922, a cattle shed near Treesbank, Manitoba, was regularly used as a sleeping place by a group of six or seven magpies. The birds rested on the backs of the cattle over night (Criddle, 1923, p. 25).

It was stated by Kalmbach (1927, p. 5) that "during the winter magpies sometimes establish roosts much after the fashion of crows, and in one instance these two species were found using the same small island in the Snake River in eastern Oregon as a place of nightly resort."

In central Nevada, after the nesting season groups of magpies sometimes roost together in some favorable place. One of these was discovered just after dark on June 26, 1930. Toward the end of a slough was a thick border of tall willow clumps through which rose vines were tangled. Ten or twenty magpies had just settled in this thicket for roosting. When found they were still making persistent cries. As the birds were disturbed they could be heard flying ahead out of the bushes and finally in small groups crossing openings.

Roosting habits of black-billed magpies in western Oklahoma were reported by Sutton (1934, p. 31), as follows: "Once the birds had gone to roost they were loath to leave the trees, and upon being frightened flopped about clumsily, making their way to trees nearby, where they became quiet as soon as possible. If disturbed in the early evening at a favorite roosting place they frequently flew to the mesas, then trailed back, one by one, in a series of swift, headlong plunges, just at nightfall."

PICA.—Brown's account (1924, p. 127) of winter roosting of the magpie in Cumberland is as follows. "With the approach of night all the Magpies in a neighbourhood flock together and roost in some favourite locality, often a fir wood or tall hedgerow. I note that dusk has usually fallen before the birds, with much chattering, go to roost, and indeed, with the exception of the Carrion-Crow, the Magpie must be the last bird to go to roost. This roosting habit lasts into the month of April, when they commence building, and during that work some pairs roost in their nest-trees at night, but when the female has begun to lay the male evidently roosts elsewhere. If two or three pairs in the same neighbourhood are robbed of their first clutches the birds will flock again for a few days, until they begin their second nests."

It is noted in Montagu (1802) that "in winter these birds assemble in great numbers to roost in some coppice or thicket, but separate again in the day."

A group of magpies observed in England by Blake-Knox (1868, p. 1405) roosted together in a pine wood. The birds appeared to be stupid just before going to sleep and a person by hiding in the dark woods then could kill any number of them. This same trait of the birds congregating in flocks just before going to roost and thus exposing themselves to being shot easily was commented on by Bree (1862, p. 7846).

According to Chasen (1921, p. 195) "the Magpies in Macedonia were fond of roosting in old nests, and a stone flung into an old Stork's nest in the evening would often cause as many as eight birds to leave in single file. A partiality for selected roosting-places was a noticeable habit, and a regular flight to these places, often groups of trees of a good height, in the evening reminded one of the Rooks' evening flights. The Magpies would settle down to rest with many chuckles, but once settled they sat close. I witnessed a good demonstration of this habit on 16 June at Kopiwa. At sunset a large number of Magpies passed over the village from the direction of the hills. They went towards a clump of trees half-way across the plain, and I judged them to be birds that had spent the day wandering about at the foot of the hills and banded together in the late afternoon. Later I saw several flocks leave the ground and mount high into the air—they always fly high on these occasions—and take a straight line for the roosting-place, exactly like a mob of Rooks. Small flocks of about a dozen birds followed at intervals, from various points, for some time."

Magpies in Rumania were seen congregating in roosts as late as April 5 in 1928 (Congreve, 1929, p. 450). That day an "incredible" number was seen going to roost in some oak-scrub growing on a low hillside. The largest flock seen by Brown (1910, p. 223) in Cumberland, England, "going to roost on a winter's night consisted of thirty-one birds."

Kirkman (1910, p. 59) wrote that magpies roost in flocks "often in company with other species. According to a writer in the *Field,* several hundreds were on one occasion found by him roosting near Morlaix in Brittany. He and his gallant companions manifested their interest in the discovery by leaping out of their traps and firing at least fifty shots into the roost, killing sometimes two or three magpies at a shot, the slaughter being rendered easy by the fact that, for all the noise, the birds did not quit the wood. One ventures to hope that no Bretons witnessed this brutal exhibition."

In northeastern France in the fall and winter of 1916, Schuster (1923, p. 292) observed that about fifty magpies spent each night together in the dense willow thickets along streams.

Concerning roosting habits of magpies in Ireland, Thompson (1849, p. 331) gave the following observation. "These birds are often so gregarious as to roost in considerable numbers at particular groves, near their feeding-ground, to which they resort in straggling flocks: I have thus reckoned twenty-six on wing together, when the distance between the first and last, was like that of an ill-matched pack of hounds during the chace. November the 20th, 1838, was a dull, dark, true November day throughout, and so early as half-past two o'clock, p.m., I saw about twenty of these birds that had evidently retired to roost for the night. On being alarmed they flew from a fine old willow on the banks of the Lagan, and looked very beautiful as they rose together."

McGregor (1906, p. 299) wrote that enormous numbers of magpies roost in the tall poplars bordering the lower reaches of the Dragor River in Turkey.

SERICEA.—Swinhoe (1860, p. 60) commented that in the vicinity of Amoy, China, the magpies roost "in company in large trees, whence parties sally every morning to the country round for food; at nightfall they all return again, cackling, curveting, and performing antics in the air . . ." At Chinkiang, China, La Touche (1906, p. 433) saw almost uninterrupted streams of these birds in late afternoons, on the way from their feeding grounds to their roosting places on the opposite side of the town.

KAMTSCHATICA.—Buxton observed that in the fall the birds made daily excursions to the settlements and returned to their nesting grounds at night (Allen, 1905, p. 247).

BATHING

NUTTALLII.—An account of circumstances under which yellow-billed magpies bathed in the wild has been given already (p. 111). Every locality so far examined by me where this form occurs has a supply of water conveniently available where the birds can bathe at frequent intervals if they choose.

HUDSONIA.—The black-billed magpie is usually so wary as to give little opportunity to watch any of its activities closely. I have not yet observed this kind of magpie bathing in the wild, but observations on caged young birds revealed that they take to water readily and make constant use of it in caring for their plumage. When a pan of water was first placed in the cage each of the young birds (which had been taken from a nest and, hence, could never have had experience with water) went through almost exactly the behavior described below for the form *pica*. At first, just as described for the birds in Europe, there were some misguided attempts to bathe on the dry floor, but the habit soon became regulated and adjusted so as to eliminate these wasted movements. Within half an hour after water was placed in the cage for the first time each of the birds had discovered it and had made use of it for drinking and for bathing.

In succeeding months fresh water was kept in the cage constantly and bathing was a part of the regular daily routine of each of the three birds. In fact, the birds appeared to await their daily supply of water with as much concern as they watched for a new food supply.

PICA.—Pycraft (1918, p. 411) reared a young magpie from the nest and observed the bird's first attempts to bathe. The observer placed the bird "in the middle of a large, shallow dish of water, and waited to see what would happen. He was clearly puzzled at the sensation of the cold water round his feet, and presently stooped down and tested the water with his tongue, then immediately hopped out on to the kitchen floor, where the experiment was made. A moment later he rushed back, jumped into the middle of the dish, and flopping down, proceeded to send the water in a shower all over and around him, by means of his wings. Then he hopped out, and presently returned to repeat the process. When he was soaked through and through he came out, a draggled, dripping bundle of feathers. Then he began to preen himself until he was dry. He bathed, in short, after the fashion of his tribe, instinctively."

The responses of another young magpie when placed in a situation almost exactly like those given above are interesting because they varied from what one would expect (Morgan, 1896, p. 97). The bird, five weeks old, "when placed in a cage and supplied with a pan of water, made one or two pecks at the surface, and then, outside the pan without entering the water at all, proceeded to go through all the gestures of a bird bathing, ducking its head, fluttering its wings and tail, squatting down, and spreading itself out on the ground. It afterwards and by degrees acquired the habit of bathing really, and seemed always anxious for a bath in rainy weather."

VOICE

NUTTALLII.—Ridgway, one of the early observers of this species in its normal surroundings, wrote of it as ". . . incessantly chattering as it flew, or as it sat among

the branches of the trees (Baird, Brewer and Ridgway, 1874, p. 270). One writer (Wheelock, 1904, p. 388) characterizes the call-note of this form as "less harsh and loud" than that of the black-billed. The note is given as being somewhat like *quee-quee-quee* instead of *chack-chack* or *quat-quat* of the larger kind. A group of three or four, writes Kaeding (1897, p. 16) can make noise enough for a dozen. In the opinion of Grinnell (MS) the rather feeble chuckle or chatter of this bird is "just like that of the black-billed species."

Special attention was given to the voice of the yellow-billed magpie by Hunt during a period of field work in Monterey County in the fall of 1918. Hunt (MS) concluded that the birds, at that season, had but one type of utterance, which, however, was varied. His account of the three variations or phases which he considered distinct enough to be described separately is given here rather completely since nearly all the statements have been verified in field observations by the present writer. The three phases are as follows.

1. *Qua-qua, qua-qua-qua,* etc. given in series of from two to six *quas*. The utterance is usually quite rapid when the *quas* are more numerous. The note is loud and the expression is rather good natured or well disposed. The timbre is raucous. It has more than a slight resemblance to that of the California woodpecker's "cracker" notes. Birds of the two species were hard calling at the same time, and the timbre of the two calls was almost indistinguishable. An element in this utterance suggests the rich-harsh scolding *chaack* note of the Bullock oriole.

2. *Quack?* A single note, rather mild in expression, yet querulous. This note has the same general timbre as number one.

3. *Queck* or *kek*. Sometimes uttered alone and sometimes heightened from phase two. The utterance has an almost absurdly weak tone. It reminded the observer of the call of the black-necked stilt. It is more piping than the other types of notes and is a little nuthatch-like. When first heard it was written down as *pêip*. The sounds in this note are less distinct and it is least spellable and least utterable by a human being of the three types. The sounds involved are less distinct in this phase.

Foraging magpies that were watched in late February in the Colusa district were usually quiet; the "weakish, un-jay-like chortle was heard only occasionally" (Grinnell, 1923, p. 172).

A bird kept in captivity by Noack (1902, p. 79) and which learned to talk, could "speak almost as clearly when holding a stick or food or any kind of solid in the bill" as when it was empty, "the movement producing the sound coming from the throat."

The exercise of an important function of the voice in magpies was observed by me on the afternoon of November 11, 1930, near Colusa in the Sacramento Valley. A series of repeated and persistent alarm notes by one individual close to a fence along the railroad brought an immediate response. Magpies came from all directions to that spot until approximately seventy-five had arrived. They perched close to one another on the fence and on the telephone wire directly above and in the nearest trees of an adjacent orchard. Other individuals gave series of alarm notes. There was some changing of places and the general commotion showed clearly that all the birds were greatly excited. After two or three minutes the birds began to leave and within five minutes all of them were gone. However, for a time after this more call notes were heard

than had been given before the alarm. Unfortunately, the original cause for the alarm which resulted in the congregation was not determined. It seemed evident that it was the discovery of the bird which first gave the calls. Whatever the cause the manner of coming together on short notice was clearly demonstrated.

At the beginning of the nesting season, January 25, 1931, a note was heard from a magpie which was almost like the usual alarm note of the Clark nutcracker, but, of course, it was not so loud.

On the morning of October 6, 1929, a magpie perched in the top of a dead tree near Colusa, gave almost continuously a series of harsh and soft notes. Accompanying most of them could be seen the opening and closing of the mandibles. At intervals the bill was opened widely and a rapid series of clicks produced. Also other individuals were seen to do this.

One of two captive yellow-billed magpies reported upon by Vargas (1934, p. 38) imitated several parrots and the neighbors and sometimes it sang. Once it replied to the statement "You're a pretty good looking bird" with the query "What kind of a bird are you Mike?" The magpies imitated a goat so closely that for days the neighbors were sure that a goat was in the garden.

HUDSONIA.—A likely use for an ordinary type of call notes is suggested in the following comment by Bailey (1902, p. 270). "Like all great talkers the magpies are fond of company and where one is seen others are usually within calling distance. Their notes have a conversational tone and varied inflections and it seems small wonder that they learn to talk when kept in confinement." Henshaw (1875, p. 334) remarked upon the singular flexibility of the voice of the magpie and he pointed out that the bird is capable of producing a variety of sounds from a guttural chuckle to the softest whistle. The distinct chatter of the usual notes, impressed Ridgway (1877, p. 520) as being unlike the notes of any other bird of his acquaintance. The more musical note which he heard uttered frequently sounded like *kay e-ehk-kay* . That observer could detect no difference between the notes of this bird and those of the yellow-billed kind.

The general demeanor of the black-billed magpie was characterized by Grinnell and Storer (1924, p. 377) as being "decidedly quieter than that of most of the other members of the jay-magpie-crow family. Its voice is far softer than that of the jays, and it does not 'bawl out' intruders as do these birds. Many of its notes are low and pleasant chuckling sounds, recalling certain notes of the California Thrasher. On one occasion one of our party was attracted by a noise arising in a mountain mahogany bush and sounding like two of the branches rubbing together. It proved to come from a black-billed magpie. Even in the early fall, when bluejays and nutcrackers are at their noisiest, the magpie is noticeably quiet."

The ordinary call note of the black-billed magpie has been written (Bendire, 1895, p. 351) as a querulous *cack, cack,* or *chäeck, chäeck,* uttered in a high key, and disagreeable to the ear. That writer adds that: "it frequently utters also a low, garrulous gabble, intermixed with whistling notes, not at all unpleasing, as if talking to itself, and if annoyed at anything it does not hesitate to show its displeasure by scolding in the most unmistakable manner."

It has been pointed out by Goss (1891, p. 376) that the magpie's voice is capable

of producing a variety of sounds, from a harsh clatter to soft, whistling notes.

Knight (1902, p. 105) wrote that nearly all the magpies that he had seen in captivity talked more or less. He added that "they usually learn to repeat all of their words and phrases by the time they are a year old. I have not found any one who has paid special attention to teaching them to talk; but believe that one could by spending a reasonable amount of time teach them many times as much as they generally know."

Knight's summary of the vocabularies of three birds is as follows:

"No. 1. Owner, Mrs. J. Rhone; bird's name, Mike; words or phrases repeated: Sic-em; Hello; Good-by; Here, Major; Hello, Major; Hello, Mag; Get out of there; Come in; What do you say? Stick of wood; Eliza. This bird also laughs.

"No. II. Owner, Mrs. Dr. Coburn; bird's name, Topsy; words or phrases repeated: Topsy; Hello; Good-by; Quit; Topsy-opsie; Pshaw; Pshawie; Oh! Topsy; Pretty Topsy; Ah there. This bird chatters, but words are not distinguishable. It whistles, laughs and coughs. When quite young there was a lady neighbor of Mrs. Coburn's who had a very bad consumptive's cough. The magpie soon learned to imitate the cough and has practiced it ever since. Age of bird 12 years.

"No. III. Owner of bird, Mrs. Hertzog; name, Jack; age of bird 15 years; words or phrases repeated: Hello, Good morning; Good-by; Pretty polly; What's the matter with the bird—he's a dreadful nice bird—rats: What's the matter with the bird—precious bird; Maggie; Good-by, love; Get there; Come in; Oh, Clara; Nettie; What. This bird laughs, sneezes and coughs. Mrs. Hertzog has two birds. They call each other by name and answer—what."

Another talking bird was mentioned by Knowlton (1909, p. 778) from southwestern Colorado. It "would start usually in the following order, each word being uttered with astonishing distinctness and with perfect human inflection: 'Pretty Maggie, pretty Maggie; Maggie's all right.' Then would come the information, 'Martin's a crank, Martin's a crank,' followed by the emphatic statement, 'Martin's drunk.' After this would often come the heartiest, jolliest laugh one could imagine, and said to be in exact imitation of that of the mistress of the house."

From Dayton, Montana, Mrs. Olive C. Meeker wrote (to Biol. Surv.) in 1927 about a magpie that had been kept captive for many years and which had developed an extensive vocabulary which she assembled as follows: "Hello: Come Roy: Baby wants to take a bath: Baby wants a fly: Baby wants to take a fly: Baby wants a baby: Baby wants to fly and take a baby: Baby wants dink (drink) of waddie (water): Baby wants to go to bed: Baby wants a hopper (meaning grasshopper): Quit it: Oh My!: Ah Deeah (for Ah dear): Goodness goodness gracious: Come on: Come Roy: Haw-tee (Hattie, my mother's name): Goodness quit: Cut it out: Huh? Its fierce: Cut it out, its fierce: Good: Yes; No; What; Hello; Goodbye: Come in: Pretty baby: Baby want: Baby wants Hawtee." Mrs. Meeker added that the bird's tongue was never operated on as so many people seem to think necessary.

OTHER KINDS OF MAGPIES.—Elms (1906, p. 53) characterizes the harsh chattering of the magpie as reminding one of the noise produced by a policeman's rattle, only less powerful. More completely, Hudson (1921, p. 163) says: "The usual sound emitted by the magpie is an excited chatter—a note with a hard, percussive sound,

rapidly repeated half a dozen times. It may be compared to the sound of a wooden rattle, or to the bleating of a goat; but there is always a certain resemblance to the human voice in it, especially when the birds are unalarmed, and converse with one another in subdued tones. But it is more like the guttural voice of the negro than the white man's voice. Their subdued chatter has sometimes produced in me the idea that I was listening to the low talking and laughing of a couple of negroes lying on their backs somewhere near. It is well known that this bird can be taught to articulate a few words."

The call has been described by Morris (1925, p. 20) as rasping and as being uttered quickly and without a break, "similar to the bleating of a goat." He wrote it as *Ar-kar-kar-kar-kar.* The comment is added that in confinement one of the birds will soon acquire a considerable vocabulary.

Yarrell (1873, p. 316) noticed that a magpie, "even when hiding from danger can scarcely leave off its characteristic chatter. Always vigilant, at times it becomes extremely vociferous, especially at the sight of a dog, a fox or a cat . . ."

Witchell (1899, p. 63) wrote of the voice of the magpie as follows: "The common cry which one hears from the wild bird is a hoarse rapid 'shushushushu'. This is given sometimes as a call-note, and sometimes as an alarm. I have also heard the wild birds chattering together with a great variety of tone and emphasis, though in a manner suggestive of amicability."

Seebohm (1883, p. 567) noticed that the harsh chatter of the magpie is "most often heard at nightfall, when the birds are about to seek a roosting-place; but in the breeding season it is said to utter a softer and more pleasant note." Voigt (1909, p. 158) reported having heard magpies give notes like those of *Garrulus,* which he represented as *Garr.* Also he noted that the birds under certain conditions of excitement gave rapid sounds like *kkkkk.*

The full characterization of the voice of the magpie as given by Coursimault (1917, p. 103) is somewhat as follows. Their cries more frequently are some *cacacacacac,* some *kèkèkèkèk,* some *rrracacacacacacacac* jerkily, at the beginning sharp and energetic, or the syllables shorter: *tsac tsoc karak kararak, krakra,* the cries harsh and not tuneful: *kraèch, kréêi, kruèèc,* which sounds are more sharp and less disagreeable; *couirrr, rouiiic, trirrr,* which they utter at the same time giving the head a strong forward thrust.

Magpies in captivity in Ireland were mentioned by Thompson (1849, p. 333) one of which without any teaching learned all the phrases of a parrot in a neighboring cage. Another learned several words and short sentences by having them repeated to it.

Stejneger (1885, p. 242) was able to detect no difference between the notes of the magpie in Kamchatka and the race in Europe.

Brooks (1931, p. 272) writes that during four years in France he "was surprised to note the great difference in voice between the Old and New World Magpies, the latter to his regret have no call that he can imitate sufficiently well to decoy the birds to him, the former on the other hand had two easily imitated calls and decoyed readily."

Ludlow (1928, p. 52) reports a sound made by magpies in Tibet (*bottanensis*) "exactly like the call of a Snipe." He adds that he has "often been deceived by it when in pursuit of the latter."

The following representations of the sounds made by magpies in France have been given by Bassetière (1913, p. 131):

câcâcâcâcâcâ	rra! rra!
rrarcacacacacaca	cac ' cac ' rrouire
raï raï raï	pïo, pïo
rrilleu rrilleu rrilleu	tock, tock
ackrille ackrille ackrille	kekekekekekeke
crè, crè	ti ' re, ti ' re
crreuil, crreuil	trrire, trrire
crreuïllrî, crreuïllî	krrrâ ' cackrrâ
arrrrat ' atatatatatata	

Loche (1867, p. 119) wrote that individuals of the magpie in Algeria could easily be taught to pronounce some words and to imitate the cry of some animals.

FLOCKING

NUTTALLII.—Mr. W. E. Unglish (MS) has observed that winter flocks of the yellow-billed magpie in Santa Clara County sometimes contain as many as two hundred individuals.

In one instance I observed in the Sacramento Valley on November 12, 1930, there was some evidence of hostility between individual magpies that came close to one another. In at least one case a bird seemed to try to drive others away, whether or not they were foraging.

On December 13, 1930, in Amador County, I saw a flock of about twenty-five magpies moving over the ground at the margin of blue oak timber. There were several houses in the vicinity and in a nearby creek valley were many nests in valley oaks. The flock moved rapidly and within a few minutes it was completely out of sight.

In a small alfalfa field near Colusa, in the Sacramento Valley, I watched a flock of about fifteen foraging magpies in the morning of October 6, 1929. At one time all, or nearly all, the birds on the ground flew up and toward the nearest valley oak. Some birds went to one tree and some to another. At the same time a jay gave alarm notes, but the first cause for alarm was not seen. It was not even certain that there had been an external cause for this concerted action.

On February 16, 1930, I disturbed a flock of magpies foraging on the ground in a grove of valley oaks by the stopping of an automobile in a road close by. The birds left the grove but they returned within fifteen minutes. Upon their return the birds perched in the trees, not on the ground whence they had flown. When an automobile door was slammed a magpie two hundred and fifty yards away quickly jumped from the ground and flew to a lower limb fifteen feet up in a tree.

Mrs. Bailey writes (1902, p. 271) that she counted in June, 1900, nineteen yellow-billed magpies flying about in one meadow near the mouth of a low cañon. This was in grain and oak fields of the Sierran foothills. That writer noted further that the birds were tame and familiar if their suspicions were not aroused, but that they would fly over the treetops and away as soon as a man appeared with a gun.

HUDSONIA.—Bendire's (1895) comments on flocking in this bird were that: "Although more or less quarrelsome, it is social in disposition and likes to be in the company of its kind. I have frequently seen from twelve to thirty feeding together near a slaughterhouse or some other locality where food was abundant; but such gatherings are oftener met with in late fall and winter than during the season of reproduction."

Kelso (1926, p. 709) records magpies in the Arrow Lakes region of British Columbia as occurring in winter singly or in small flocks of up to eight or ten birds. When they were unusually numerous the flocks counted ten, twenty or even thirty or forty individuals. Winter flocks of magpies in Walla Walla County, Washington, contain any number of individuals up to fifty according to Dice (1917, p. 121). In western Nebraska, Zimmer (1911, p. 23) observed magpies to occur abundantly but usually singly or in pairs, though never in flocks.

According to Dille's (1888, p. 23) observations in Colorado, after the young are out of the nest and for the balance of the year, the birds roam over the country in large flocks. In the same state Rockwell and Wetmore (1914, p. 319) saw usually not more than six together, although in one November evening a straggling flock of at least fifty individuals was seen flying across a valley. In the course of a detailed study of the birds of a small area near Choteau, Montana, Saunders (1914, p. 206) learned that all the magpies left the area after the nesting was over.

It was the opinion of Goss (1891, p. 376) that the small flocks so often met with resulted from the social natures of the birds holding the family groups together. In northwestern Nevada, Taylor (1912, p. 377) observed in the latter part of June and the first of July that the adults and young were traveling about in company. Families of young birds seen out of the nest in Washington, were so tame that it was easy to approach within a few feet of them (Edson, 1926, p. 5).

OTHER KINDS OF MAGPIES.—The experiences of Brown (1924, p. 126) in Cumberland showed that the young left the nest when their tails were about five inches long. They then skulked about the undergrowth, were fed by the adults, and did little flying until the tails were full grown. The family groups kept together for some time and then the young appeared to be driven away. He saw fighting among the family parties during July and August. This last mentioned trait was observed by Chasen (1921, p. 195) to take place in late May, when the young were beginning to fly, in Macedonia.

Another phase of post-nesting activities of young magpies was commented on by Moll (1924, p. 99) who cited Groos for the statement that young magpies "address one another in September, and often in August and in October, in consecutive clucking notes, and in this way make exactly the same noise that they are always heard making in early spring just before the pairing season."

Brown (1924, p. 126) writes that during the winter months in Cumberland, the magpie is "partly gregarious and in places where they are not molested parties of fifteen to twenty can be seen during the daytime. In these same localities, however, odd pairs are to be seen, so possibly the small flocks may consist of unmated birds."

A flock of thirty-four magpies seen November 16, 1875, was considered by Prior (1876, p. 4879) to be exceptionally large; usually he observed not more than six or eight birds together. The birds in the large flock were feeding in stubble. Flocks numbering as high as thirty birds were reported as occurring frequently during December and January on the northwest coast of England (Durnford, 1876, p. 4907).

In Brittany where magpies were numerous, Hadfield (1874, p. 3945) observed towards sunset numbers "passing overhead, sometimes singly, but more frequently in strings or irregular flocks, all flying in the same direction to their roosting quarters."

Glegg (1929, p. 11) writes that although winter flocking is not common there is

some evidence of it between September 17 and March 29. Numbers of individuals in recorded flocks in Essex range from twenty to fifty.

One group of birds in England, was observed flocking together from December on through the winter. The eighteen to twenty birds were always seen together, "though perhaps scattered over an extent of some fields, rarely more than one field, but more often in immediate company. They fly in a straggling flock when disturbed, usually getting up one after another . . ." (Blake-Knox, 1868, p. 1405.) The birds were still together as late as April 4, and although at least six had been shot, the reduction in number could not be detected.

Chasen (1921, p. 195) in Macedonia observed flocks of magpies numbering twelve to twenty birds foraging in the fall. However a good many of the birds kept in pairs through the winter.

One point that has been noted in England is that although the birds tend to come together and remain in groups through the winter this takes place only in those parts of the country where the birds are plentiful and not persecuted (Pitt, 1922, p. 251). That observer had seen flocks on only two or three occasions and the largest number seen together was about sixty. Kirkman (1910, p. 59) was of the opinion that flocking in winter was a regular habit and that single pairs were to be accounted for by local scarcity of birds due to persecution.

In northeastern France, during the years of the war, Schuster (1923, p. 292) noted that magpies joined into large companies in the fall and winter. On several occasions in September and October of 1916, 1917, and 1918, he saw flocks number from twenty to fifty birds each.

Jones (1911, p. 672) found that in northeastern China, flocks numbering up to thirty magpies occurred in September. He suggested that some of the birds in these parties may have wandered in from other districts.

In southern China just as in Europe, Mell (1924, p. 287) found that magpies kept in family groups after the young left the nest. In September these family groups joined to form larger flocks, observed examples numbering 38, 47, and 60 individuals.

In Tibet, magpies (*bottanensis*) were seen in flocks, numbering up to thirty birds, especially in winter as they moved from feeding ground to roosting places in the evening (Ludlow, 1928, p. 52).

DAILY ACTIVITY

NUTTALLII.—Behavior of yellow-billed magpies at the start of a winter's day was watched by me on February 16, 1930, near West Butte, Sutter County, California. At 6:45 a.m. a group of six magpies came flying over the tops of the valley oaks, from the northwest. A few rods behind them was a flock of about twenty crows. The six magpies, which gave calls as they flew, went to the top of a tall valley oak where there were other individuals that had not been noticed before. Other magpies flew into this tree until there were twenty-eight perched near the top of one limb, all chattering and preening. At 6:55 another group of six birds arrived from the northwest and five of them lit in a tree in the grove; one bird flew on to the south. Within a short time, less than five minutes, the large group began to scatter, the birds going to other tree tops. At 7:07 the sun first appeared over the horizon and the thick layer of fog which had been close to the ground cleared away. At its thickest the lower limit of this fog was on a

level with the lowest limbs of the oak trees. At 7:10 the first magpie was seen on the ground in the grove, although others had been seen on the ground out in adjacent cultivated fields for several minutes.

On November 11, 1930, I watched a group of magpies for several hours during the middle of the day. By 1:30 p.m. the periods of inactivity were more frequent and of longer duration than when this group was watched at first. During these periods the birds withdrew to the screen offered by the heavy foliage which was still on the valley oaks. There they perched quietly. Some preening was noticed and, a few times, birds were seen to move from one perch to another. By 3:15 magpies at another locality fifteen miles distant were beginning to forage actively after the mid-day period of quiet.

On November 12, 1930, several magpies were present in this same grove when observations were begun there at 6:45 a.m. Soon after that a group of about eight and one or two single birds arrived from the northwest, probably the direction of the roost. For the next hour there was much foraging activity. The birds were on the ground beneath the trees, in the grass of adjoining fields, and among the branches of the trees. They were much more noisy than they had been at any time during the middle of the previous day. They were scattered in one's, two's, three's or in groups of fewer than ten.

On October 4, 1929, a group of about fifty magpies was watched in a freshly irrigated bare field in the Sacramento Valley. Early in the afternoon these birds were scattered on the ground in the shade beneath a row of walnut trees bordering a road. Later in the afternoon (4:30) when the air was considerably cooler these same birds were much more active than they had been earlier.

Representative magpie behavior during mid-day hours was watched by me October 6, 1929, at a place ten miles north of Colusa. At 11:30 a.m. several magpies were in flight between an orchard and a lone valley oak on the opposite side of a road. From 12 to 12:30 several magpie calls were heard coming from this tree. Two magpies could be seen (from below) near the top of the tree. They were preening and moving about from perch to perch but they made a distinct impression on the observer of being not active. Finally, one bird flew off about half a mile to another tree. The other one gave calls for a few minutes and then flew to a farm house one-half mile away, where there were other magpies. During this time the sun was shining and the air was warm. In the hour from 1:30 to 2:30 p.m. several localities near Colusa where magpies had been seen earlier in the day were visited but not one individual of this species was seen.

MISCELLANEOUS RESPONSES

NUTTALLII.—Noack (1902, p. 79) wrote of a captive magpie that "all play-things not too large are buried in sand or grass or covered over with sticks and leaves or poked into nooks and crevices in the cage." Behavior of yellow-billed magpies in captivity has been reported by Vargas (1934, p. 37). One bird would hide anything it could lift such as needles, nails, pins, buttons, money, trinkets, and food of all kinds. When a cat or dog would come into the house the bird would fly down and give it a vicious peck and dash away to safety. This would be repeated until the animal left or the bird was put out of the house.

An example of a type of curiosity sometimes displayed by this bird was noted in Monterey County in the fall of 1918. When a collector (Grinnell, MS) shot a woodpecker, a magpie was attracted and came up to see, whereupon it was itself easily shot.

Mr. Loren Bryan, of Paicines, San Luis Obispo County, has given me an account of young magpies taken from the nest and raised by hand. The birds were left free to fly about and to obtain their own food if they wished. If raised singly a magpie seemed to enjoy the company of a person, especially a child. The birds learned to distinguish between different members of a family and to react differently to each. A magpie soon picked up words it heard and repeated them when talking to itself, which it often did when left alone. Each magpie seemed to become very angry when teased by certain people. When so angered it would repeat words it had heard, such as names of persons or dogs. Bryan once saw a magpie allow itself to be chased up a tree by a cat. After the cat was in the tree the bird got behind it and pulled hairs from its tail. The magpie kept just out of reach of the cat, almost driving it frantic.

HUDSONIA.—Mrs. Bailey (1902, p. 270) recites several instances which reflect the type of response which magpies make to new objects in their surroundings. She tells how the birds will come down to investigate cotton markers that may have been used to indicate locations of mouse traps set among sage bushes. If the traps have caught mice these are carried off and eaten and the traps left. At another time a flock of six or eight came to where a naturalist was sleeping on a hay cock. Several birds lit on his head and one even permitted the awakened collector to catch it in his hand.

Bendire (1895, p. 351) pointed out that "any bright, glittering object is sure to draw their attention, and is promptly picked up and secreted, it matters not how large it may be, if it is not too heavy to carry or drag away." Expression of curiosity on the part of magpies was noted in Colorado by Rockwell and Wetmore (1914, p. 319). Usually when the collectors sat down to eat lunch one or two of the birds were in sight watching them. The birds would make a complete circle around the place and, as soon as the men left, they would come down to investigate. Hawks and owls were followed with eagerness by the magpies.

Taylor (1912, p. 377) gives it as his opinion that sagacity is "the most notable trait of the magpie." He found, in Nevada, that it was practically impossible to approach one of the birds closely if he carried a shot gun. One instance he cites shows a typical magpie response to surprise. He was setting a mouse trap close by a willow thicket and heard a vigorous chattering. In the thicket a few feet away was a magpie "the personification of surprise. The bird did not linger, but speedily made off, chattering until out of hearing."

An American writer (Webber, 1858, p. 188) noted that the magpie hides things that are of no value, as well as objects of food. Ward (1775, p. 66) wrote of the magpie that "when satisfied for the present, it treasures up the remainder of the feast for another occasion" (spelling changed).

On the basis of observations made near Lake Tahoe, Mrs. Wheelock (1904, p. 384) wrote that the curiosity of the magpie knew no bounds "and any unusual appearance of the neighborhood he must investigate and talk over. An experiment of hanging bits of black, white, red, and yellow cloth on the bushes near the abode of the magpies resulted in a curious selection of the yellow and white first and an apparent terror of the red. Repeated experiments seemed to prove that this color was repulsive to the birds, and for a long time I could not guess why, knowing that raw red meat was a favorite dainty. Finally, noticing how excited both birds became at the approach of

some little Indian girls who lived in the fishing village and who were dressed in red calico gowns, I was forced to conclude that in some way the wise old birds associated that color with persecution by the children. It seems that the latter had played the old cross-string trick with red flannel, which had been promptly seized again and again by the birds, greatly to the delight of the tricksters, to whom the temptation to snare by this means became too great to be resisted. The feathered playmates learned to shun both the color and the children."

Knight (1902, p. 105) knew of two captive magpies that were great imitators. Upon seeing their owner pick flowers they would do the same. They were also anxious to ride upon a wheelbarrow when in motion or upon a swinging gate. The birds would not eat angle worms but would catch and hang them over their perches.

In South Dakota, Tullsen (1911, p. 90) mentioned an instance in which a cat was harassed by two magpies which picked at the tip of its tail. He added that: "it is said that jack rabbits are sometimes harassed by these avian mischief-makers in like manner."

OTHER KINDS OF MAGPIES.—The magpie has been recorded as commonly teasing a dog (Ingram, 1909, p. 447). The birds would settle and hop about in front, behind, and all around the dog, "croaking loudly and fluttering away just as the dog thought he had got one, and driving him perfectly wild."

An occurrence similar to the one recounted above (both in Asia) is given in detail by Radcliffe (1909, p. 526). A tame magpie was friendly with two dogs. One day the bird walked around the two while asleep then pecked one hard and then hid behind a pillar of a veranda. After the dogs resumed their sleep the performance was repeated. This time the magpie moved around the house and flew down to the dogs, they still unsuspecting the source of the disturbance.

Seigne (1930, p. 113) records his personal experiences in England, with the often mentioned magpie habit of teasing other animals. He notes that ". . . by the use of a little stratagem they seldom fail to steal the choicest morsels from the pea fowl's dinner. One of the pair will hop jauntily with merry chuckles to and fro underneath the peacock's tail, and when at last that outraged bird turns slowly round to deliver a dignified rebuke, the other magpie will go off with as much as it can grab from the dish. Then both birds will share the spoils from a safe distance and return to repeat the performance.

"The cat always comes in for a good deal of unwelcome attention, for besides ruining some of her most exciting stalks, I have actually seen one of the magpies hop up very quietly behind her, while she was enjoying a peaceful siesta, in a sunny corner of the garden, and give her tail a vicious tweak with its bill."

Bowles (1929, p. 69) reports some experiences of Charles de Blois Green in France during the war. "At one time the opposing forces were shelling each other across a deep ravine. Some tall trees in the ravine contained a number of occupied nests of magpies. These birds, like most other species near the front, had become fairly well accustomed to a moderate number of shells exploding around them, and usually paid little attention. However, when the fire became exceptionally heavy, the birds would retire into the safety (?) of their closed-in nests and wait patiently until matters quieted down a little."

Another type of response to heavy firing on the battle front was seen on October

30, 1917, when a magpie flew up to a crater, made by a shell a few seconds earlier, and began to feed on grubs among the freshly scattered earth (Kennedy, 1917, p. 529).

Kirkman (1910, p. 58) cited an instance of a captive magpie expressing its anger. "It would utter loud barks, 'and would jump on the grass, gather a mouthful of daisies and stones, and commence burying them amid continuous notes of displeasure'." In another place (p. 60) he commented that "The magpie undoubtedly hoards. In the winter hoard of one thrifty bird the following objects were found—nuts, almonds, apples, scraps of bread, bones, fragments of china, bits of coloured cloth, and a thimble."

Magpies in England, that were semi-domesticated, were in the habit of "flying in at the windows of the cottagers, and of carrying off anything that was portable within their reach." (Mortimer, 1864, p. 8885.) One of the birds was killed. The other "pined away, surviving his companion but a very short time."

Another tame magpie was in the habit of using as a larder, for food not immediately required, some long grass. A dog made a practice of taking this stored food. Once when the dog was searching, the magpie made a great commotion and hurried to a particular grass clump and drew out a piece of meat which the dog had overlooked. The meat was securely fixed far above the reach of the dog and then the magpie, "at a little distance, began preening his feathers, chattering to himself with a very self-satisfied air . . ." (Matthews, 1849, p. 243).

Knight (1921, p. 133) has commented upon a pair of magpies which he watched during the war, "not far from the ruins of Ypres, building their nest at the top of a battered tree within 200 yards of our front-line trenches."

Jaubert (1859, p. 102) mentioned the magpie habit, well known in France, of hiding polished or brilliant objects which the birds might find. Lilford (1895, p. 232) comments of the magpie that "his thieving- and hiding-instincts have long been historically famous or infamous." At another place (p. 231) he points out that the magpie is wary and cautious but is exceedingly inquisitive and "may be called into gunshot-range from a distance by a very feeble imitation of the squeal of a wounded rabbit, or the chatter of a combatant stoat, weasel, or rat, and it will also follow a sandy-coloured dog, a fox, or a cat to a great distance."

Prater (1848, p. 2146) reported that "a magpie in the possession of Mr. C. Beesley, of Summertown, near Oxford, having, from the time it was taken, been allowed to go freely about the premises, was lately—on account of its mischievous propensities in the garden—placed in a spacious cage. Although very talkative before, it became totally silent, and, on a greenfinch being introduced into the cage, instantly seized it and tore it limb from limb."

A phase of magpie behavior observed by Selous (1927) occurs often enough among other species to have general significance. His account follows. "Every now and then, at intervals of ten minutes or thereabouts, a considerable proportion of the gathering would fly from the ground, as by a common impulse, into the adjacent trees, either the quite low fruit trees on the stretch of land itself where they were assembled, or some small ones on the other side of an earth-bank that bounded this. The fact that they flew only into the trees just at hand or quite near, and then back to where they were, instead of flying right away, shows that there could have been no great (ten-minutely!) cause for alarm; nor can I imagine any extraneous cause whatever that could send up

a number of magpies, or any other birds, at one and the same instant of time as they seemed to me to rise, whilst an approximately equal number of other ones, intermixed with them, stayed where they were. But if the cause was obscure, the effect, at any rate, of such a flock of boldly pied large birds flying up thus, all together, was very striking indeed."

In the middle of the nineteenth century it was traditional in England that whenever there was sickness in a house, magpies were sure to come about. This response was thought by Briggs (1849, p. 2563) to be because the birds were attracted by the peculiar odor which was then inseparable from a sick room. This indicates an acute sense of smell on the part of the bird. One winter several birds were noticed about a house where there was sickness and where ordinarily none was present. A pair of magpies built a nest on the house top.

Coward (1920, p. 30) in writing of the magpie in England mentioned an individual in a park which hopped along railings toward him and tried to wrest from his fingers a shilling which he proffered. Buxton (*in* Allen, 1905, p. 247) reported that at Kooshna, Siberia, magpies (race *kamtschatica*) became so persistent in their attempts to carry off his minimum thermometer, hanging on the side of his cabin, that he had to encase it until he had killed off all the birds.

An instance in France was reported by Harting (1883, p. 273) in which a game keeper attracted a magpie to be shot by imitating the squeal of a rabbit.

POPULATIONS

NUTTALLII.—In one small valley in Monterey County where first impressions in November, 1918, indicated that this species was abundant throughout the whole valley, more detailed observation showed that not more than fifteen or twenty individuals were present (Hunt, MS). The conspicuous birds, flying back and forth between trees and calling constantly, always made it seem that more were present than was actually the case. Fifteen birds were observed together at one time, thirteen of them being in flight together.

On the basis of counts made at a roosting place in Colusa County at a time just at the beginning of the breeding season in 1923, it was estimated that the nesting population of the territory was close to ten pairs to the square mile (Grinnell, 1923, p. 173). Four hundred birds was the minimum number thought to be using the roost and it was thought that they came from a wedge-shaped territory to the northward not more than six miles in radius from the roost.

Mr. W. E. Unglish who lives at Gilroy in southern Santa Clara County has informed me (1931) that twenty or thirty years ago magpies were not common in that vicinity, but they have increased steadily until they are one of the common species. He noted further that "there seems to be a decrease during the last two or three years along the highways due probably to promiscuous shooting. However, the birds are holding their own and they do not seem to be greatly persecuted." Another observer in Santa Clara County, Dr. G. B. Pickwell, wrote to me in 1930 as follows. "When working on the White-tailed Kites in the Silver Creek hills to the southeast of San Jose in the summer of 1928, I noticed magpies there frequently. None has been observed in that vicinity during the past year, though many trips have been made there. I fear that they have been exterminated there."

HUDSONIA.—In the early nineties magpies were known to be abundant in Custer County, Montana (Cameron, 1907, p. 393). The birds proved to be a source of annoyance to trappers until they were exterminated in that vicinity by poison and traps used to kill wolves. A single pair came from an adjoining county to one ranch and nested in 1902. From this start the birds began increasing again. In February, 1907, a group of eighteen was counted in a pasture in this same ranch.

Bendire (1895, p. 351) considered that the range of the magpie had been restricted on its southern and eastern borders, since the birds were not found by him at localities where they had been reported, thirty years previously, as fairly common.

In Okanagan Valley, British Columbia, Munro (1919, p. 72) reported that magpies were increasing rapidly in numbers. Three pairs of magpies came in the summer of 1919, to the Brookhart ranch in the panhandle of Oklahoma and nested there (Tate, 1927, p. 244). The group remained on the ranch and increased so that by 1927, fifteen to twenty individuals were present the year around. This ranch was at least thirty miles east from the nearest nesting colony, in Colorado.

In a summary of changes during twenty-five years in the bird life in southwestern Saskatchewan, Potter (1930, p. 148) wrote that during the years 1901–1904 the magpie was fairly common in that territory. It then vanished and was entirely absent for the next six years. In the fall of 1910 a few magpies reappeared and, since that time, they increased so much as to become a pest. The bird in that period also extended its range

to the north and west into central Alberta where previously it was unknown.

On an eighteen-acre tract near Choteau, Montana, Saunders (1914, p. 206) found four pairs of magpies nesting.

At Fort Lapwai, Idaho, Bendire (1895, p. 351) found that "more than thirty pairs bred within a radius of a mile of the Post."

At one ranch near Belvedere, Alberta, a single pair of magpies had a nest in a small poplar patch in 1926. Several birds came about the house each winter and the nesting pair had brought off a brood each year for three years, but the summer population did not increase (Taverner, 1928, p. 96).

In the days of the Geographical Surveys west of the 100th meridian, Henshaw (1879, p. 306) observed magpies in especially great numbers along the Carson River in western Nevada. In fact, he wrote that he had never seen the bird so abundant as it was there. This agrees with the observations of Ridgway (1877, p. 520) in that region and at about the same time. The latter writer contrasted the situation here with that on the opposite side of the Great Basin where the absence of this species from many seemingly favorable localities was noted as strikingly peculiar. One nesting colony of magpies in northwestern Nevada, was made up of five nests (Taylor, 1912, p. 377). Kalmbach (1927, p. 4) has recorded that in 1912 he "collected 26 broods of young magpies in a distance of about a mile along a creek bottom near Kaysville, Utah, and once found two occupied nests in the same cottonwood."

Agersborg (1885, p. 282) wrote that the magpie was formerly very common in southeastern Dakota in winter but had "within the last four years [before 1885] disappeared entirely." He continued that "those seen as late in summer as July by Professor Aughey must have been exceptional, as they never remained here longer than till the last week of March."

OTHER KINDS OF MAGPIES.—In the county of Surrey, England, the magpie was becoming less common in 1900, although it had never been plentiful in that county (Bucknill, 1900, p. 76). That writer had heard of no more than twenty-one individuals being seen together at one time and he added that a person might go for a whole day through the woods in Surrey and not see or hear a single magpie.

According to Norman (1864, p. 8866), the magpie is the bird most frequently noticed throughout Norway. Zedlitz (1911, p. 325) wrote that never in his life had he seen so many magpies in so small an area as he found on the shores of Lyngen Fjord.

In a line three kilometers long Reichling (1919, p. 83) in April counted twenty-six freshly built nests. Each farm was inhabited, many by two breeding pairs.

One gamekeeper in Ireland told Thompson (1849, p. 329) in 1836, that "having ranged the country for miles around the park, he, by robbing their nests, shooting and trapping them, destroyed in one half year 732 birds and eggs." These magpies were presented for bounty which was paid.

Commenting on numbers of magpies Gibson (1862, p. 7881) wrote that "previous to the year 1859 large flocks of magpies were frequently observed in the neighbourhood of Stocksmoor, near Huddersfield, when the weather was severe; sometimes they numbered thirty, or even forty, in a flock. But since that time the gamekeepers have nearly exterminated the species in that neighbourhood, and where formerly you could see scores you cannot see one now."

The magpie has been recorded as the commonest bird in Manchuria (Ingram, 1909, p. 447). Also in the neighborhood of Chinkiang, China, the magpie is one of the most abundant resident birds (La Touche, 1906, p. 433).

Saunders (1884, p. 378) saw magpies in northern Spain, nesting so close together that the impression was left of a straggling rookery.

Glegg (1929, p. 11) gives the magpie as probably "less scarce than it was forty years ago" in Essex County, England.

The practice of game keeping reduced the magpies in Norfolk so that for many years the sight of one was an exceptional event (Riviere, 1925, p. 285). Then during the war when the attention of the game-keepers was drawn elsewhere the birds increased. One game-keeper reported that in 1924 he killed 28 magpies and destroyed seven or eight nests on 2,000 acres where before 1914, he had never seen a single bird. By 1928, only one nesting pair was known to that writer (1929, p. 248) in eastern Norfolk County and only a few birds in the western division of that county. This rapid increase in number of magpies in England which followed the slight let-up in pressure against them during the war has been noted by many other recent writers.

In one area of 5760 hectares in France where most of the land was wooded a bounty was paid for three years for the destruction of magpies and their eggs. The practice was finally stopped because of the continued influx of the birds from neighboring territory to take the places of the ones killed (Madon, 1928, p. 89).

In an account of the birds of the Camargue region of France, Glegg (1931, p. 215) characterized this as "one of the most abundant birds of the delta throughout the year, in spite of the fact that the keepers wage ruthless war on it, being rewarded for its destruction." One group of persons in an automobile found fifty-seven nests, most of them containing eggs, in half an hour. One observer noted flocks of from fifty to sixty in the cornfields in November, 1927.

In the north of Ireland, Lilford (1895, p. 230) reports that he "on one occasion counted two hundred and seventy-three of this species in a three hours' journey on an outside car."

The history of an increase of one small nesting colony in Germany was traced by Schalow (1919, p. 339). The years of observation and the number of brooding pairs in each were as follows: 1865, 1; 1868, 3; 1869, 4; 1871, 5; 1872, 7.

Gengler (1925, p. 122) cites several examples of increase and decrease of magpies in certain localities in middle France. Killing by hunters, robbing of nests, and capture of young birds are given by him as factors in the decrease of the species.

HISTORY OF COLONIZATION OF NEW TERRITORIES

Taverner (1922, p. 161) is authority for the statement that "in 1879 a number of Magpies imported from England were liberated at Lévis opposite Quebec." The species has been recorded from that part of Canada in recent years but no specimens actually were collected so it is impossible to say definitely whether these birds were descendants of introduced ones or were migrants from the west. Two individuals were observed, October 17, 1915, at Hatley, Stanstead County, Quebec (Mousley, 1916, p. 73).

A rather full account of the introduction of the magpie into Ireland is summarized by the statement that the bird "first appeared in Ireland, in the County Wexford, about the year 1676. We have also to observe that the earliest writers who refer to this bird

had heard nothing of its supposed introduction into Ireland by the English, but consider it to have arrived unaided" (Barrett-Hamilton, 1891, p. 249).

Swinhoe (1870, p. 351) quotes the 'Gazetteer' of Hainan as authority that the magpie was introduced onto the island of Hainan, A.D. 1450–1456, from the Chinese mainland. In the King-tai reign of the Ming dynasty, Admiral Le-yih brought from Haipih, at the head of the Gulf of Tonquin, ten or so males and females and let them loose. These bred freely and the bird became extremely numerous.

LONGEVITY

HUDSONIA.—Knight (1902, p. 104) reported upon one bird which lived to be at least twelve years of age and another that was twelve years old. A magpie received at the Philadelphia Zoological Garden on September 18, 1917, died on September 24, 1924, seven years later (Brown, 1928, p. 345).

In a letter written (to Biol. Surv.) on March 4, 1927, Mrs. Olive C. Meeker said that one of three young magpies not yet feathered had been removed from a nest in Montana on June 15, 1907. That bird was kept captive until it died on January 11, 1927, when it was nearly twenty years old.

PICA.—Records of length of life of nineteen magpies kept in captivity were tabulated by Mitchell (1911, p. 484). Of this lot the average duration in months was 51, the maximum 131 (10 years and 11 months). Picchi (1913, p. 212) listed a male which lived for 20 years and a bird of unknown sex which lived for 18 years in captivity. Preyss (1916, p. 465) knew of an individual that was kept for 24 years and "it had been with its owners sometime before that." This bird laid an egg after it had been kept for 16 years. An abnormally plumaged bird was kept in captivity in Dijon, France, for 19 years, 1880 to 1899 (Paris, 1910, p. 103).

MAURITANICA.—Loche (1867, p. 119) reported a magpie in Algeria that was kept in captivity for ten years and then was killed by accident.

Summary.—The few examples given above are inadequate to supply more than a suggestion as to actual populations in the magpie or the kinds of factors which influence them. Several counts or estimates of numbers in various parts of the range of the bird and other observations cited lead to generalizations as follows: (1) The birds tend to live in colonies; (2) the colonies vary in size from single pairs to several hundreds of individuals; (3) the area occupied by each colony varies roughly, but not exactly, according to number of birds in it; (4) the size of each colony changes from year to year and the changes occur at different rates; (5) locations of the colonies change at irregular intervals; (6) borders of the ranges of the magpies change over periods of years; (7) after periods of artificial reduction magpies recover in numbers rapidly when the pressure is removed; (8) several instances of artificial colonization of new territory have been successful; (9) records of longevity in captivity extend to more than twenty years.

RELATIONS TO OTHER ANIMALS

Relations of magpies to other animals can be treated more fully than some other phases of the life in this group because a greater amount of the information available can be used in qualitative analysis than is the case with most of the other topics. Possibly on account of the wide variety in kinds of animals associated with magpies in different parts of their range, there is less duplication of observation than in more commonplace topics such as come under the head of general habits.

In addition to the relationships already noted under the head of food and feeding habits it is probable that every large group of terrestrial animals shows some connection with the life of magpies. These relations are most commonly food relations, where the magpie eats or is eaten by some other animal. Magpies are themselves sometimes pursued and captured for food by larger animals. In other examples the magpie is merely associated with another kind of animal in food-getting, sometimes as a competitor, sometimes as a helper. Indirectly magpies are associated with a large group of animals, mostly birds, which make use of their nests for rearing young or for shelter. There are indications that some invertebrate parasites, especially internal ones, are important in the welfare of magpies. In at least two races, magpies harbor avian parasites which leave eggs to be cared for by the magpies.

ASSOCIATION WITH OTHER BIRDS

NUTTALLII.—The magpie's forage ground in winter brings it into close association with few other kinds of birds. Usually no attention is paid to them but sometimes a representative of some smaller species will drive away the larger magpie. One case is reported below, of a shrike flying at a magpie. In California, in winter, the Lewis woodpecker forages commonly in the area where magpies live. This woodpecker is naturally quarrelsome, but even so, it seems to have an extraordinarily great number of skirmishes with magpies. The strange thing is that there is scarcely ever any sort of retaliation. The magpie simply retreats to a safe distance.

On November 11, 1930, near Meridian in the Sacramento Valley, I watched a foraging flock of magpies for several hours during the middle of the day. Once a crow that was foraging with the magpies gave alarm notes and flew out from among them to join another bird of the same species that was chasing a red-tailed hawk. Every other bird on the ground, including about twelve magpies, flew hurriedly to the thick foliage of the trees overhead and then became quiet. In this case the responses of crow and magpie to the same situation were widely different. In them the whole instinctive make-up of each species was expressed.

In midafternoon of the same day, at another locality fifteen miles to the north, a magpie and crow were seen in flight across a road. Apparently the magpie was darting after the crow and trying to drive it away from a foraging ground. The attack was weak and possibly not made in earnest.

Near the San Joaquin River, east of Crow's Landing, Stanislaus County, A. H. Miller (MS) observed, on November 29, 1929, magpies and shrikes feeding in the same field. Once, two magpies and one shrike were perched within ten feet on a fence top. One of the magpies and the shrike flew up and together in the air, "feet extended toward one another, and hovered in erect position for a second, striking with the feet. No noise

was made by either." The two birds separated a short distance and clashed again. They then returned to the fence and perched six feet apart. The magpie went to the ground and began feeding. The shrike dived at the larger bird once without recognition and again when the magpie turned but showed little concern. No further disturbance was noted, both birds feeding on the ground and afterwards leaving.

At the colony of magpies near Llagas school in Santa Clara County, on May 11, 1929, a magpie, that I watched, lit in the top of a tree and immediately a male Brewer blackbird lit close by it and began to call nervously. Next, another male blackbird came and the first one left. This second blackbird perched still closer to the magpie than had the first one. It gave calls and occasionally varied its position, but it did not actually attack the larger bird. However, as soon as the magpie started to fly, the blackbird pursued it and, several times, attacked and pecked it. The pursuit extended over nearly one hundred yards.

On October 6, 1929, magpies and crows were watched in a field near Colusa. Once, when a crow flew to a tree a magpie flew after it but did not persist in the attack. At one place a mixed flock containing about fifty magpies and several crows was seen in flight for a distance of about one hundred yards.

In one field where magpies, Brewer blackbirds, meadowlarks, crows, and a flicker were feeding on the ground on November 11, 1930, the magpies appeared to pay no attention to the other kinds or to be heeded by them.

During observations made in the morning of February 16, 1930, near West Butte, Sutter County, a Lewis woodpecker, twice, was seen to fly after and chase a magpie which was foraging on the ground near the base of a valley oak. The latter bird retreated by jumping away or making short flights. It would resume its foraging near the same tree and again the woodpecker would fly down at it from a perch on the lower part of the tree trunk. For a part of the time the same two individuals were on the ground within one yard of each other. The difficulty appeared to result from jealousy on the part of the woodpecker over sources of food. Kinds of birds seen in this grove which might be expected to compete with the magpie for food were Lewis woodpecker, red-shafted flicker, California woodpecker, mourning dove, meadowlark, robin, and crow (mostly in trees).

In Santa Clara County on February 23, 1930, I watched a magpie foraging close to the base of a small blue oak tree on the trunk of which was a Lewis woodpecker. The latter flew down at the magpie three times and then flew on to another tree trunk. The magpie, each time, barely hopped out of the way. On the fourth flight the woodpecker lit on the ground at the place from which the magpie jumped.

At 7:15 a.m. of July 13, 1930, I watched about twenty-five magpies along a row of valley oaks two miles west of West Butte. On both sides of the road were fields of stubble. When the birds were first noticed a sparrow hawk was pursuing a magpie. Several western kingbirds, stationed in the oaks, continually flew at the magpies, especially when one would fly from one tree to another or would perch on open ground. Sometimes two kingbirds would fly after the same magpie. Once three kingbirds flew after one magpie. The latter lit on the ground in stubble, where one of the kingbirds dived at it. At each approach of the small birds the magpie raised its wings and turned to keep an attentive defense. No offensive move on its part was noticed. When the

magpie flew away one of the kingbirds followed it for more than a quarter of a mile. At another time a magpie flew after and drove a meadowlark from the top of a valley oak. After a few minutes thirteen of the magpies flew in a group to the north over the stubble.

Heermann (1853, p. 269) observed magpies abundantly in California and found them frequenting the same localities as ravens (*Corvus corax*) "and devouring the same food in their company."

HUDSONIA.—In New Mexico, Bailey (1928, p. 481) comments upon seeing three or four ravens and four magpies perched on a corral fence near the carcass of a cow. The ravens were trying to drive away the magpies and they ignored entirely the approach of the intruders. In another locality she reports magpies foraging in company of crows, Brewer blackbirds, and piñon jays on a sunny southwest slope, below a ridge of aspens, pines, and spruces. A flock of 18 or 20 magpies was observed in February, 1924, on the west coast of Washington. The group was associated with a smaller number of crows and together the birds were making a noisy demonstration (Scheffer, 1924, p. 11). Ridgway reported (1877, p. 520) that in the days of the survey of fortieth parallel the magpies daily resorted with ravens to slaughter houses to feed upon the offal. Two were seen in September, 1907, in company of bluejays in Sedgwick County, Colorado (Smith, 1908, p. 186). Fuller and Bole (1930, p. 63) in July and August, 1927, found magpies associating with crows and ravens, in meadows about Pinedale, Wyoming.

In Alberta, Taverner (1919, p. 252) found magpie nests invariably in the neighborhood of or not more than a hundred yards or so from nests of red-tailed or Swainson hawks. He was not sure that this circumstance had a meaning, nor was it clear, if it was more than accidental, which bird was first to choose the locality.

Bowles and Decker (1931, p. 68) in writing of the ferruginous rough-leg commented that "the remains of Jack Rabbits are always to be found scattered on the ground around the nest, which probably accounts for one of the strangest examples of community nesting that we have ever heard of. This is the fellowship that the Magpie (*Pica pica hudsonia*) has apparently thrust upon the hawk. It does not occur in the ground nests, but in the tree nestings it is almost invariable to find a nest of the magpie in the same tree only a few feet from that of the hawk. Indeed, in one instance the Magpie had nested for a year or two a few feet from the hawk, but, as if not satisfied with this, the next year she had inset her nest directly into the side of the hawk's nest. When we approached the tree, which was a lone Juniper about fifteen feet high, the male hawk left when we were at a distance of about a hundred yards. At a distance of about fifty yards one of the Magpies left, the other Magpie sticking until we were a few feet away. We walked around under the tree discussing the possibility of the nest having eggs, but it was not until we shouted that the big female hawk rose from the nest and flew away. The hawk's nest contained four eggs while that of the Magpie held seven, incubation being about the same in both. It is perfectly obvious why the Magpies like this community housekeeping, since there is a continual supply of food to be had from the leavings of the hawks. Just why the hawks tolerate the presence of the Magpies is harder to understand, unless it may be because of the watch the smaller birds continually keep for intruders. What is completely past comprehension is the fact that such hardened egg and young bird eaters as the Magpies never bother the eggs or young of the

hawks. A somewhat parallel case is found in Ravens nesting near Prairie Falcons, but in that last case the nests are not literally in each other's mouths. The Ravens will clean up all the eggs from nearby nests of Western Red-tailed Hawks and Horned Owls, but they are very careful never to bother the Falcons."

Rhoads (1894, p. 325) cited Captain Lewis as observing "that the nests of the Bald Eagles, where the Magpies abound, are always accompanied by those of two or three of the latter, who are their inseparable attendants."

On the Columbia River a magpie's nest was once found by Dawson (1909, p. 29) in the "basement" of an occupied osprey's nest. He does not state which species originally chose the site, but intimates that the magpies derived benefit in having access to surplus food brought in by the ospreys.

In Mount McKinley National Park, Alaska, three magpies watched on August 23, 1932, by Dixon (1933, p. 161) took a ground squirrel away from an adult golden eagle (*Aquila chrysaëtos canadensis*). The flying magpies stopped and walked completely around the eagle which was standing on and eating the squirrel. Then two of the smaller birds took turns swooping down at the eagle. This was repeated five times with increasing intensity until the eagle struck back at its tormentors. In doing this it relinquished its hold in order to use its talons, whereupon the third magpie came in on the ground and carried off the squirrel. Later, the food was "shared *without fighting* with the other two magpies."

Criddle (1923, p. 25) has noticed in Manitoba that magpies persistently mob hawks and owls.

On June 11, 1933, L. V. Compton (MS) was examining a young crow from a nest in Smoky Valley, Nye County, Nevada. The cries of the young bird attracted six adult crows which came and circled about overhead. In addition, a magpie flew near, evidently also attracted by the commotion. Immediately, a crow drove the magpie into a *Shepherdia* bush and completely out of sight. The magpie continued to give alarm notes after it had sought refuge within the bush.

PICA.—Selous (1927, p. 119) concluded that "magpies appear to be somewhat select. They do not amalgamate with rooks nor have I seen them in the company—unless as I think accidentally—of any other birds, either of the crow kind or generally."

An account of an interesting observation of a gull and a magpie is here quoted from Thompson (1849, p. 332). "Once, in the month of May, when driving between Larne and Glenarm, I was surprised to observe a lesser black-backed gull (*Larus fuscus*) hovering very low over, and making a stoop at a ditch-bank near the road. On looking attentively, however, a magpie was discovered changing its position from whatever side of the bush the gull hovered over, to the other side. After a short time, the gull took its departure, and then the magpie flew along the bank with some whitish-coloured object in its bill. The gull returned and played the same part over again, as the magpie likewise did; the object of the latter, from the commencement, being evidently to conceal itself from the gull's observation. On seeing the food in the magpie's bill, I had no doubt of its being the gull's prey, which having been accidentally dropped, was carried off the magpie, whose thievish cunning it was amusing to witness, though I pitied the honest sea-bird, for being thus gulled."

The same author wrote that magpies occasionally annoy a kestrel. His account of

the curiosity exhibited toward a peregrine falcon by two magpies follows. "A trained falcon at Fort William, near Belfast, on being given its liberty, alighted, after taking a few circuits through the air, in a small tree, where first one, and then another magpie, likewise perched, without exhibiting the least fear, and with the intention only, to all appearance, of examining it more closely. They gradually approached until almost touching the hawk; one indeed seemed to strike it, immediately after which, they both flew to a tree close by, and commenced an incessant chattering. This was continued so earnestly for some time, that it could be nothing less than a discussion upon the merits of the strange bird. When in the tree with the hawk, they maintained a respectful silence."

That the magpie's relations with other birds are not entirely harmful has been pointed out by Seigne (1930, p. 113) who observed that "they never fail to warn small birds that the cat is about and are very diligent in driving away all other marauders."

Brown (1924, p. 128) noted that occasionally a magpie would be seen feeding with a flock of rooks, but that such an individual was usually driven away. Chasen (1921, p. 195) in Macedonia observed magpies feeding in winter in company of jackdaws and rooks.

Poole (1921, p. 335) in France observed an encounter between three kestrels and a group of magpies, which he called a "game." The kestrels "would hang over the bushes in which the Pies were concealed and dart down on one whenever it exposed itself. Thereupon the whole assemblage of Pies would pursue the Kestrel until it returned to its former elevation." This was continued for over half an hour.

Butler (1896, p. 151) reported that in one particular wood in England he had often seen several pairs of the magpie and the jay simultaneously flying up from their feeding ground in a small clearing.

That the magpie is very pugnacious was the opinion of Ussher (1900, p. 89) who knew of an instance where a magpie and a kestrel, fighting on the ground, were taken, one in each hand, both torn and bleeding. When they were placed in a cage, the magpie immediately attacked the kestrel again. The same writer once saw two magpies gripping each other in a fierce combat on a lawn, "while six others danced round them chattering." However, he had also seen a magpie sitting quietly in the same bush with a hooded crow.

OTHER KINDS OF MAGPIES.—Dörries (1888, p. 77) wrote that in eastern Asia magpies spent the winter in villages but that they, as soon as the snow melted in spring, united with *Corvus corone* and *C. japonensis* along rivers and in swampy places in fields where there were rich food supplies.

A strange relationship was indicated by Bosche (1912, p. 405) who wrote that, in France, a young individual of *Fringilla coelebs* carried food to a nestling magpie, neglecting itself until it died.

Hammonville (1895, p. 270) knew of two magpies that killed an owl (*Otus vulgaris*).

Lilford (1895, p. 231) wrote that in central Spain constant noisy disputes are carried on between the magpies and the spotted cuckoos. He points out that a close relative, the blue-winged magpie (*Cyanopica cooki*), occurs in many parts of Spain, but it and the magpie never consort together or even within a short distance of one another.

According to Ussher and Warren (1900, p. 91) Dr. Blake Knox has found "Jack-

daws, Magpies, Starlings, House-Sparrows (and a Long-eared Owl higher up) all breeding harmoniously" in the same tree in Ireland.

It was reported by Schinz (1854, p. 41) that magpies in Germany often quarrel with shrikes, ravens, and crows.

RELATION TO LARGE MAMMALS

NUTTALLII.—Evermann (1886, p. 181) wrote that yellow-billed magpies in Ventura County, were most likely to be found where sheep or other stock were herded. In a more extended account of the birds in this region the same author wrote (1886, p. 607) that "one of the great industries of Southern California is wool growing; the valleys and hillsides are covered with flocks of sheep, from a score to several thousands in number; and nearly every cañon has its corral to which the herder and his faithful dogs drive the flocks at eventide. . . . In and about these corrals are various kinds of filth —carcasses of sheep that have died of disease or starvation, bodies of dead lambs and the refuse of the sheep which the herder has slaughtered for his own larder, for jerked mutton and tortillas constitute the chief part of his meager bill-of-fare. Such a place as this is a paragon of restaurants to the magpies. Here they can be found in the early morning, in the evening, and at any other time of day when they happen to be hungry."

On November 19, 1905, C. H. Merriam recorded in his notes (Biol. Surv.) that the yellow-billed magpie had been formerly plentiful on the Walker Ranch near Mount Diablo, in Santa Clara County, and that the birds had pecked the backs of horses in that vicinity. Mr. Loren Bryan, who lives near Paicines, San Luis Obispo County, told me (1936) that he once saw a magpie picking insects from the back of a horse. The horse seemed not to mind the presence of the bird.

HUDSONIA.—During his travels on the western frontier in the first half of the nineteenth century, Audubon was told that buffaloes became so very poor during hard winters that they lost their hair and became covered with scabs on which the magpies fed (Audubon, M. R., and Coues, 1898, vol. 2, p. 131).

The following passage from the diary of Pike on an exploring trip in the west, also in the first part of the nineteenth century, gives an insight into experiences with these birds by early travelers: "Monday, Dec. 1st. The storm still continuing with violence, we remained encamped; the snow by night was one foot deep. Our horses were obliged to scrape it away to obtain their miserable pittance, and to increase their misfortune the poor animals were attacked by the magpies, which, attracted by the scent of their sore backs, alighted on them, and in defiance of their wincing and kicking, picked many places quite raw. The difficulty of procuring food rendered these birds so bold as to alight on our men's arms and eat meat out of their hands" (Coues, 1895, p. 460).

An extended account by Lord (1866, p. 71) shows early-day relations of magpies to horses and mules and other animals in British Columbia. Part of his account is as follows: "I call them murderers, because I have seen them kill mules; and worse than that, pick the eyes out of a living animal when, wounded and helpless, it lay down to die; and pounce on maimed birds, break in their skulls, and deliberately devour their brains whilst the muscles still quivered with life.

"To the packer the magpies are dire enemies. If a pack-mule or horse has a gall, and happens to be turned out to graze with the wound uncovered, down come the magpies on its back; clinging with their sharp claws, reckless of every effort to displace

them, they peck away at the wound; the tortured beast rolls madly, and for a short time the scoundrels are obliged to let go, but only to swoop down again the instant a chance offers. This repeated agony soon kills an animal, unless the packers rescue it."

In Montana magpies are known to perch on cattle for the warbles which infest the hide and also to alight on horses and the mule deer (Cameron, 1907, p. 393). That observer concluded that the deer did not appreciate this attention, after he saw a doe push a magpie from her back with her nose. Munro (1919, p. 72) wrote that in British Columbia, magpies walked over range horses' back and picked off wood-ticks. He knew of one instance where the birds of a small band had picked holes in the backs of several young shoats. Merrill (1888, p. 261) observed in Oregon that when snow was deep upon the ground, the magpies spent much of their time perched on the backs of mules and horses. Taylor (1887, p. 1123) records complaints made in 1850 to 1865 by farmers in southeastern Nebraska, who told him that magpies in winter pecked holes in the backs of fat hogs and ate off the tips of their ears. Two complaints for Wyoming were given by Knight (1902, p. 104) as results of magpies troubling cattle or horses that had sores on their backs. However, his opinion was that this trait was exceptional.

An account of the changes in status of some of the animals of central Alberta has been obtained from old-time buffalo hunters by Farley (1925, p. 201). His comments upon the magpie are of sufficient worth to be given in full. "The appearance of the Magpie in large flocks in this section of the province during the last ten years has been the cause of much discussion. Until 1907, they were unknown north of the Red Deer River. In October of that year the writer observed a pair about six miles north of the town of Lacombe. The following year magpies were reported from the vicinity of Bittern Lake, and from then on, they have gradually become more numerous, until at present they are our commonest winter resident bird. Magpies were very numerous during the buffalo days, when flocks would follow the hunting parties and live on the refuse of the hunt. The bird was considered a great pest in those times on account of its habit of alighting on horses, with saddle or harness galls, and persistently pecking at the sores until the death of the animal resulted. The only means of saving the horses when thus attacked was to stable or blanket them. With the extinction of the buffalo, the magpies disappeared and the present incursion is the first which has occurred since that time." The buffalo was plentiful in that district until 1875.

In northern New Mexico the magpie occurs commonly wherever sheep and goats are kept (Bailey, 1928, p. 481). One fall a flock of seventeen magpies was seen in a pasture, evidently attracted there by the presence of two burros. Four of the birds, at one time, were sitting on the back of one burro.

Shaw (1893, p. 211) wrote of the relation of the magpie to stock which is important in that it shows that these habits of the birds are permanent features of their behavior. They may be expected to recur whenever suitable circumstances arise. The birds "will alight upon the cattle and horses while out on the ranges in winter months and pick the grubs from their backs, and if the weather is cold and the snow deep so as to render it hard for them to get food they will pick large holes in the backs of the more feeble cattle, and as the sore becomes numb from cold they continue their destructive work till the critter becomes too weak to resist the battle and give themselves up to the mercies of this terrible pest." In a similar manner it was reported (Rockwell, 1908, p. 168) that

in Colorado magpies attack open sores on the cattle, "sometimes with serious results." Another observer (Reagan, 1908, p. 466), in South Dakota, noticed that the birds pecked holes through the hide and into the flesh on the backs of horses and cattle. "If the poor creature tries to switch or rub off the pesterer, the bird simply hops to the other side of the animal and begins to peck there. . . . The work of these birds, however, is not always a detriment. I have seen them pick grubs from cows' backs by the hour."

A recent series of attacks upon sheep in the neighborhood of Linwood, Utah, was reported upon in detail by Schorger (1921, p. 276). In this instance the attacks were of rare occurrence; sores were opened on ten out of sixty or seventy rams in two years. The magpies worked one at a time. The sheep were not wounded previous to the attack. The wounds were always in the backs, the magpie sitting there and pecking until it had opened up a small hole in the flesh. This was made deeper and deeper until, in one case, the entrails of the ram were exposed. Two or three old cows in the same vicinity received similar injuries in one winter.

After commenting upon the shyness of magpies when man is concerned Criddle (1923, p. 25) pointed out that it is a bird of great audacity in relation to other animals. He had observed that they "move about among cattle with absolute fearlessness, at one time hopping among them, at others resting on the animals' backs. It is interesting to see their freedom in making themselves at home among the live stock and it leads one to suspect that the same antics were performed amid the buffalo in former days and possibly among the deer too."

The same writer quotes a letter written by his brother at Treesbank, Manitoba, on February 24, 1922, in which he comments on six or seven magpies that were wintering at his place. " '. . . They have also been seen constantly skipping about on the cattle during the day time. I have kept a very close watch on their movements and last week noticed that one of the cows had a sore near the base of her tail, originated, I think, by the skin having been knocked off by accident. The magpies also noted the injury, and within two days enlarged the wound until it was fully two inches across and half an inch deep, besides which the surrounding flesh and skin were much swollen. I at once began to treat the sore and filled it with cotton wool, which the Magpies promptly pulled out as soon as my back was turned. They then proceeded to further enlarge the wound. Curiously enough the birds seemed to be so gentle that the cow took no notice of them, indeed she semed to rather like their attention than otherwise.' "

As an example of the quickness with which magpies take advantage of circumstances, Mrs. Bailey (1902, p. 270) comments that they have been found "during deep snows in Oregon keeping their toes warm by spending a large share of their time perched on the backs of horses and mules."

A group of five wintering magpies in Iowa was observed (Bennett, 1915, p. 134) feeding on the ground in a herd of cattle in a piece of open woodland.

An extended account of injury to sheep by magpies was given by Berry (1922, pp. 13–17) on the basis of observations made during a decade of summers spent at Winnecook, Wheatland County, Montana. According to him "it doubtless fairly summarizes the actual experience of almost any cattle and sheep ranch in central Montana where the magpie is one of the most abundant and ubiquitous of birds, whether on the open prairie or among the woods and pastures of the river bottoms."

Berry continued: "It is customary in many of the western ranches to bring the rams into a roomy bottom-land pasture after shearing, where they remain fenced in, usually without the constant care of a herder, through the summer. Magpies abound in just such localities as those generally chosen for the 'buck pasture', the isolation of which gives them a better opening for any deviltry to which they may be inclined than is afforded by the sheep bands out on the prairie with their herders always watching over them. Now ordinarily the abundant wool of the range sheep is an ample protection against even so powerful a weapon as a magpie's bill, but in July a Montana sheep has just been deprived of this padded armor by the June shearing and is as defenseless as a kitten. Not only that, but the chances are that a cut of the shears here or there opens up a tempting display of raw, juicy flesh,—just a nice little tidbit to bait a meat-loving magpie. During that summer a number of magpies began bothering the newly shorn rams, *beginning,* as I believe is usually the case, . . . on those showing particularly bad shearing cuts. As soon as this was discovered the birds were driven away and I believe a few of them shot as a warning, but they soon returned to the attack, and before the seriousness of the situation was realized they had opened up ugly wounds on quite a number of the sheep, from which they would pick and tear the flesh whenever the least chance was allowed them. The sheep seem utterly helpless in such circumstances, merely lying or standing pitifully while their tormentors, alighting on their backs and clinging there, give the wounds no chance to heal. Blow-flies soon add their quota to the troubles of the poor quadrupeds and a wound of this sort cannot long go unattended before it becomes a writhing mass of maggots. What made matters worse during the year in question was that soon the magpies, or some of them, began, by dint of their own efforts, to open up entirely new wounds on the sheep. For some reason the kidneys are particularly favored tidbits, and the birds were quick to learn the location of these organs in the animal's body and the ease with which they could penetrate to them by drilling a shallow hole just at the side of the spine in the lumbar region, through this they would peck away piecemeal, first the overlying tissues, then the toothsome fatty layer, and then work into the kidney itself. The wretched sheep would become weaker and weaker, soon sink by the wayside, and in the absence of prompt human intervention the end was not long delayed. . . . So far as I could ascertain the magpies were not content with the fatty layer, but ate the true glandular tissue as well. . . . I still have a photograph of the 1912 hospital band at Winnecook which shows about 15 rams all suffering simultaneously from injuries of this nature. As the total number of rams on this ranch at that time was certainly under 350, this gives a percentage of animals attacked of more than 4 per cent. As a result several valuable rams were lost entirely in spite of all that could be done by means of remedial measures applied directly to the wounds, and protection from further magpie attacks, together with an active war of destruction against the birds. The latter failed to diminish the total number of pies very much, but must have been successful in eliminating most of the guilty ones, for I have no record of much trouble of such virulent nature during the seasons following. . . .

"Whether in earlier times magpies ever made a practice of preying in this manner upon wild quadrupeds is doubtful. No such case has ever come to the notice of the present writer and as none of the 'old timers' with whom the matter has been discussed seem to recall anything definite about stock losses from magpies in the early days, it

seems reasonable to suppose that attacks on living ungulates have been undertaken only quite recently. This perhaps constitutes an explanation why this habit is still more or less a sporadic one, and why some magpie individuals or colonies are so much more prone to practice it than others seem to be. The individual experience of any given bird is evidently an important consideration or even the ruling one, but there seems little doubt that the addiction is one easily acquired by almost any of them when circumstances favor it."

"On this same ranch not long since the cowboys reported two cases where the magpies in attacking freshly branded cattle penetrated well into the body cavity. . . .

"Another instance of magpie depredation occurred in the winter of 1919 when a half dozen hogs caught in a blizzard at some distance from the farmyard gave up fighting the storm, and lay down together as such animals so frequently will. In that situation they were set upon by magpies and when found the birds had one of the six, though some were in much worse condition than others."

Mrs. J. A. Campbell, in Lincoln County, Minnesota, observed two magpies in December, 1919, which spent their time in a barnyard on the backs of cows, which "did not mind them in the least." However, a colt turned out in the same lot did not like to have the birds on its back and would try to reach them. The magpies would keep just out of reach (Roberts, 1932, p. 67). Taverner (1926, p. 255) summarized his experiences with this trait of the magpie by writing that "occasionally it attacks horses and cattle, even to their death, perching on the foolishly unresisting animals' backs and enlarging saddle galls, fresh brand marks, or other open sores to serious proportions. The animals for some unaccountable reason seem to make no objection, and even appear to enjoy the sensation of being pecked to death." Wood (1923, p. 54) reported that in North Dakota he was told of many instances where magpies had eaten holes on the backs of living sheep, cattle and horses.

Bendire (1895, p. 349) wrote of the supposed habit of magpies in winter of pecking holes in the backs of horses, cattle and sheep that "while this is possibly true to a limited extent in exceptionally severe winters, I have never observed it, although stationed on several Indian reservations, where sore backed ponies were common enough; but I have seen them industriously pecking away at green hides hung out to dry. Mr. John Bucher, of Warner Valley, Oregon, states that he has observed numbers of Magpies on the backs of cattle, in the spring, eating grubs, the larvae of *Hypoderma bovis,* which infest the backs of old and thin animals, and he is likewise of the opinion that they do not confine their attention to the grub alone, but pick at the living flesh as well."

PICA.—Brown (1924, p. 127) in Cumberland, found that in the early autumn months magpies perched on the backs of sheep and searched for insects in the fleece. Outside of that season his only record of a magpie on a sheep's back was in early March. An additional trait noted by Hewett (1843, p. 351) was that the birds sit on the backs of sheep to "observe the grasshoppers which the flocks disturb as they feed, and on which these birds feast luxuriously."

A weakly donkey was turned out into a field in England in winter. Fourteen or fifteen magpies hovered about the animal and picked at its sore back until it died from the wound made by the birds (Lilford, 1888, p. 184). That observer knew of cases in which magpies had made sores in the backs of cattle, but of no other case of the attack causing the death of the victim.

The following incident related by Pitt (1922, p. 245) gives an idea of how intimate an association may exist between the magpie and some of the larger domestic animals. This particular group of English magpies was busy among a flock of sheep. "One of the magpies suddenly hopped up on to the back of a sheep that was lying peaceably at rest, whereupon another hopped up after it. The first turned round and chattered angrily at the second, but number two was not going to give ground, and a fight began. Up and down the sheep's broad woolly back they danced, until one drove the other up on to its head, which disturbed even the sheep's placid serenity. It shook its head, rose with deliberation, and tilted the combatants off its back on to the ground, where, swinging their tails in high disdain of each other, they hopped off in opposite directions, and resumed their business of searching for insects and worms among the sheep droppings and the cow manure."

Briggs (1849, p. 2563) observed that magpies lit on the backs of sheep to pick out the lice "with which the fleece abounds, more especially on sunny days when, owing to the unusual warmth, they creep towards the surface of the fleece." That writer also credits these birds with visiting the backs of cows to get the maggots of warbles from the skin. In either case the quadruped was supposed to benefit.

Meinertzhagen (1914, p. 389) records that in Mesopotamia, magpies are frequently seen "perched on camels' backs."

Yarrell (1873, p. 315) wrote that in England the magpie is said "to be of service in ridding cattle of maggots embedded in their hide, and sheep it will free from lice."

The pecking out of the eyes of lambs by magpies in England was reported to Browne (1889, p. 91). He thought the habit a true one. Injury to newly born lambs by magpies was cited by Horne (1871, p. 2483) from a letter to him, as follows: " '. . . I have seen several hopping about sheep at the time of lambing, and on one occasion I noticed the magpie go to the lamb just when dropped and fly away, and on my going up to it I found it without its tongue and bleeding. On speaking to my shepherd he said that he had also seen the same thing, and always watched them.' "

Ward (1775, p. 65) observed more than one hundred and fifty years ago that the magpie "has the insolence to tease the largest animals, when its insults can be offered with security." He added that the birds "are frequently seen perched upon the back of an ox or a sheep, pecking up the insects that are to be found there; chattering and tormenting the poor animals at the same time" (spelling changed).

KAMTSCHATICA.—Dybowski (1883, p. 362) considered this bird as a great nuisance in winter because it made great wounds in the backs of cattle.

INVERTEBRATE PARASITES

NUTTALLII.—Two individuals out of twelve that were shot by Willett (1908, p. 138) in the upper Salinas Valley were infested with intestinal parasites. It was suggested that the parasites may have been responsible for the decrease in numbers that had taken place in that vicinity.

HUDSONIA.—One cause of death of magpies along with other birds has been noticed which is rather accidental and which affects few individuals. In the Yellowstone National Park many of the openings at the hot springs give out carbonic acid gas which quickly proves deadly to any birds that get into it. The gas is odorless and not directly poisonous, and it kills by suffocation, shutting off the necessary supply of oxygen (Skinner, 1925, p. 86).

PICA.—Gape worms are recorded by the Nicholsons (1930) as having been found in the magpie. The species of parasite referred to was *Syngamus trachea* (Montagu, 1811). According to Cram (1927, p. 35) these nematodes occur, as adults, in the trachea and bronchi, as larvae, in the lungs. The second-stage larvae in the soil are infective. "The fact that birds swallow a large amount of mineral matter, to furnish sand, gravel and small pebbles for the gizzard, ensures their ingesting the eggs containing larvae or the larval worms present in the soil, and it is not necessary to assume that the larvae are injested on vegetation or in food or water, though this too may happen." That author continues: "Railliet has regarded the magpie (*Pica pica*) as a carrier of importance in France, and it may be that a number of wild birds will be found of importance in this connection. However, wild birds can hardly play the part that domesticated birds can in carrying and maintaining infection, and the turkey must be looked on as especially dangerous in this connection." The turkey is considered the normal host of this parasite. Distribution is "more or less cosmopolitan."

A nematode, *Porrocaecum ensicaudatum* (Zeder, 1800), which occurs in the intestine and whose life history is unknown has been recorded from magpies in Europe (Cram, 1927, p. 139). Another species of this class of worms *Acuaria anthuris* (Dujardin, 1845) has been recorded from magpies. Cram (1927, p. 220) lists this species as a synonym of *Acuaria cordata* (Mueller, 1897) whose primary hosts are shrikes (*Lanius*) of Europe. This parasite occurs in the stomach wall, and is thought to have intermediate stages in other hosts.

OTHER KINDS OF MAGPIES.—Kellogg and Paine (1914) have recorded mallophagan parasites from magpies as follows. *Docophorus crassipes* Nitzsch (female from bird from Punjab, India); *Nirmus olivaceus* Nitzsch (many specimens from Upper Burma); *Nirmus varius* Nitzsch (many specimens, Gilgit and Ladak); *Menopon meniscus* Piaget (female, Shiraz, Persia).

A species of cestode worm, *Davainea corvina* Fuhrmann, 1905, has been recorded from magpies in the Zoological Garden in Calcutta. The same species of parasite was found also in *Corvus macrorhynchus* and *Corvus splendens* (Southwell, 1916, p. 9).

Hall (1929, p. 9) gives the magpie, along with the duck and crow, as a primary host of the cestode worm *Hymenolepis serpentulus*. The secondary hosts given for this species are Copepoda, *Diaptomus spinosus* and *Cyclops serratus*.

External parasites which infest magpies were listed by Naumann (1905, p. 79) as follows: *Docophorus subcrassipes, Docophorus picae, Menopon picae, Ornithomyi avicularia, Pulex avium.*

Internal parasites of magpies were listed by Naumann (1905, p. 79) as follows: *Ascaris Picae* Rud., *Filaria attenuata* Rud., *Filaria anthuris* Rud., *Syngamus primitivus* Molin, *Trichosoma resectum* Duj., *Echinorhynchus teres* Westrumb., *Echinorhynchus hepaticus* Molin, *Distomum ovatum* Rud., *Distomum cirratum* Rud., *Taenia serpentulus* Schrank, *Taenia stylosa* Rud., *Taenia angulata* Rud.

A nematode, *Capillaria corvicula* (Wassilkowa), has been reported as occurring in the esophagus of the magpie and several other members of the Corvidae. According to Cram (1936, p. 19) adults of this species vary from about 12 to nearly 20 mm. in length. Parasites of this genus occur in the upper digestive tract of birds, that is, anterior to the intestine. The one infecting magpies has been found in Russia. Its pathology

and life history are unknown, but are presumed to be similar to those of *C. contorta* (Creplin), the species which has been found in many kinds of birds.

Extensive studies have been made by Macy (1934) on trematode parasites which live in the bursa Fabricii (commonly) and the oviducts (occasionally) of birds, especially domestic fowls. Dragonflies, both adults and naiads, serve as intermediate hosts. At least one species of this parasite, *Prosthogonimus ovatus* (Rudolphi, 1803), which occurs in Europe and Asia has been reported in the bursa of magpies. Early loss of this organ in birds restricts the extent of infestation. An investigation is cited (p. 25) in which the highest numbers of one kind of this parasite found in one host (the magpie) were 42 and 53, in the Don region and in Turkestan, respectively. Since one of the effects of these parasites on poultry is supposed to be a decrease in egg production, it is conceivable that a similar effect might sometimes result in magpies, even to the extent of modifying the range of the species.

Cestode parasites recorded from magpies by Joyeux and Baer (1936, p. 560) are as follows.

Hymenolepis farciminosa (Goeze)
Hymenolepis serpentulus (Schrank)
Hymenolepis stylosa (Rud.)
Anomotaenia constricta (Molin)
Dilepis undula (Schrank)
Tetrathyridium variabile (Dies.)

USE OF NESTS BY OTHER ANIMALS

NUTTALLII.—Barlow (1898, p. 40) ventured the opinion that in San Benito County the majority of the nesting sparrow hawks used old nests of the magpie. He thought it probable that in some instances the hawks took possession of occupied nests by force. An account is given in detail of one instance. On April 10 two magpies' nests in the same tree were examined. In one a magpie was brooding five fresh eggs. In the other a sparrow hawk sat on five eggs also fresh. The two sets of eggs were collected. On May 7 the tree was again visited and the nests were examined. This time the sparrow hawks were in possession of the nest that had previously been occupied by the magpies. In addition to the partly incubated eggs of the hawks there was one egg of the magpie. Barlow accounted for the presence of this egg by suggesting that the robbed set of five eggs may have been incomplete and that the magpie returned to lay the last egg and then deserted the site, which was subsequently taken by the sparrow hawks. That observer concluded that usually the magpies and sparrow hawks each rear their broods peaceably, neither molesting the other.

In Yuba County, May 13, 1906, Bolander (1907, p. 25) found a set of eggs of the sparrow hawk in an old magpie's nest. A nest in an adjacent tree held a fresh set of eggs of the magpie. A set of sparrow hawk's eggs was found in a magpie nest in Ventura County, on April 2, 1881 (Evermann, 1886, p. 610). Mr. W. E. Unglish writes in a letter (1931) that he had found many old magpies' nests used by sparrow hawks in Santa Clara County, but none that was occupied for nesting by any other kind of bird.

Nearly every nesting colony of magpies watched by me in Santa Clara County, had at least one pair of nesting sparrow hawks. Observations recorded earlier in this account (p. 65) suggest that, although it may not be evident all through the season, there is considerable strife between these species when nest sites are being selected. After a given nest has been successfully defended and all the pairs are settled the two species appear to take little notice of each other.

HUDSONIA.—At one place near Denver, Colorado, a magpie's nest found by Bradbury (1917, p. 143) held seven fresh eggs. At the same time the flattened roof of this nest held three eggs of the black-crowned night heron. Both pairs of birds evidently had started about the same time to nest in the one structure. However, broken egg shells in other herons' nests and on the ground showed that the magpies were actually taking toll from the nesting colony of herons. Another magpie's nest within fifty feet of the one just mentioned had been taken over by a pair of long-eared owls which was brooding five eggs in the mud cup. The canopy of this nest was entirely gone.

In the near vicinity of an Indian reservation in New Mexico, English sparrows made frequent use of old magpie nests for supports for their own nests. House finches made similar use of these structures. The strangest use of the nests by other kinds of animals was discovered when four young house cats were found in a nest sixteen feet up from the ground (Gilman, 1908, p. 148).

It has been reported on the authority of C. E. Aiken that near Colorado Springs, Colorado, a gray fox was once found resting in the daytime in an old magpie nest (Warren, 1912, p. 333).

Rockwell (1909, p. 90) has written a rather full account of the use of magpies' nests by other birds. The abandoned nests furnish protection during severe rain or hail storms or other severe weather for robins, blackbirds, bluebirds, warblers and other species which live along the timbered streams. Some birds, the horned owl, short-eared owl, and screech owl make use of these nests almost continuously for daytime hiding retreats. These birds, especially the first two, also lay their eggs on old magpie nests. The sparrow hawk uses these nests for laying, but nearly always it chooses nests which still have their roofs intact. Rockwell noted that sparrow hawks which utilized old magpie nests always appeared more timid than the ones which nested in cavities of trees. Other species reported as using these nests for their eggs or as bases for nests of their own are the sharp-shinned hawk, at Fort Lewis, Colorado, the mourning dove, at Fort Harney, Oregon, and the bronzed grackle at Littleton, Colorado. At Barr, Colorado, a brood of young magpies left a nest early in May, and within a week a pair of English sparrows started to build within the structure. Afterwards a cowbird's egg was found in this nest. Nearly all the birds found laying eggs in these used nests chose nests between fifteen and thirty feet above the ground.

A nest of a gadwall built of down and containing nine eggs was found May 29, 1868, by Ridgway (1877, p. 622). This nest was placed on top of a dilapidated nest of a magpie and was in a willow tree, about eight feet from the ground. This was on the Truckee Reservation, near Pyramid Lake, Nevada.

PICA.—In England, writes Gordon (1931, p. 496), "the discarded nest" is at a premium, "particularly in a country where the birds are not numerous. Kestrels, sparrowhawks, tawny owls, great-tits, and squirrels are among the creatures that appreciate its value, and the kestrel at any rate is not above making a bid for the desirable establishment when new, a desperate fight for possession being the consequence."

In England a set of four freshly laid eggs of the jackdaw was found in a magpie's nest that had been built evidently the same spring (Blagg, 1887, p. 267). The opening in the nest had been enlarged and a new lining added. Half a mile from this nest was one from which the magpies had been ejected, before the nest was completed, by a pair

of kestrels. Two years later when this locality was again visited (Blagg, 1889, p. 230), there were six old nests of the magpie each tenanted by a pair of jackdaws and one new nest still in the possession of magpies. Each nest occupied by jackdaws had been relined with "sheep's wool and other materials."

Prior (1876, p. 4875) reported that the tree sparrow in England often builds its nest within the cavity of an old magpie's nest. That observer also recorded (1880, p. 143) at least four instances in which stock doves had been known to place their nests within vacant magpies' nests.

Browne (1889, p. 107) writes that the long-eared owl of England (*Asio otus*) "refits" a deserted magpie nest for its own eggs. He also credits (*op. cit.*, p. 113) the sparrow hawk (*Accipiter nisus*) with this trait as well as the hobby (*Falco subbuteo*) (p. 116) and the kestrel (*Tinnunculus alaudarius*) (p. 119).

Bird species reported by Kirkman (1910, p. 57) as nesting in magpie nests are kestrel, starling and "sparrows". In a note in *British Birds* (1915, p. 270) Jourdain mentions having noted moorhens breeding in magpies' nests.

Walpole-Bond (1932, p. 335) records that on June 28, 1926, near Newhaven, England, he found a female sparrow hawk (*Accipiter nisus*) brooding on an old, unroofed magpie's nest. The contents were on relics of the original lining.

Ussher (1885, p. 309) reported that he had "a clutch of Jackdaw's eggs taken on the 18th April, 1883, from an old Magpie's nest in a Scotch fir near a farmhouse." The jackdaw was said to have nested there before. Another example was reported by Warren (1885, p. 264) in more detail, as follows. "One day, about the middle of April I was surprised at seeing several Jackdaws making a great noise, and playing about a Magpie's nest on an ash tree about sixty feet high, situated about twenty yards from the cottage. I had shot the hen Magpie, and so there was no owner to dispute possession with the Jackdaws, who took up their abode there, the hen laying and hatching out her young safely."

MAURITANICA.—Heinroth (1916, p. 160) reported that in Tunisia an owl (*Scops*) nests in old magpie nests rather than its usual type of situation, hollow trees.

FEEDING UPON OTHER BIRDS

NUTTALLII.—Evidence was seen by me only once—and that circumstantial—which indicated the rôle of the yellow-billed magpie as a killer of smaller birds. In the early morning of May 31, 1931, as the long cement causeway one mile west of West Butte was approached, it was noticed that the cliff swallows whose nests were beneath the roadway were especially disturbed. Closer approach showed the cause of the excitement to be a magpie which flew out from beneath the bridge and back again and then out and away. All the time the magpie was being pursued by the large flock of adult swallows. Circumstances indicated clearly that the magpie was there to get young swallows, which at that time filled most of the nests. No actual raid was seen. Many of the nests had long entrance tunnels, and they appeared to be too long to permit a magpie to reach into the main cavity of the nest.

HUDSONIA.—Saunders (1914, p. 206) observed in an area near Choteau, Montana, that the magpies nested earlier than other kinds of birds. After nesting they left the area so that smaller birds there were not molested by them.

A bluebird that had been killed by collectors and left lying in the shade was dis-

covered and carried off by a magpie. Four or five of the birds devoured a mourning dove on another occasion (Rockwell and Wetmore, 1914, p. 319).

The magpie was considered by Wetmore (1921, p. 16) to be the most common natural enemy in 1915 and 1916, of ducks in the Bear River Marshes, Utah. The depredations consisted chiefly of pilfering eggs from the nests, although newly hatched ducks were occasionally killed. They damaged especially nests exposed during haying operations. That investigator considered that here, where conditions were favorable to their increase, magpies had multiplied until they were directly injurious to other more valuable species. Reduction of their numbers by poisoning was recommended.

A magpie that was caught in a bird trap by Mailliard (1927, p. 309) killed, and ate the head of, a sparrow that was confined in the opposite end of the trap.

At Moses Lake, Grant County, Washington, nesting colonies of the white pelican, great blue heron, and black-crowned night heron were disturbed by magpies which carried off, broke, and ate the eggs. In the case of the great blue heron it was thought that the effect of this robbery was to prolong the season of nesting. The night herons suffered most. It was doubted whether they raised any young (Brown, 1926, p. 50).

A magpie has been observed (Wheelock, 1904, p. 384) taking both eggs and young from nests of tree swallows in hollow piles of a deserted pier at Lake Tahoe, California. This bird, a male, would search over the colony of swallows and wherever the size of the opening to the nest cavity permitted it would reach in and take the contents, eggs or young. These were then carried to and given to the brooding female magpie. Young domesticated chickens were also taken by this bird.

Dice (1917, p. 123) recorded that on April 27, 1906, a magpie ate two eggs from the nest of a long-eared owl. The adult owls had been driven away by shooting. In an account of the birds of Lake County, Oregon, Prill (1922, p. 138) writes that magpies are "very destructive to eggs of other birds", but no details are given as basis for the statement. Dawson (1897, p. 177) in an account of the birds of Okanogan County, Washington, wrote that "no other birds can thrive where the Magpies flourish, for their annual destruction of eggs and young is simply incalculable." However, no examples were given to show the basis for such an impression.

Kalmbach's (1927, p. 11) thorough study of the magpie led him to the conclusion that depredations against smaller birds are primarily in the breeding season and that the "serious cases of bird destruction reported against the magpie are probably localized or due to some peculiar environmental factor, as lack of cover for the birds attacked, an over abundance of magpies, or scarcity of other food." Only 8 of 313 stomachs contained remains of wild birds. Specific identification could not be made. Remains of eggs of native birds were found in two stomachs, "those of a robin and what appeared to be those of a shorebird being recognized." Three young from the Bear River marshes in Utah had been fed portions of coots, "probably disabled by alkali poisoning."

The manner in which some smaller birds drive magpies from the vicinity of their nests indicates that they recognize a potential danger to their young. Brewer or red-winged blackbirds have been seen chasing magpies on occasions as follows. June 27, 1931, at Birch Creek, Lander County, Nevada; May 29, 1932, at five miles southeast of Millett P.O., Nye County, Nevada (one in patch of cattails, mobbed by red-winged blackbirds); June 9, 1932, along Reese River west of Austin, Lander County, Nevada (one chased from marshy area by male red-winged blackbird).

Dawson (1921, p. 34) reported that he once saw a magpie take a half-grown meadowlark from its nest and feed it to young magpies. A second young meadowlark was taken in spite of the protests of the parent birds. The same observer once frightened a magpie away from a hen's egg that it had been carrying. Taverner (1926, p. 255) considers that "next to the Crow, and possibly before it, the Magpie is the most persistent nest robber in the bird world."

OTHER KINDS OF MAGPIES.—Brown (1924, p. 127) has given a rather full account of the destruction of birds by magpies in Cumberland. He writes: "It is during the spring and early summer that the magpie commits most damage, as it takes any eggs it can find. When a nest is found, generally both Magpies will visit it, and usually one bird keeps guard whilst the other robs the nest. In my experience the egg or eggs (as occasionally two eggs are carried at once) are taken away in the beak, laid on the ground, broken, and eaten. I have never seen a Magpie take a young bird, but have no doubt it will occasionally do so, especially if it has young to feed. Thus one day I noticed a pair of Starlings driving a Magpie away from their nest, which was situated in the roof of a deserted house and contained partly fledged young. The following day the young had disappeared. Another time a pair of Willow Warblers were observed attempting to drive a Magpie away from their nest of young, flying at it and striking it with their wings. In both these cases the Magpies had nests of young. On a third occasion I had concealed myself near a Kingfisher's nest. Hardly was I hidden before a Magpie flew down to a branch beside the tunnel and craned its neck up the tunnel as if wondering whether it could reach the young, but eventually it flew away."

Aplin (1883, p. 499) records an instance in December, in which a magpie was seen pouncing upon a crippled fieldfare on the ground. The bird probably had been wounded before the attack, although this is not definitely so stated. In a similar case a magpie had attacked a full-grown redwing. The redwing's eyes were pecked out first (Curtler, 1850, p. 2799).

In northern Europe, along the Muonio River, Davies (1905, p. 75) noted that the magpie was persecuted by the natives on account of the damage which it does to the nests of the house-martin. The Finns consider the latter species sacred.

A magpie that was watched in July attacked a young pheasant and cornered it against a bush but a parent appeared and drove off the magpie so that the young bird escaped (Gurney, 1883, p. 335).

Slater (1896, p. 232) expressed the opinion that he had long considered this bird as a natural and important check upon the wood pigeon in England. It is the opinion of Collinge (1924, p. 63) that although he has quite a number of records of magpies destroying young birds, mostly blackbirds, thrushes, and wood-pigeons, the damage they do to young game and the eggs of game birds is exaggerated. Morris (1870, p. 297) recorded that at Walton Hall, Yorkshire, a wood pigeon "built in a tree only four feet below the nest of a Magpie; both lived in the greatest harmony, hatched their eggs, and reared their young."

Weir (*in* MacGillivray, 1837, p. 571) summarized his experiences with this phase of magpie life nearly a century ago, as follows: " 'To all kinds of eggs they are destructive. Even the nest of the smallest bird does not escape their minute observation. To their rapacious appetite a great many partridges and pheasants, and several other birds,

fall an easy prey. Day after day, I have observed them in pursuit of the same covey; and they never appeared to be satisfied until the poor birds were extirpated.' " The reliability of these statements is insured by the high quality of the whole account given by that observer.

Raspail (1908, p. 149) observed that magpies eat small eggs at the nests where they find them but that they carry off larger eggs before eating them. He found eggs of the missel thrush that had large holes punched in their shells by a magpie but that had been left when the parent birds returned to the nest. On June 11, in Germany an old magpie was shot as it flew away shrieking from the attack of a yellow thrush upon whose eggs or young it had probably made an attack (Jour. für Ornith., 1880, p. 55). In France, on May 21, 1913, a brood of chaffinches was destroyed by a magpie that had been driven away from the same nest many times (Coursimault, 1917, p. 103).

Altum (1880, p. 354) thinks that depredations of magpies upon the nests of smaller birds are always made in the early morning hours, the rest of the day being spent in fields and gardens and on open ground. On this point, Ussher and Warren (1900, p. 89) comment that in Ireland, a magpie will conceal itself in the top of a lofty fir-tree in the early morning, and from this look-out will watch the small birds go to their nests and then plunder them. During his work in southern China, Mell (1924, p. 287) heard of no instances of nest plundering by magpies or of attacks upon small birds or mammals by them. However, in the same region, the Caldwells (1931, p. 5) note that they "have seen the magpie defy the attacks by parent birds of fair size, while it mercilessly killed and devoured the fledglings in a nest."

Instances are known in which magpies have lived peaceably near other birds. *British Birds* (1930, p. 84) cites Mr. N. T. Walford as authority for the observation that a pair of magpies and a pair of herons (*Ardea c. cinerea*) nested in the same tree in Savernake Forest, England. The two nests were about ten feet apart and both pairs of birds reared their young. The same man knew of a second instance where the magpie built in the same tree as two pairs of herons.

Finn and Robinson (1922–23, p. 186) have made the general observation that the magpie is useful "in keeping down the numbers of small birds, whose eggs and young it devours" and they have made the suggestion that "it would be an excellent check on the undue increase of sparrows and Pigeons." Saunders (1927, p. 11) expressed the opinion that magpies prey upon small birds "during periods of severe weather". Feeding upon the eggs of ring doves, he considered a benefit which helped to counterbalance destructiveness to the eggs and young of game and poultry.

Craig and Baur (1912, p. 107) report that a man in Beith, Scotland, watched a magpie follow a skylark to its nest which contained young ones. The magpie seized one of the young skylarks in its beak and flew away with it. The man followed the magpie and when he came near, it dropped the young bird from which it had pulled out nearly all of the feathers.

Johns (1862, p. 261) wrote of the preying upon other birds by magpies that "Partridges and Pheasants are watched to their retreat and plundered mercilessly of their eggs and young." D'Urban and Mathew (1895, p. 89) wrote that "in the severe winter of 1880–81, Magpies kept sleek and fat, finding plenty of starving small birds to devour."

BIRD PARASITES

MELANOTOS.—In parts of Spain the magpie is commonly parasitized by the great spotted cuckoo (*Clamator glandularius*). Jourdain (1925, p. 657) writes of this relationship that "the females usually remove an egg of the fosterer when laying their own, though sometimes a particularly vigilant Magpie manages to keep her clutch intact. When the young Cuckoos are hatched they make no attempt to eject their foster brothers, and all live peaceably together. The first glance at a nest with fledged young of both species shows that the juvenile Cuckoo is quite a different looking bird to the adult. As it lies crouching at the bottom of the nest, one is struck by its black crown and dark back, totally different to the ashy grey of the adult, but bearing a superficial likeness to the young Magpies by its side. . . .

"The natural explanation of this extraordinary state of things seems to be that the Crows and Pies, with their superior intelligence, have enforced, by a process of selection, a certain degree of mimicry on the part of the young parasite in addition to extremely close resemblance in the egg; while the smaller Passeres, with their lower brain power, respond to the stimulus of the widely-opened mouth and the insistent hunger cry instinctively, even in some cases when they are not the actual fosterers."

Saunders (1869, p. 401) in the neighborhood of Aranjuez, Spain, found the great spotted cuckoo to be abundant and to lay its eggs in magpie nests. Although only one or two eggs were usually laid by the parasite in any one nest, this observer found one containing as many as four, and one with six. He noticed that when a cuckoo was near a nest the magpies could hardly be driven away, although at other times there was no hesitation in leaving. Five sets of magpies' eggs from the Island of Cyprus contained, each, an egg of the cuckoo (Müller, 1879, p. 387).

SERICEA.—Harington (1905, p. 520) has written about the parasitizing of magpie nests by the koël (*Eudynamis honorata*) as follows: "In March 1903 I got two Magpies' nests: one containing three magpies and two koël's eggs, the other five magpies and one koël's egg: in the latter case, the magpies' eggs were practically fresh (no traces of blood), while the koël's egg was well incubated, the young bird being well developed, showing that the koël's eggs must hatch out well before the foster-parent's eggs, thus giving the young koël a better chance of kicking out his young foster brothers and sisters."

Another case in upper Burma was recorded by the same author (1909, p. 108). "At Loijè on the 29th of March I found a nest in a small peepul tree. On sending up a coolie a cock Koel flew out of the tree as well as a Magpie from the nest." The koël had been continually calling during their stay at the tree. In the nest were four magpies' and two koëls' eggs.

PREDATORS

NUTTALLII.—No direct evidence is available which shows that the yellow-billed magpie is ever preyed upon by other birds. It seems possible that this form may be free from pressure of this sort and thus enabled to live in surroundings where brushy thickets do not predominate. There is little doubt but that the yellow-billed birds are more conspicuous in their relatively open tree habitat than are black-billed magpies in the usual dense thickets inhabited by them.

HUDSONIA.—On July 5, 1931, I observed several magpies in a small flock among

the desert bushes five miles southeast of Millett P. O., Nye County, Nevada. Some of these birds showed much concern and flew about excitedly. Then a prairie falcon flew up about two hundred yards away. It was carrying a dead magpie. The hawk went down among the bushes and a few minutes later flew away, without its bird. It should be remarked that the magpies were probably young ones that could be captured more easily than old ones. If this example represents a normal danger to confront magpies it might help to explain their evident preference for densely growing bushes in this locality. At any rate the falcons occupy the same general area and may be seen regularly foraging over the thickets.

In his report on the food habits of hawks in Canada, Munro (1929, p. 113) wrote that "on April 22, 1919, a Goshawk was flushed from the still warm body of a Magpie."

At Olancha, Inyo County, California, A. H. Miller, on December 27, 1933, watched a sharp-shinned hawk that was tormenting and pursuing two or three magpies over the rabbit brush and sage brush at the margin of Owens Lake. Apparently the magpies were able to care for themselves and to keep out of reach of the hawk. At any rate they showed little concern over its efforts.

OTHER KINDS OF MAGPIES.—The point has been raised by Pitt (1922, p. 244) as to whether carnivorous animals really relish the flesh of magpies. Her experience indicates that "birds of prey would rather have other food, but will eat them if they cannot get anything else." Trained sparrow hawks would not touch the flesh of magpies when it was offered to them as food, unless exceedingly hungry. A tame tawny owl and a goshawk refused this kind of flesh. Foxes seemed to have a distaste for it. The suggestion is offered that magpies might afford their bright colors "because they are not so palatable as to need special concealment."

Detmers (1912, p. 28) considers the principal enemy of the magpie to be the hen hawk (*Astur gentilis*=*Accipiter gentilis*). He has found almost naked young magpies in the nests of the hawks. Skovgaard (1927, p. 122) pointed out that in Denmark the control of rapacious birds has been favorable to the magpie. Close to the great forests where there are pigeon hawks it cannot maintain itself. That writer also states that martens can drive it away and that these two factors change its distribution. In his general account of the magpie, Kirkman (1910, p. 53) implies that they suffer heavy damage from the attacks of hawks, "from whom they find it no easy matter to escape." Also, he thinks that the magpies are benefited by the persecution of hawks by gamekeepers.

Newton (*in* Yarrell, 1876, p. 315) has described the English practice, of former times, of "hunting this bird to death by a process in which Falcons are trained to take part—and hence called 'Magpie-hawking— . . . . However much excitement may attend it, . . . it appears nearly the utmost degradation of a noble sport. There is no gallant contest of speed and power. Bird is not matched against bird in open flight, for on the wing a Pie has not a chance against a Falcon. The quarry's only resource lies in his cunning and sagacity, which are met by driving him from one refuge after another until none be left, when he becomes an easy victim to the clutch of the Falcon (the most merciful perhaps of his persecutors) and his terror and fatigue are at once ended." That the magpie is prepared to make the chase exciting is proven by its tendency, when the bushes are far apart, to "pass under the bellies of the horses, flutter along a cart rut, and avail himself of every little inequality of the ground in order to escape."

Biddulph (1881, p. 78) has reported that the natives in Kashmir, northern India, train a hawk (*Accipiter nisus*) to take the magpie.

In one instance a brood of nearly fledged young was attacked by a carrion crow which seized one of the young and started away with it. The parent birds attacked the invader and caused it to release its captive and hurriedly to fly away from the neighborhood (Briggs, 1849, p. 2563). The magpie is liable to have its eggs taken by other birds, especially the carrion crow, according to Brown (1924, p. 127). That writer mentions one instance in which a squirrel was seen running from a magpie's nest with the two birds chattering loudly and pursuing it but not actually making an attack. In the nest was one broken egg and a number of magpie feathers, suggesting that the squirrel had surprised the brooding bird.

An account of the procedure employed by the carrion crow (*Corvus corone*) in taking eggs of the magpie has been given in detail by Raspail (1888, p. 126). A pair of crows together approached the nest upon which a magpie was brooding. One crow perched quietly near the nest while the other drew off both the magpies to a distance in pursuit of it. Then the crow which had perched hurried to the magpie nest, left unguarded, and obtained an egg which it carried off. This drew the attention of the two magpies to the retreating bird and permitted the first crow to return and make off with still another egg. This "trick" was considered by Raspail to be beyond the capabilities of the magpies which always go out singly to forage for eggs.

In Ireland, on May 9, Thompson (1849, p. 330) "once saw a grey crow attack the nest of a magpie, when the latter, 'single-handed,' boldly repulsed and drove the intruder to some distance. The crow nevertheless returned to the nest several times, but was always beaten off without effecting its evil purpose. Bold as the magpie is in defense of its own nest, I have more than once seen it beaten away by a pair of missel-thrushes from the vicinity of theirs."

A predator possibly effective upon magpies in England, is mentioned by Prentis (1884, p. 44) who wrote, as follows. "I am inclined to think they are kept down by the foxes; I once saw where a Magpie had been buried by a fox, leaving the tip of its tail in view. When the weather is rough they roost low, becoming an easy prey." I know of no other evidence which confirms this opinion, nor do I know any reason why such occurrences should not happen sometimes.

Harting (1883, p. 92) reported that the peregrine will kill magpies. A magpie which Booth (1881) saw dive from a position high in the air to the cover of a bush and stay there even when approached closely was thought by him to have been frightened by a peregrine falcon although the human observer saw no hawk. According to Naumann (1905, p. 79) the goshawk is the most serious enemy of magpies. This hawk, he says, can capture a magpie on the wing, easily. He said that magpies are not frequently caught by pigeon hawks.

The Heinroths (1927, p. 237) concluded that magpies had few natural enemies for Uttendörfer in his study of birds of prey found remains of magpies only 38 times out of 10,000, while nutcrackers were found 414 times.

RELATIONS TO MAN

Man encroaches upon the territory of the magpie in nearly every part of the range of the bird. Through much of that area the requirements of these two kinds of animals overlap so much that they come to occupy common ground. This is especially striking since in most places the combined habitats of man and magpie involve only a small part of the total land area. Concentration of these two animals on the same ground results partly from their need for water, but their competition is mainly for food materials that are produced there.

When man settles in magpie country he immediately begins to "improve" his surroundings. Very often this also means that the environment is improved for the magpies. The birds usually need, and they are quick to take advantage of, increased food stores which human settlement brings. It is rare that human concentration on an area within magpie range reaches a point where the continued presence of the birds is hindered, unless direct killing is resorted to by the people.

Improvement of the habitat by the magpies, if it takes place, is usually not noticed at all by people. However, if the magpies remove or interfere with any article of food material claimed by man this is likely to be noticed immediately and to be followed by some kind of retaliation. The result is often the destruction of a certain part of the magpie population. But the magpie is a hardy kind of animal and unless the destruction is organized and well planned the birds have a good chance to survive, at least in small numbers. Some races of people are naturally more tolerant of animals than others and they have let magpies live near them unmolested or, even, have encouraged the birds to be neighborly. And these people seem to fare just as well as the ones who make constant effort to rid their surroundings of magpies.

The history of the long series of skirmishes between men and magpies could be inferred in part from a knowledge of their present-day relations. Some of the more obvious of these relations are suggested in the examples included in this report. However, these are verified and supplemented by the large stock of information implied in the folk lore and the vernacular names that have been applied to this bird. The legends, omens, and names that refer to magpies constitute an epitome of all the experiences of man with this bird.

BENEFICIAL EFFECT OF MAN ON MAGPIES

NUTTALLII.—In the neighborhood of Newman, Stanislaus County, an early settler, Mr. R. E. Shepherd, told me (1932) that although he believes there are fewer magpies in the vicinity now than when he came in 1891, they now occur in places where there formerly were no trees and hence no birds. It seems evident that in other parts of California, for example, the Sacramento Valley, the planting of trees and the extension of cultivation have tended to favor the spread, locally, of magpies. Study of present-day conditions in that region indicates that extension of human occupation of this land has, also, over a long period of years, resulted in increased numbers of this bird there.

HUDSONIA.—Gabrielson and Jewett (1924, p. 300) record that every Indian camp in western North Dakota has its magpie attendants.

In Surprise Valley, Modoc County, California, where there was an abundant population of jack rabbits, many of these animals were killed in the roads by automobiles.

Magpies gathered along the roads in especially large numbers to feed upon this artificially provided food supply (Mailliard, 1927, p. 309). An extended account of the attractiveness of roads for magpies in the Great Basin has been given under consideration of food.

One instance has been recorded (Wheelock, 1904, p. 384) in which a pair of magpies was permitted to nest close to a dwelling on account of their supposed value in keeping down rodent pests. Lord (1866, p. 73) commented that formerly in British Columbia, magpies became so tame and impudent in winter that he had often given them food from his hand without their showing any evidence of fear.

It was noted by Baird, Brewer, and Ridgway (1874, p. 266) that "the party of Lewis and Clark, who were the first to add this bird to our fauna, also describe them as familiar and voracious, penetrating into their tents, snatching the meat even from their dishes, and frequently, when the hunters were engaged in dressing their game, seizing the meat suspended within a foot or two of their heads." They add further that "Mr. Nuttall, in his tour across the continent, found these birds so familiar and greedy as to be easily taken, as they approached the encampment for food, by the Indian boys, who kept them prisoners. They soon became reconciled to their confinement, and were continually hopping around and tugging and struggling for any offal thrown to them."

PICA.—Norman (1864, p. 8866) wrote that no one in Norway thought of shooting a magpie and as a consequence the birds were remarkably bold and familiar. Pogge (1902, p. 378) observed that the Chinese people did not kill magpies and that the species was common everywhere in that country and showed an extraordinary boldness.

DETRIMENTAL EFFECT OF MAN ON MAGPIES

NUTTALLII.—In a brief sketch of the history of this species in the forty-year period beginning with 1850, W. E. Bryant (1890, p. 290) traced the rapid reduction of this bird in numbers in occupied localities in central California during the latter half of the nineteenth century. According to that writer the birds were much less wary in the early days than they became after a period of persecution. He attributed the decrease of the species to its feeding on poisoned carcasses that were left for coyotes, and the few "that are killed for scientific purposes and more that are sacrificed to the insatiable demands of the votaries of fashion." A likely prophecy at that time was the one given that ". . . unless some means are taken for its protection, [the bird will] soon be included with the doomed birds of North America."

It was suggested by Cooper (1875, p. 198) that the rapid decrease in numbers of the yellow-billed magpie may have resulted from reckless scattering of poisoned grain by farmers to destroy ground squirrels. The Mailliards (1901, p. 124) cite the effects of squirrel poison as an apparent cause for the marked decrease in the number of magpies in San Benito County.

One writer thinks that the great decrease in numbers of magpies was not the result of their being killed by man (Willett, 1908, p. 138).

Relation of magpies to automobiles and travel by that type of vehicle may be considered as detrimental to the species in several ways. For one thing, passing machines in some places may continually drive the birds from favorable foraging places. For example, on November 12, 1930, about ten magpies in a road near Colusa were feeding on the shoulders at the sides of the pavement. These birds always left this place when

an automobile approached within fifty yards, but each time they flew back within one minute of the time they were disturbed. When disturbed they flew to trees in an orchard next to the road.

On January 25, 1931, at the colony near Coyote, Santa Clara County, magpies showed no concern at the presence close by of persons in an automobile. However, when a man walked along the southern border of the grove, carrying a shotgun, all the magpies became quiet and were temporarily out of sight. The birds soon resumed activity after the departure of the man.

On October 4, 1929, six magpies on some burned-over ground along a railroad track permitted approach by me to within twenty yards before any one of them flew. Then two of them left. The others allowed still closer approach; one to within twelve yards. A hog that was still farther away from the intruder than the bird became frightened and ran off, but still the bird did not leave. Another group of birds that were quiet in a bare field in early afternoon permitted close approach by a person but when a train passed close by the birds flew away.

Close to Orestimba Creek, southeast of Crows Landing, on March 9, 1930, three magpies came to within ten or fifteen feet of an automobile parked at the roadside. One bird perched on the top of a post as the others foraged on the ground. They did not appear to be especially afraid of the two persons in the automobile. They left of their own accord, merely moving to another location on the fence.

At 10:30 a.m., November 11, 1930, near Meridian, about twenty-five magpies were seen resting quietly in the shade of a lone valley oak about fifty yards from the road. When an automobile was stopped opposite the tree all but one of the birds left the ground. One flew to the branches of the tree and the others flew off. In a short time the two remaining birds left.

HUDSONIA.—The hatred which many persons hold for the magpie has found expression in carrying on contests in an attempt to "exterminate" the species. A news item from a newspaper in British Columbia, gives some results of one of these contests as it was conducted in 1931 in the Okanagan Lake region. Two teams, of six persons each, killed a total of 1033 magpies in one season.

Lord (1866, p. 72) gives the following account of a large kill of magpies in British Columbia. "We had frightful trouble with magpies at our winter mule-camp near Colville. They gradually accumulated, to eat the offal and what there was besides, until they were in hundreds, and became perfectly unbearable. Shooting at them was only wasting ammunition. The packers were driven almost into a state of revolt. We had an old maimed suffering mule which was to be killed, so the packers gave it a ball containing a large dose of strychnine; death was immediate, and the carcase, ere ten minutes had elapsed, was covered with magpies working at the eyes, lips, sores, and soft skin inside the thighs. It was the most singular spectacle I ever witnessed. One after the other the birds rolled from off the dead mule, and as they fell and died, others greedily took their vacant places; and so this terrible slaughter went on, until the heaps of dead magpies nearly buried the body of the mule. . . . It was a terrible revenge—how far justifiable is a matter of opinion."

In some of the western states magpies in certain localities have hindered campaigns against predatory animals to such an extent that special efforts have been made to

remove the birds before spreading poison. Kalmbach (1927, p. 22) summarizes the results of several such magpie-campaigns, as follows. "During campaigns against coyotes in the winter of 1921–22 along Butter Creek, in Umatilla County, Oreg., it was conservatively estimated that 5,000 magpies were killed. In Douglas County, Colo., magpies were practically exterminated in the country covered by poison lines placed for coyotes in the winter of 1922–23. In the winter of 1921–22 a coyote campaign planned on the Pyramid Lake Indian Reservation, Nev., called for preliminary measures against magpies. On the first day after placing the baits three grain sacks full of dead magpies were picked up. An inspection of this reservation during the following winter showed not a dozen magpies, where in the previous year there were probably more than a thousand. At one poison station at Summit, Utah, 143 of these birds were accounted for within a few days."

More recently a newspaper clipping dated at Boise, Idaho, May 29, 1935, contains the information that "the State Game Department ended a 30-day drive to exterminate magpies, with an estimated death toll of 150,000 birds." A letter to the Idaho Game Department for verification of the report brought a reply that the drive was very successful and that the bounty of one cent on eggs and two cents on heads of magpies provided an "incentive to school children, especially in the rural districts, as well as adults to make a little extra money." The letter contains the added information that "this campaign has covered a period of several years and we are of the opinion that the situation is well in hand although it is doubtful if this species will ever be entirely eliminated. The magpies steal the eggs from nests of game birds and eat them, hence the bounty. Next year we plan to pay bounty on heads only as we find a tendency on the part of the young people to take the eggs rather than the birds, allowing them to lay several times during the season."

PICA.—Casemir (1926, p. 127) recorded that in East Prussia the continual persecution of this species had resulted in its being almost completely killed out. Muirhead (1889, p. 202) wrote that magpies were nearly all killed off in Berwickshire, Scotland, about 1840. After that the birds were found only infrequently and then where out of the reach of the gamekeepers. The destruction was usually by poisoning or trapping.

A magpie was found dead in Germany which apparently had been killed by flying against a wire (Thienemann, 1922, p. 81).

Concerning the effect upon the birds of persecution by man Butler (1896, p. 151) wrote that "the Magpie is at times both restless and noisy, but chiefly when aware of the approach of man whom it has learnt from sad experience to look upon with suspicion. Naturally less shy than the Jay, it would doubtless soon be confiding if mankind would but treat it more gently; it is indeed an ascertained fact, that wherever it is not persecuted, this bird commonly builds its nest close to the habitations of men, and in most conspicuous places."

As an example of a way in which organized efforts at bird protection may be detrimental to the maintenance of numbers of some one species the following statement from a report by Csörgey (1920, p. 29) is of interest. He wrote concerning conditions in Hungary as follows: "In consequence of the requisition of every kind of guns during the occupation by foreign troops after the war, the number of harmful animals as well as the nest robbing Magpies and Grey Crows has increased incredibly. To lessen these

birds an action has been prepared by the authorities through all the Kingdom. The experiments were made by putting in artificial nests half shells of hen's eggs, filled up with a mixture of phosphorated hashed meat; the result was exceedingly good, at some places even to the extent of 90%. We didn't like to use this last expedience, the poison, but considering the interest of our singing birds and the diminished small game, we were obliged to proceed with it."

The use of poison has had some part in the reduction of numbers of the magpie in England. As early as 1866, Dix (p. 138) wrote of magpies in Pembrokeshire, that he had "heard of a place in the extreme south of the principality, where they used to congregate at night like rooks: it took all the keeper's time to watch them, till some poison was laid, and the following morning he picked up two or three barrow's full of the dead birds."

Gengler (1925, p. 338) reported that in twenty-five years, 1730 to 1755, 1647 magpies were killed at Ansbach and Triesdorf, Middle Franconia, Bavaria. He considered the bird not so troublesome for he had seen in magpie-rich regions young song birds flying as in magpie-poor districts. Mitchell (1892, p. 85) has pointed out that "the enmity which the Magpie excites amongst sportsmen is perhaps a little unreasoning."

BENEFICIAL EFFECT ON HUMAN INTERESTS

NUTTALLII.—Tendencies in this magpie to act as a scavenger were noted and appreciated by the early settlers in California (Henshaw, 1876, p. 252). That author further remarked that when a group of the birds found a body of a dead aminal they never left the vicinity until only the bones and skin remained.

HUDSONIA.—Near the middle of the nineteenth century Audubon saw two magpies in a cage in the Missouri River region. They had been caught in nooses, by the legs, and were being kept as pets (Audubon and Coues, 1898, vol. 2, p. 480). It is said that Lewis and Clark sent four magpies alive to President Jefferson from Fort Mandan, Montana, on April 4, 1805 (Coues, 1893, p. 251).

PICA.—A statement in the Zoologist (1903, p. 240) quoted from the Daily Mail concerns magpies in Russia and states that "one Berlin firm alone has given an order for the immediate supply of 80,000 of these birds, which will be shot to provide trimmings for the ladies' hats." The chief claim for authenticity of this item is that it was republished by the editor of this reliable natural history journal. Blake-Knox (1868, p. 1405) has recorded an instance where a man killed six magpies to get their tail feathers for making a fan. It is intimated by Pearson and Bidwell (1894, p. 231) that in northern Norway, boys sometimes take magpies' eggs from the nest for food. Brown (1924, p. 223) gives the magpie credit for performing a useful service for farmers in "scattering the droppings of beasts whilst searching such dung for insects."

Another peculiar use which man has made of magpies is the taking advantage of the disturbance which the birds make when an intruder comes into their haunts. Actual instances are known of the capture of poachers by game keepers who profited by this habit (Yarrell, 1876, p. 316). A similar use for magpies (race *sericea*) in South China was mentioned by the Caldwells (1931, p. 5) who wrote that "the magpies are noisy and boisterous, quarrelling among themselves and becoming a nuisance about the habitation of man. The common call is a '*clack clack*' uttered with varying intensity and rapidity in expressing the feelings of the individual. There is one community where

the magpie is always a welcome resident, and that is a region infested by tigers. The rapid-fire *'clack clack clack'* of the magpie is usually interpreted in such a region as meaning 'cat, cat, cat'. Cattle and goats are hurriedly corralled when the magpie strikes up his rat-ti-tat-tat behind the village. Serving as a sentinel of this kind a magpie is at his best."

Soldiers in Afghanistan formerly were accustomed to bring numbers of young magpies into camp in July and keep them as caged pets (Ramsay, 1880, p. 63).

White (1855, p. 131) quotes from Waterton, a curious account of the services of magpies as watchmen. In this story an especially expert human thief was captured only because the magpies made such a disturbance near him that searchers were directed to the spot where he was active.

Birchley (1909, p. 121) recommends that magpies to be reared be taken from the nest when nine or ten days old, kept in a warm room, and fed every hour with moist food consisting of barley meal and fine scraped raw beef, with a worm or slug occasionally when obtainable; moisten the whole with milk, and be careful to see that it does not turn sour. He had never heard of any one attempting to catch an adult magpie and thought that all captive ones were taken from the nest.

Ticehurst (1932, p. 45) gives the following account of a utility of magpies: "In the early part of the War I had a curious and enlightening experience. I found the coast-line at Easton Broad literally strewn with the remains of Magpies, mostly wings and tails, and some were found as far south as Aldeburgh. I collected a large armful to examine at my leisure as I was not a little puzzled as to how they got there; when later I examined them more closely I found from the size of the wings and tails and the large amount of white in the wing that these remains could not have belonged to the European Magpie but to the Siberian race. I subsequently ascertained that a boat from Archangel had been wrecked off Southwold containing, amongst other things, a consignment of plumage for Paris plumassiers consisting of Magpies, Willow Grouse, Owls and other birds!"

In the valley of the Elbe it was once a common practice to kill magpies, not because of the injury which they did, but for their feathers which were used for pen cases for police and soldiers (Peiter, 1900, p. 397).

Ritchie (1920, p. 226) commented that it was a common practice in Rome to hang magpies in cages at the entrances to houses, "to keep guard against intruders and to salute those who were invited to a villa." A somewhat similar use for magpies was recorded by Gurney (1921, p. 65) who wrote that in England in the fourteenth century, at the baronial mansions the magpie "had a place in the poultry yard, because from its watchfulness against depredators and the noise it made on the approach of fowl-stealers, it was considered a useful safeguard." From the same author (p. 17) we learn that the Romans kept magpies in barbers' shops. These birds may have been imported from England.

The magpie occurs among the birds listed in a bill of fare drawn up for monastic use at the Abbey Church at Waltham, England, in 1059. According to Gurney (1921, p. 39) this was preserved in a manuscript "stated by Professor Dawkins" to have been written about 1177. It is recorded by Schuster (1923, p. 291) that during the Great War the soldiers on the battlefront sometimes captured young magpies which they used

as food to add variety to their usual rations. Schinz (1854, p. 41) wrote long ago that the flesh of the young magpie tasted like pigeon flesh.

MAURITANICA.—Evidently magpies are used as food in some parts of the world for Whitaker (1894, p. 94) has seen the dead birds for sale in the game-market of Tunis.

DAMAGE TO HUMAN INTERESTS

NUTTALLII.—This bird has often been charged with showing a food preference, in season, for over-ripe figs, and the presence of chattering groups of individuals in the trees has been commented upon by Mrs. Bailey (1902, p. 271).

Kaeding writes that they can always be found in fig trees (1897, p. 16), and Tyler (1913, p. 65) hinted that retaliation on the part of an orchardist in response to attempts of some magpies to satisfy this taste may have accounted for diminution in numbers that was noted in that particular colony.

Although he expressed the opinion that this magpie probably did more good than harm, Belding (1890, p. 108) thought it would likely be exterminated because of its fondness for the eggs of domestic fowls.

In the Colusa district complaint was heard that this bird stole eggs and young chickens and that it took feed put out for chickens and hogs (Grinnell, 1923, p. 172). In the same area Stoner (1924, p. 24) heard a complaint that the magpies "stole the prunes." This is also the basis for much concern about this bird in certain parts of the Santa Clara Valley.

After his exhaustive study of magpies, Kalmbach (1927, p. 28) pointed out that the yellow-billed kind appeared to be somewhat more insectivorous than the black-billed kind. He added that "at the same time it is capable of committing practically all the offenses of which the latter is so frequently accused." In his opinion the scarcity of the yellow-billed bird precluded the possibility of its doing serious damage, and "its minor offenses can well be tolerated lest aggressive measures result in the actual extermination of an unusual species of restricted range."

HUDSONIA.—With regard to the black-billed magpie in western North America, it has become a tradition accepted almost universally that the bird deserves an adverse opinion. Kalmbach (1927, p. 29) has pointed out that the magpie has indeed some outstanding faults. His summary is that "it is guilty of the destruction of poultry and beneficial wild birds and their eggs; it has at times become a pest on the cattle ranch by its attacks on sick, injured, or weak livestock; and [it] has proved a nuisance and hindrance in campaigns against coyotes by feeding on baits or tripping traps set for these mammals.

"There are times when these birds become so bold or gather in such great numbers that their faults become emphasized to the degree that a reduction in their numbers is warranted. . . . As in most if not all problems of bird control, the real need for drastic action against the magpie is confined to local areas where one or another of its faults has become unduly emphasized. Over much of its range, where it appears in moderate numbers, the bird is not an outstanding agricultural pest or a serious menace to other wild birds, and the present study has revealed the fact that there are times when its influence may even be decidedly beneficial. Consequently, extirpation of the bird over large areas is not called for, and before local campaigns of control are inaugurated careful consideration should be given to their necessity and scope."

My own observations have brought conclusions which agree almost exactly with those quoted above from Kalmbach. It is not at all surprising that these opinions differ from those of many persons who may be acquainted with magpies in one or a few localities. It might seem natural for these persons to be so impressed by unfavorable experiences with the bird as to fail to consider its whole range of behavior.

PLACE IN FOLKLORE

PICA.—Yarrell (1876, p. 313) concluded that the magpie had in past times been a much more familiar bird than when he wrote, because of the "frequent mention made of it by writers on almost every kind of subject, from the many omens it furnished to popular superstition, and from its being one of those species to which human names were applied."

According to Swann (1913, p. 151) the folk lore of the British Isles is "tolerably rich in allusions to the Magpie, as are also the still, or recently, existing evidences of totemism or animal worship." The following selected phrases hint at the nature of some of the beliefs given more fully by that writer for some one or many localities in that country: ". . . in Ireland a Magpie tapping at the window is taken as a death-warning . . . it is unlucky to kill one of these birds; . . . a Dunbar bailie . . . was in the habit of turning back home if he encountered a pair of Magpies on setting out. . . . it is unlucky to meet a Magpie, and when it is seen the hat is raised in salutation and the cross signed on the breast or made by crossing the thumbs and then spitting over them." It is unlucky "to see *two* Magpies together. . . . the peasant, on seeing a single Magpie, spits over his right shoulder three times to avert ill-luck, . . ." It is . . . "unlucky to see it cross the path in front of one from left to right, but lucky if from right to left. . . . the sight of one is considered lucky in some villages and unlucky in others."

"A belief in the power of the Magpie to transform itself into human form is recorded. . . ."

". . . Magpies flying near the windows of a house portend a speedy death to some inmate." The origin of the ill luck attributed to meeting a magpie is explained "by the supposition that it was the only bird that refused to enter the ark with Noah, preferring to perch on the roof and jabber over the drowning world. . . ."

"When Magpies fly abroad singly, the weather either is or will soon be stormy, but when both birds are seen together the weather will be mild."

The extent to which this bird influenced the traditions and beliefs of people on the British Isles in past centuries is further demonstrated in the lengthy (8 pages) collection of traditions and stories connected with it, which Loyd (1926, pp. 31–38) has gathered together. All of these stories indicate that in these early times magpies were numerous and familiar to all persons. Indeed, as in the case of most other kinds of birds, it has been only in late years that writers have been able to give rational interpretations of even the major features of behavior. It seems strange that along with this better understanding of the ways of the bird, man has developed an intolerance for its presence which is expressed by actually killing or driving away any individuals which appear. On occasions when the magpies are permitted to live close to human habitations, they may be ignored and their presence often overlooked.

An instance of a rather strange superstition concerning magpies was quoted by Alston (1868, p. 1092) as follows: " 'In the latter part of 1860 an official dispatch was presented to the Chamber of Deputies of Dresden, requesting a supply of magpies for the purpose of manufacturing a powder all potent against epilepsy. Great stress was laid on two points, that the birds must be neither deficient in claws nor feathers, and that they must be shot between the 24th of December and the 18th of January. This extraordinary document was not only presented and read in good faith, but was backed by many noble names.' "

A bird so well known as the magpie is likely to have recognition in geographical place names. In Berwickshire, Scotland, several places derive their names from having been frequented by this bird (Muirhead, 1889, p. 204). These are "Pyatshaw-knowe, a hill (1162 feet), and Pyatshaw Ridge (1250 feet) above Byreclergh, in the parish of Longformacus; Pyatshaw, a wood in Westruther parish, a short distance east of the Dod Mill on the Lauder Road; and Pyatshaw Burn, which flows into the Brunta Burn in the same neighborhood." An old adage in this locality was that "it is not too late to sow bear [barley] when the leaves cover the Pyet's nest." The magpie's power of talking gave rise to the nickname "of 'Tale Piet' or 'Piet Tongue', which is given by boys to a schoolfellow who is guilty of tale-bearing" (*op. cit.*, p. 206).

Thompson (1849, p. 329) cites an instance where in Ireland in the first half of the nineteenth century the peasantry gave this bird immunity because of a belief that if they harmed one, the birds would take revenge by carrying off the young ducks and chickens belonging to their persecutors.

Liebe (1878, p. 56) mentions an old German belief that if a magpie were killed in March and its wings hung over the door, there would be no sickness. Newton as late as 1893 (p. 720) in England wrote that "superstition as to the appearance of the Pie still survives even among many educated persons, and there are several versions of a riming adage as to the various turns of luck which its presenting itself, either alone or in company with others, is supposed to betoken, for some of these versions contradict one another in details, though all agree in this that the sight of a single Pie unquestionably forebodes sorrow." In Breconshire, England, Phillips (1882, p. 47) stated that he knew of no bird that was noticed more generally as one of ill omen than the magpie.

The old superstition concerning the significance of the number of magpies observed in a small group has been mentioned by many authors. Alston (1868, p. 1082) reported that in England the saying was as follows:

"One is grief, two is mirth,
Three's a marriage, four's a birth."

while in Scotland it was just the contrary:

"Ane's joy, twa's grief,
Three's a wedding, four's death."

Hunt (1815, p. 58) wrote of certain notions about magpies as follows: "In ancient authors many absurd tales are told of this bird, which at the present day would only create a smile. It is said that if a person happens to espy her nest, and the bird observe him, that she will transport the eggs to some other place, either between her claws, or in a way that would puzzle our best balancing masters; namely, by glueing to the

under side of a twig, with her excrements, an egg at each end, and taking the burthen equally poised on her neck.

"Numerous similar anecdotes might be selected, but we think the above sufficient. Even at the present day in various parts of England, if one of these birds is observed flying by itself, it is accounted by the vulgar a sign of ill-luck: if two they are supposed to forebode something fortunate: three indicate a wedding, and four a funeral."

According to Ralfe (1905, p. 93), "Old Manx people considered the sight of a Magpie hopping on the road before one unlucky."

Studer (1903, p. 80) wrote that "the Greeks and the Romans dedicated the Magpie to Bacchus, as all men when drunk are garrulus." According to this writer, in Norway the magpies are "treated to a Christmas dinner."

In reporting on certain legends connected with the origin of magpies Walker (1908, p. 71) wrote that "on the authority of Ovid, magpies were the discontented, tale-bearing daughters of Pierus, who were changed into birds for their garrulity. When the curse fell upon them, endeavoring to speak and, with great clamor, to menace with their insolent hands, they beheld quills growing out of their nails, dusky feathers springing from their arms, and each saw the face of the other shooting out into a hard beak, as these new birds were added to the wood. When in their alarm they frantically beat their breasts they were elevated by the motion and hung poised in the air as magpies, the scandal of the groves. And even though their forms were changed, their talkativeness remained, and their garrulity and enormous love of chattering."

A legend of the magpie's nest building related by Walker (1908, p. 72) characterized this as the "last bird to learn nest-building. When it became necessary for her to establish a home, though she was proud and arrogant, she finally put away her pride to the extent of asking the other birds to give her some instruction in the art. In their generosity they agreed and assembled on the appointed day to assist her.

"The materials having been collected, the blackbird, taking up a twig, said: 'Place that stick there,' and laid it in place. 'Ah!' said the conceited magpie, 'I knew that before.' Each of the other birds there assembled followed with useful suggestions, demonstrating every step, but all through the lesson the heedless magpie chattered: 'Ah! I knew that before. Ah! I knew that before.'

"At length, when the nest was but half completed, and the patience of her instructors entirely exhausted, they said with one voice: 'Well, Mistress Mag, since you know all about it you may build your nest yourself.'

"From that day on, no bird of the wood would allow the foolish magpie to see her building her own nest, even, and so it is that magpies, ever since, have built ramshackle nests."

Schalow (1919, p. 492) wrote that in one part of Brandenburg, Germany, there is a belief that the house on the roof of which a magpie settles is inhabited by a witch. In the neighborhood of Krossen a person must not shoot magpies: that brings misfortune. Another belief was that on the evening before May 1 the witches rode on the tails of magpies to the Brocken. From that circumstance no magpies were to be seen on the first of May because they had not yet returned. In the twelve nights after Christmas, that is, in the days from Christmas to the evening of the Epiphany, one must, according to a belief in Lausitz, shoot magpies and burn them to powder, which is good for cold

fever. When a magpie settles and walks on a tree near the house, company comes, and indeed from the direction which its tail points. If a magpie flies from a tree, and a person sees its back, there will be bad luck in the family.

Gengler (1925, p. 297) gives a variety of beliefs about a magpie perching and calling on the roof of a house. In one locality in Middle Franconia, Bavaria, such behavior is thought to indicate coming death for a member of the household. At another place it signifies the coming of friends. He also reports that in Middle Franconia one often hears the following expressions: He steals like a magpie. He is an even greater rogue than a magpie. When a Jew (Jud) dies the magpie rejoices.

Bassetière (1913, p. 131) quotes a saying common in France which means "talkative as a pie."

SERICEA.—La Touche and Rickett (1905, p. 26) point out that since, in southeastern China, "the natives consider the bird lucky they do not molest it, in consequence of which it builds in most exposed and often easily accessible sites."

VERNACULAR NAMES OF MAGPIES

The vernacular names of birds have a double interest. First, they reveal in a condensed form much of a bird's history and the features of it that have been most impressive to men. Second, they are worth study for their indication of past and present traits of human response to some particular kind of animal. The names given to an animal by different races of people reflect deep-seated characteristics of those people.

Many factors may be singled out to account for the application of bird names. For the magpie these are shown in the accompanying tabulation. A large share of these names have some connection with the voice of the bird; they may be descriptive (chatterpie), or onomatopoetic (otcotc). Some of the names refer to the appearance of the bird (pie or rudder-bird) or to its similarity to some other kind of bird (a-pish-ka-gog-i' =like the raven). Habits are indicated by a considerable proportion of the names which may refer to nesting place (tree-mag) or to thieving traits (duzd=a thief).

Magpie, the name used now almost universally among English-speaking people, is a contraction of Magot Pie, a middle English name for the bird. According to Swann (1913, p. 150) the first part of the name appears to have no reference to the bird's habit of picking maggots from the backs of sheep (as some persons have supposed), but it is "derived from the French Margot, a diminutive of *Marguerite,* but also signifying a Magpie, perhaps from its noisy chattering, in which it is popularly supposed to resemble a talkative woman." The second part of the name is supposed to come through French from Latin *pica* which refers to the black and white coloration of the bird.

Most of the 422 names listed here can be shown to have come from a few old roots, but I am without the philological knowledge requisite for adequate analysis of this sort. The list is useful, however, to show what a great variety of names have been applied to one type of bird. It suggests that in earlier times the names were much more localized in application than at present. With the standardization of languages certain names have been adopted over great areas and the remainder have been forgotten, except as they were preserved in written records. Doubtless, this tendency also reflects a decrease in interest in natural objects, particularly birds, that may have accompanied progress in mechanized human activity.

VERNACULAR NAMES APPLIED TO BIRDS OF THE GENUS *Pica*

Name	*Language*	*Authority*
Aakster	Dutch	Hoare, 1925, p. 278
Aarlaster	German	Olphe-Gaillard, 1890, p. 80
Acka	Persian	Dresser, 1902, p. 417
Ackzel	German	Suolahti, 1909, p. 194
Ad	Saxon	Heyder, 1916, p. 443
Adelhetz	German	Suolahti, 1909, p. 194
Adelster	Saxon	Heyder, 1916, p. 443
A'dn	Selish Indian	Hoffman, 1885, p. 9
Aegerschte	Swiss (Interlaken)	Fatio, 1899, p. 746
Aegerst	German (Baden)	Journ. für Ornith., 1886, p. 228
Aegersten	German	Schinz, 1854, p. 41
Aelster	. . . . .	Pennant, 1776, 1, p. 225
Aga	German (old high)	Suolahti, 1909, p. 192
Agaag	Arabian	Koenig, 1895, p. 209
Agace	French (old)	Hoare, 1925, p. 278
Agacer	French	Olphe-Gaillard, 1873, p. 62
Agache	French	Olphe-Gaillard, 1873, p. 62
Agacier	French	Olphe-Gaillard, 1873, p. 62
Agag	Arabian	Whitaker, 1905, p. 11
Agahq	Arabian	Tristram, 1859, p. 292
Agalastra	German (old high)	Suolahti, 1909, p. 197
Agalstra	German	Suolahti, 1909, p. 195
Agalastra	German	Hoare, 1925, p. 278
Agasia	Latin	Hoare, 1925, p. 278
Agassa	Provençal	Hoare, 1925, p. 278
Agasse	French	Whitaker, 1905, p. 11
Agasso	French	Gurney, 1901, p. 383
Agastra	German	Suolahti, 1909, p. 192
Agastria	German (old low)	Hoare, 1925, p. 278
Agatsche	Swiss (Burgdorf)	Fatio, 1899, p. 746
Agaz	Arabian	Whitaker, 1905, p. 11
Agaza	German (old high)	Hoare, 1925, p. 278
Agazza	Italian	Hoare, 1925, p. 278
Age	German (middle high)	Suolahti, 1909, p. 192
Ageace	French	Abadie, 1922, p. 318
Agelaster	Saxon	Heyder, 1916, p. 443
Agelhetsch	German	Rey, 1905, p. 373
Agelster	German	Suolahti, 1909, p. 194
Agerluster	German	Rey, 1905, p. 373
Ägerste	German	Suolahti, 1909, p. 195
Aglâster	German	Tschusi and Dalla Torre, 1889, p. 519
Aglister	German	Suolahti, 1909, p. 195
Agritsch	Swiss (Berne)	Fatio, 1899, p. 746
Agu	Anglo-Saxon	Hoare, 1925, p. 278
Aiarat	Castanoan Indian	Mason, 1916, p. 427
Ajace	French	Olphe-Gailliard, 1873, p. 62
Ajassa	Italian	Giglioli, 1907, vol. 2, p. 11
Akaka	Arabic	Irby, 1895, p. 82
Akha	Afghanistan (Cabul)	Baker, 1922, p. 38
Âkster	Friesian	Suolahti, 1909, p. 506
Alaster	Saxon	Heyder, 1916, p. 443
Alebster	German	Olphe-Gailliard, 1890, p. 80
Alester	German	Rey, 1905, p. 373
Algarde	German	Russ, 1873, vol. 2, p. 240
Algarte	German	Rey, 1905, p. 373
Algarte Häster	German	Olphe-Gailliard, 1890, p. 80
Algaster	German	Floericke, 1892, p. 263
Algorte	German	Floericke, 1892, p. 263

Name	*Language*	*Authority*
Almindelig Skade	Danish	Rey, 1905, p. 373
Alster	German	Friderich, 1923, p. 16
Alsterkâdl	German	Suolahti, 1909, p. 196
Alsterkatel	German	Suolahti, 1909, p. xxxiii
Apishkagogi	Chippewa Indian	Cooke, 1884, p. 245
Aqaq	Mesopotamian	Baker, 1922, p. 38
Argáza	Italian	Giglioli, 1889, p. 36
Argàza dalla coda longa	Italian	Giglioli, 1907, vol. 2, p. 11
Argàza d'la coda longa	Italian	Giglioli, 1907, vol. 2, p. 12
Ascholaster	German	Russ, 1873, vol. 2, p. 240
Aster	German	Russ, 1873, vol. 2, p. 240
Aṭaṭ	Castanoan Indian	Mason, 1916, p. 247
Atce' tc	Antoniano, Salinan Indian	Mason, 1918, p. 126
Atzel	German	Kleinschmidt, 1893, p. 204
Atzelgift	German (Rhineland, Prussia)	Journ. für Ornith., 1886, p. 228
Atzle	German	Floericke, 1892, p. 263
Azel	German	Friderich, 1923, p. 16
Badascule	Italian	Giglioli, 1907, vol. 2, p. 11
Baumhestel	German	Gengler, 1925, p. 297
Berta	Italian	Giglioli, 1907, vol. 2, p. 11
Berta Checa	Italian	Giglioli, 1907, vol. 2, p. 11
Berta d'la cóa longa	Italian	Giglioli, 1907, vol. 2, p. 11
Berta d'la couva longa	Italian	Giglioli, 1907, vol. 2, p. 11
Bertha	Italian	Swainson, 1886, p. 76
Bird of Joy	Chinese (tr.)	La Touche, 1925, p. 13
Blanca	Valencia, Spanish	Arévalo y Baca, 1887, p. 261
Bonte Ekster	Dutch	Jourdain, 1906, p. 17
Borraca	Spanish	Tait, 1924, p. 24
Bush-magpie	English	Swann, 1913, p. 37
Caiazza	Italian	Arrigoni, 1929, p. 80
Cajazza	Italian	Giglioli, 1890, p. 493
Caragască	Rumanian	Dombrowski, 1912, p. 36
Caragaţă	Rumanian	Dombrowski, 1912, p. 36
Carcarazza	Italian	Giglioli, 1907, vol. 2, p. 11
Carcarazzu	Italian	Giglioli, 1907, vol. 2, p. 11
Caula o Ciaula baida	Italian	Giglioli, 1907, vol. 2, p. 11
Caziola	Italian	Giglioli, 1907, vol. 2, p. 11
Cazzola	Italian	Giglioli, 1907, vol. 2, p. 11
Cecca	Italian	Dresser, 1902, p. 417
Chatterpie	English (Staffordshire and Norfolk)	Swann, 1913, p. 45
Chècca	Italian	Giglioli, 1907, vol. 2, p. 11
Checche	Italian	Arrigoni, 1929, p. 80
Cheche	Italian	Giglioli, 1907, vol. 2, p. 11
Chishima-kasasagi	Japanese	Uchida, 1922, p. 165
Ciaula baida	Maltesian	Rey, 1905, p. 373
Ciaula bajda	Italian	Arrigoni, 1929, p. 80
Ciorcobară	Rumanian	Dombrowski, 1912, p. 36
Ciricaca	Italian	Giglioli, 1907, vol. 2, p. 11
Cola	Italian	Giglioli, 1907, vol. 2, p. 11
Cornish Pheasant	English	Johns, 1862, p. 261
Coţofană	Rumanian	Dombrowski, 1912, p. 36
Dame	French	Olphe-Gailliard, 1890, p. 82
Diebsch	Saxon	Heyder, 1916, p. 443
Doalaster	German	Rey, 1905, p. 373
Duzd	Persian	Cumming, 1905, p. 686
Egerste	German	Floericke, 1892, p. 263
Egester	German (middle low)	Suolahti, 1909, p. 197
Egglift	English	Kirkman, 1910, p. 8

Name	*Language*	*Authority*
Eisterrabe	German	Olphe-Gailliard, 1890, p. 80
Ekster	Flemish	Dubois, 1887, p. 202
Elster	German	Dresser, 1902, p. 417
Elsterrabe	German	Rey, 1905, p. 373
Engster	German (Brandenburg)	Journ. für Ornith., 1887, p. 431
Exter	. . . . .	. . . . .
Extersteine	German	Journ. für Ornith., 1880, p. 55
Frača	Croatian	Rey, 1905, p. 373
Gacha	Provençal	Hoare, 1925, p. 278
Gäckenhetze	German (Bayern)	Journ. für Ornith., 1887, p. 431
Gäckerhätze	German	Journ. für Ornith., 1886, p. 228
Gackerhätzel	German	Gengler, 1925, p. 297
Gada	Italian	Giglioli, 1890, p. 202
Gaggia	Italian	Hoare, 1925, p. 278
Gaggia codalunga	Italian	Giglioli, 1907, vol. 2, p. 11
Gaggia domenicana	Italian	Giglioli, 1907, vol. 2, p. 11
Gaggia ladra	Italian	Giglioli, 1907, vol. 2, p. 11
Gagia	Italian	Giglioli, 1890, p. 69
Gaglia	Italian	Giglioli, 1907, vol. 2, p. 11
Gaia	Italian	Giglioli, 1890, p. 202
Gaiola da sorgo	Italian	Giglioli, 1907, vol. 2, p. 11
Galster	German	Tschusi and Dalla Torre, 1889, p. 519
Galsterkatel	German	Suolahti, 1909, p. 196
Garsa marinera	Cataluña, Spanish	Arévalo y Baca, 1887, p. 261
Garten-grabe	. . . . .	Selby, 1833, p. 358
Gartenkrähe	German	Friderich, 1923, p. 16
Gartenrabe	German (Bayern)	Journ. für Ornith., 1887, p. 431
Gassa	Italian	Giglioli, 1907, vol. 2, p. 11
Gavran	Bosnian	Jourdain, 1906, p. 17
Gaza	Italian	Dresser, 1902, p. 417
Gaza bastarda	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza checa	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza de la coa lunga	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza de la cua longa	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza ladra	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza mora	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza negra	Italian	Giglioli, 1907, vol. 2, p. 11
Gaza nera	Italian	Giglioli, 1907, vol. 2, p. 11
Gazella	Italian	Giglioli, 1890, p. 485
Gazha	Italian	Giglioli, 1890, p. 202
Gazza	Italian	Hoare, 1925, p. 278
Gazza cudona	Italian	Giglioli, 1907, vol. 2, p. 12
Gazza dalla coa longa	Italian	Giglioli, 1907, vol. 2, p. 11
Gazza dalla couva longa	Italian	Giglioli, 1907, vol. 2, p. 12
Gazza dalla cova longa	Italian	Giglioli, 1907, vol. 2, p. 12
Gazza ladra	Italian	Giglioli, 1907, vol. 2, p. 11
Gazza mora	Italian	Giglioli, 1907, vol. 2, p. 11
Gazzana	Italian	Giglioli, 1907, vol. 2, p. 11
Gazza negra	Italian	Giglioli, 1907, vol. 2, p. 12
Gazza neigra	Italian	Giglioli, 1907, vol. 2, p. 12
Gazzera	Italian	Hoare, 1925, p. 278
Gazzera commune	Italian	Giglioli, 1907, vol. 2, p. 11
Gemeiner Häher	German	Rey, 1905, p. 373
Giazella	Swiss (Engadin)	Studer and Fatio, 1901, p. 289
Giazza	Swiss (Sils)	Fatio, 1899, p. 746
Goister	German	Suolahti, 1909, p. 196
Graja	Murcia, Spanish	Arévalo y Baca, 1887, p. 261
Grazza	Italian	Menegaux and Rapine, 1921, p. 61
Grückelster	German	Friderich, 1923, p. 16

Name	*Language*	*Authority*
Guest-Bird	Chinese (tr.)	La Touche, 1925, p. 13
Haberhetsche	Saxon	Heyder, 1916, p. 443
Haggess	English	Suolahti, 1909, p. 193
Haggisher	English	Loyd, 1926, p. 28
Haggister	English	Kirkman, 1910, p. 8
Hagister	English (provincial)	Montagu, 1802, vol. 2
Häkster	German	Journ. für Ornith., 1888, p. 403
Harakas	Esthonian	Rey, 1905, p. 373
Harakka	Finnish	Dresser, 1902, p. 417
Harak wares	Esthonian	Rey, 1905, p. 373
Häster	German	Schalow, 1919, p. 492
Hätz	German	Gengler, 1925, p. 297
Hätze	German	Friderich, 1923, p. 16
Hätzel	German	Gengler, 1925, p. 297
Hatzel	German	Gengler, 1925, p. 297
Hatzl	German	Rey, 1905, p. 373
Hatzle	German	Suolahti, 1909, p. 194
Häxter	German	Journ. für Ornith., 1880, p. 55
Häxle	German	Suolahti, 1909, p. 194
Hazla	Swiss (Vrin)	Studer and Fatio, 1901, p. 289
Hazlas	Swiss (Vrin)	Fatio, 1899, p. 746
Heart-bird	Natives of Hudson Bay region	Franklin and Sabine, 1823, p. 66
Hechster	German	Rey, 1905, p. 492
Hedge-mag	English	Montagu, 1802, vol. 2
Heester	German	Rey, 1905, p. 373
Hêgster	German	Suolahti, 1909, p. 197
Heigster	German	Suolahti, 1909, p. 197
Heister	German	Meier, 1885, p. 94
Heste	German	Rey, 1905, p. 373
Hester	German	Schalow, 1919, p. 492
Hetsche	Saxon	Heyder, 1916, p. 443
Hetz	German	Suolahti, 1909, p. 193
Hetze	German	Suolahti, 1909, p. 193
Hizen-karasu	Japanese	Dresser, 1902, p. 417
Hôr Kâv	Kashmir (Dras)	Koul, 1930, p. 571
Husheister	German	Journ. für Ornith., 1880, p. 55
Hutsche	German	Olphe-Gailliard, 1890, p. 80
Huus Skade	Danish	Pennant, 1776, vol. 1, p. 225
Hy Tsio	Chinese	Edlinger, 1886, p. 35
Iazzula	Italian	Giglioli, 1907, vol. 2, p. 11
Jacques	French (Burgundy)	Swainson, 1886, p. 76
Jäkster	German	Suolahti, 1909, p. 197
Jängster	German (trivial name in Westphalia)	Floericke, 1892, p. 245
Jaquette	French	Encycl. Brit., 1911, p. 393
Jelster	Luxemburg	Rey, 1905, p. 373
Käckerätze	German	Rey, 1905, p. 373
Kaeje	German	Suolahti, 1909, p. 198
Kaeke	German	Suolahti, 1909, p. 198
Kägersch	German (Bayern)	Journ. für Ornith., 1887, p. 431
Käke	German	Suolahti, 1909, p. 198
Kakuk	Kamchatkan	Clark, 1911, p. 62
Karakáza	Greek	Rey, 1905, p. 373
Kasasagi	Japanese	Hepburn, 1894, p. 872
Katschagak	Armenian	Radde, 1884, p. 129
Katschkatschi	Grusian	Radde, 1884, p. 129
Keckersch	German	Rey, 1905, p. 373
Khashim Brāh	Kashmir (Suru)	Koul, 1930, p. 571
Kheh chian	Formosan	LaTouche, 1895, p. 335

Name	*Language*	*Authority*
Kibsakas	Esthonian	Rey, 1905, p. 373
Kikelot	English	Yarrell, 1876, p. 313
Kitsakas	Esthonian	Rey, 1905, p. 373
Koreg garasu	Japanese	Rey, 1905, p. 373
Krähke	German	Sunkel, 1926, p. 131
Kré	Luxemburg	Rey, 1905, p. 373
Krei	German	Suolahti, 1909, p. 198
Krek	German	Suolahti, 1909, p. 198
Krikelster	German	Giebel, 1887, p. 128
Krückelster	German	Rey, 1905, p. 373
Kruk sroka	Polish	Jourdain, 1906, p. 17
Kwi'ti wut	Shoshoni Indian	Hoffman, 1885, p. 9
Kya-ga	Tibetan (Gyantse dialect)	Bailey, 1911, p. 184
Làja	Italian	Giglioli, 1890, p. 39
Lajâssa	Italian	Giglioli, 1889, p. 36
Langstiel	German	Rey, 1905, p. 373
Longtailed-nan	English	Kirkman, 1910, p. 8
Madge	English	Swann, 1913, p. 150
Mag	English	Swann, 1913, p. 150
Magaty-pie	English	Cent. Dict. and Cycl., vol. 5, p. 3578
Maggaty-pie	English	Cent. Dict. and Cycl., vol. 5, p. 3578
Maggidipye	Anglo-Irish	Thompson, 1849, p. 328
Maggie	English	Swann, 1913, p. 150
Maggot	French	Cent. Dict. and Cycl., vol. 5, p. 3578
Maggot-pie	English	Cent. Dict. and Cycl., vol. 5, p. 3578
Maggoty-pie	English	Cent. Dict. and Cycl., vol. 5, p. 3578
Magot	English	Encycl. Brit., 1911, p. 293
Magot-a-pie	English	Cent. Dict. and Cycl., vol. 5, p. 3578
Magot-pie	English	Swann, 1913, p. 150
Magot o' pie	English	Cent. Dict. and Cycl., vol. 5, p. 3578
Magpie	English	Encycl. Brit., 1911, p. 393
Magpil		Giebel, 1877, p. 128
Mangot	Swiss (St. Maurice)	Studer and Fatio, 1901, p. 289
Ma'quits	Ute Indian	Hoffman, 1885, p. 9
Margaret	English	Swainson, 1886, p. 76
Marget	English	Swann, 1913, p. 150
Margot	French	Babin, 1912, p. 238
Marica	Spanish	Dresser, 1902, p. 417
Maruša prava	Croatian	Rey, 1905, p. 373
Maurenelster	German	Zedlitz, 1909, p. 185
Meggatapy	English	Skeat, 1882
Meggit	English	Kirkman, 1910, p. 8
Miggy	English	Swann, 1913, p. 150
Mita	Italian	Giglioli, 1907, vol. 2, p. 11
Mock-a-pie	English	D'Urban and Mathew, 1895, p. 87
Nanpie	English	Yarrell, 1876, p. 313
Ninut	English	Jourdain, 1906, p. 17
Oklaster	Bohemian	Journ. für Ornith., 1877, p. 315
Okulaster	Bohemian	Journ. für Ornith., 1877, p. 315
Olelster	German	Naumann, 1905, p. 75
Ootaw-kee-askee	Cree Indian	Swainson and Richardson, 1831, p. 292
Otcotc	Yokut Indian	Kroeber, 1907, p. 242
Ouasse	French	Olphe-Gailliard, 1873, p. 62
Pega	Portuguese	Dresser, 1902, p. 417
Pega rabilonga	Galician (Spain)	Tait, 1924, p. 24
Pega rabuda	Galician (Spain)	Tait, 1924, p. 24
Pegpie	English	Gladstone, 1910, p. 114
Pia	Welsh	Swann, 1913, p. 182
Pianet	English	MacGillivray, 1837, p. 562

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Pianete	English	Swann, 1913, p. 179
Piannad	Manx	Ralfe, 1905, p. 92
Piannet	English	Yarrell, 1876, p. 313
Piannot	English	Swann, 1913, p. 179
Pianot	English	Mitchell, 1892, p. 85
Pica	Latin	Coues, 1882, p. 66
Picaraza	Valencia, Spanish	Arévalo y Baca, 1887, p. 261
Picaza	Spanish	Cadena, 1900
Pie	English	Skeat, 1882
Pieanat	Manx	Ralfe, 1905, p. 92
Pieannat	Manx	Ralfe, 1905, p. 92
Pie-Anne	English	Ralfe, 1905, p. 92
Pie-Annet	English	Mitchell, 1892, p. 85
Pieannot	English	Swann, 1913, p. 179
Pie-Nanny	English (Yorkshire)	Swann, 1913, p. 180
Pienet	English	Swann, 1913, p. 180
Pienot	English	Mitchell, 1892, p. 85
Pie ordinaire	French	Dresser, 1902, p. 417
Piet	English	Swann, 1913, p. 181
Pighe	Irish	Ralfe, 1905, p. 92
Pighead	English	Skeat, 1882
Pigheid	Gaelic	Tait, 1924, p. 24
Pinot	English	Swann, 1913, p, 179
Pinut	English	Swann, 1913, p. 182
Pioden	Welsh	Swann, 1913, p. 182
Piogen	Welsh	Swann, 1913, p. 182
Pioghaid	English	MacGillivray, 1837, p. 562
Piot	English	Swann, 1913, p. 181
Pitarra	Italian	Giglioli, 1907, vol. 2, p. 11
Pitheid	Scottish Gaelic	Ralfe, 1905, p. 92
Praka		Pennant, 1776, vol. 1, p. 225
Putta	Italian	Hoare, 1925, p. 278
Pyanet	English	Swann, 1913, p. 179
Pyannat	English	Skeat, 1882
Pyat	English	Kirkman, 1910, p. 8
Pye mag	English	Swainson, 1886, p. 76
Pyenate	English	Swann, 1913, p. 179
Pyet	English	MacGillivray, 1837, p. 562
Pynot	English	Swann, 1913, p. 179
Pyot	English	Swann, 1913, p. 181
Que'-tou-gih, gih	Paiute Indian	Ridgway, 1877, p. 520
Rabilarga	Spanish (Galicia)	Arévalo y Baca, 1887, p. 261
Ragasse	French	Olphe-Gailliard, 1890, p. 82
Reios' a-karanas	Laplandian	Rey, 1905, p. 373
Rikelot	English	Yarrell, 1876, p. 313
Rudder-bird	English (U. S.)	Miss Amy Rinehart, MS
Sagi	Persian	Radde, 1884, p. 129
Sagasagan	Tatarisch (Tartar)	Radde, 1884, p. 129
Saja	Italian	Giglioli, 1907, vol. 2, p. 11
Sajâssa	Italian	Giglioli, 1907, vol. 2, p. 11
Sârcă	Rumanian	Dombrowski, 1912, p. 36
Sarka	Lithuanian	Rey, 1905, p. 373
Saüskan	Tatarisch	Radde, 1884, p. 129
Schackelster	German	Journ. für Ornith., 1885, p. 267
Schackelstra	German	Schalow, 1919, p. 492
Schacker	German	Schalow, 1919, p. 492
Schackhäster	German	Schalow, 1919, p. 492
Schackheist	German	Schalow, 1919, p. 492
Schagaster	German	Suolahti, 1909, p. 196

Schagata	Lett	Rey, 1905, p. 373
Schäkerhex	German (Bayern)	Journ. für Ornith., 1887, p. 431
Schalaster	German	Journ. für Ornith., 1887, p. 404
Schare	German	Suolahti, 1909, p. 198
Schätterhex	German	Friderich, 1923, p. 16
Schirigadl	German	Suolahti, 1909, p. 196
Scholaster	German	Russ, 1873, vol. 2, p. 240
Sepalaster	German	Floericke, 1892, p. 263
Sgazza	Italian	Giglioli, 1907, vol. 2, p. 12
Shepecum-mewuck	Maskegon Indian	Swainson and Richardson, 1831, p. 292
Sirică	Rumanian	Dombrowski, 1912, p. 36
Skade	Danish	Dresser, 1902, p. 417
Skamsfugel	Swedish	Jourdain, 1906, p. 17
Skär	Swedish	Rey, 1905, p. 373
Skara	Swedish	Pennant, 1776, vol. 1, p. 225
Skata	Swedish	Dresser, 1902, p. 417
Sker	Swedish	Suolahti, 1909, p. 193
Skiór	Norwegian	Pennant, 1776, vol. 1, p. 225
Skiura	Swedish	Pennant, 1776, vol. 1, p. 225
Skjaere	Norwegian	Dresser, 1902, p. 417
Skjer	Norwegian	Rey, 1905, p. 373
Skjor	Danish (provincial)	Brynildsen, 1902, p. 646
Skjora	Swedish	Rey, 1905, p. 373
Skjur	Norwegian	Rey, 1905, p. 373
Skjura	Swedish	Rey, 1905, p. 373
Skora	Swedish	Rey, 1905, p. 373
Soraka	Dalmatian	Rey, 1905, p. 373
Soroka	Russian	Dresser, 1902, p. 417
Sō-rō′-kah	Russian	Allen, 1905, p. 247
Spachheister	Prussian	Suolahti, 1909, p. 197
Spochheigster	Prussian	Suolahti, 1909, p. 197
Sraka	Slovakian	Tschusi and Dalla Torre, 1889, p. 519
Sročka	upper Wendish	Schalow, 1919, p. 492
Sroka	upper Wendish	Schalow, 1919, p. 492
Ssoroka	Russian	Edlinger, 1886, p. 35
Sswraka	Bulgarian	Boetticher, 1919, p. 247
Straka	Bohemian	Edlinger, 1886, p. 35
Stroka	Polish	Floericke, 1892, p. 263
Svraka	Italian	Giglioli, 1907, vol. 2, p. 11
Swrakati	Bohemian	Edlinger, 1886, p. 35
Swrćati	Slavic (old)	Edlinger, 1886, p. 35
Szarka	Hungarian	Chernel, 1919, p. 15
Szazagai	Buratisch, Daurien	Dybowski and Parrex, 1868, p. 332
Tah′-tut	Washoe Indian	Ridgway, 1877, p. 520
Tarcă	Rumanian	Dombrowski, 1912, p. 36
Tcheo	Chinese	Swinhoe, 1870, p. 351
Tell-Pie	English (North Yorkshire)	Swann, 1913, p. 235
Tell-Pienot	English (North Yorkshire)	Swann, 1913, p. 235
Tell-Piet	English (North Yorkshire)	Swann, 1913, p. 235
Tōkarasu	Japanese	Hepburn, 1894, p. 872
Traga	Tibetan (Lhasa dialect)	Bailey, 1911, p. 184
Tra-kak	Tibetan	Walton, 1906, p. 66
Traşcă	Rumanian	Dombrowski, 1912, p. 36
Tratschkatel	German	Suolahti, 1909, p. 196
Tree-mag	English	Montagu, 1802, vol. 2
Tree Magpie	English	Swann, 1913, p. 240
Tschadel	German	Suolahti, 1909, p. 196
Tschaderer	German	Suolahti, 1909, p. 196
Tschaderkatel	German	Suolahti, 1909, p. 196

Tschôgelster	German	Suolahti, 1909, p. 196
Tschokalaster	German	Suolahti, 1909, p. 196
Tunfugel	Norwegian	Rey, 1905, p. 373
Tunfugl	Norwegian	Pennant, 1776, vol. 1, p. 225
'Uq 'aq	Arabian	Edlinger, 1886, p. 35
Urraca	Spanish	Dresser, 1902, p. 417
Vaondeigeat	Swiss (Fribourg)	Studer and Fatio, 1901, p. 289
Wobish Kakagee	Chippewa Indian	Schoolcraft, 1855, p. 104
Xatca'tc'	Migueleno, Salinan Indian	Mason, 1918, p. 126
Y Bi	"Ancient British"	Morris, 1891, vol. 1, p. 296
Zagi	Persian	Radde, 1884, p. 129
Zaquettaz	French	Olphe-Gailliard, 1890, p. 82

SUMMARY AND CONCLUSION

The magpies constitute a group of birds peculiarly suitable for comparative study of natural history. Large size, conspicuous markings, widespread range in the northern hemisphere, and preference of the birds for the vicinity of human dwellings are factors which help make this one of the best known birds.

This group comprises a genus in the Corvidae, a family which includes the largest of the passerine birds. A magpie is essentially a crow with short wings and long tail and with the habits of a jay. It is distinguished structurally by possession of a falcate (sickle-shaped) tenth primary. Systematic workers have defined seventeen kinds of magpies, that seem to warrant recognition either as races or distinct species. The rank allotted to each form depends largely upon the personal bias of the individual worker. Characters of magpies, which vary geographically and which have been employed in systematic studies, are as follows: Size, as indicated by body weight; wing length; tail length; color of bill; color of skin around head; color of rump; color of iridescent blackish parts of plumage; size of white areas on primaries; habits.

In the case of the magpie the true home may be thought of as the nest or the nesting site; it is the place where the young are hatched and reared and it serves as a center for the activities of the bird through much of its life. Although there is much variety in the general appearance of magpie surroundings, and the habitat may extend in altitude from near sea level to far above 10,000 feet, many conditions are common throughout the range of the group. Forage ground that is open and covered by sod or low vegetation to insure a variety of plant and animal food is required. The short wing and limited powers of flight cause the magpie to require a convenient avenue of escape and restrict it to places where scattered bushes or small trees predominate. Trees or bushes are necessary for nest supports, and these must be close to streams or a substitute supply of surface water. Several factors account for the obvious preference for the neighborhood of human habitations.

Examination of stomachs has shown that from one-half to three-fourths of the food of a magpie is animal matter. Availability of various kinds of items within the normal forage range appears to be the chief determiner of what is actually eaten. Most of the food is obtained from the surface of the ground, but the birds will go into trees for food or, even, will pursue flying insects and capture them in the air.

The migratory habit is developed to different degrees in the various races of magpies, but nowhere is it well marked. In the southern part of the range the birds move scarcely at all. Farther north they migrate, sometimes great distances, but always probably in immediate response to severe winter conditions. In the United States fall and winter movements are noted regularly within the general range of the bird, and in some years well-defined migrations occur outside that range.

Magpies tend to form small colonies for nesting in which up to ten or twenty pairs may occupy a single small grove. There is little tendency to establish any special kind of territory for nesting, although close watching shows the tendency is present especially at the time for selecting the site. At other times a nesting pair is usually indifferent to other birds.

Mating in this bird seems to be for life, with the result that few opportunities are offered to observe courtship antics. Apparently, the usual procedure in pairing is for

a company of single birds to gather on a sunny day in late winter in some tree where there is much chattering, utterance even of musical notes, and pursuing in which two's or three's fly out in a circular course. After some display the pairs scatter. The same sort of procedure brings replacement of mates lost by death. Either the male or the female may be replaced at a nest; sometimes mates are replaced as many as six times in one season. Replacement usually takes place within twenty-four hours after the loss.

A favored nest site is normally occupied by magpies year after year. Sometimes the same nest is reoccupied. Some of the forms (*nuttallii*) regularly nest in high trees, at the ends of branches, usually near the top. Others (*hudsonia*) select bushes or sites close to the ground in trees. Almost any sort of support will hold the nest whether near the trunk, out on a limb, or among smaller branches. The exceptionally large and bulky nest, as much as three or four feet high and two or three feet in diameter, has a base of coarse sticks, and a cup of finer material and mud, lined with rootlets or hair; the whole is capped by a dome with one or more side entrances. Occasionally, however, especially when it is in a thorny bush, a nest will be without a dome. Both birds of a pair take part in nest building which requires about six weeks. Nest construction may be interrupted by storms.

Eggs of all the magpies are an olive-buff, variously spotted and blotched. Geographic variations may be distinguished in their coloration and size. Numbers in a set normally vary from four to ten, averaging around seven. There is possibly a greater number per set in the northern part of the range than in the south. Normally only one brood is reared per year, but nests and eggs may be replaced if early ones are destroyed.

Incubation of magpie eggs requires approximately eighteen days. Brooding begins with laying of the fourth or fifth egg. The female alone broods. The male carries food to the female, beginning before the eggs are laid. Usually the female leaves the nest to be fed; sometimes the male goes into the nest with food. The feeding is accompanied by loud calls. The bird broods closely, but nearly always it slips off when the nest is approached.

The young magpies are naked when first hatched; they have no down at any nestling stage. They are fed by both parents. Young stay in the nest for about three weeks, crawl out on the nearby branches when four weeks old, fly a little when they are five, and fly well when six weeks old. The young leave the nest in a group which joins with others and, together, they wander and forage for the remainder of the summer. Usually, only three or four survive to leave the nest.

On the ground a magpie walks, hops, runs, dodges or makes short leaps with the aid of its wings. The flight is usually short and in the wind it is wavering, for the long tail then proves to be a hindrance, although, ordinarily, it gives the bird a graceful appearance.

Magpies have a great variety of notes, some of them musical but most of them harsh. They also show an ability to imitate and to learn human speech.

Danger is quickly sensed by these birds whereupon they become particularly shy, and they attempt to slip away.

Except that the total numbers are continually changing, and they can be kept at a low level by persistent human effort, almost nothing can be said definitely about magpie populations. The large number of eggs laid suggests a high natural mortality which if

it is cancelled wholly or in part leaves the bird able to replace or build up its numbers at a rapid rate. Occupation of magpie range for agriculture tends to improve conditions for the bird; its numbers increase unless special effort is made to remove the surplus.

Occasions are few when magpies pay more than casual attention to other kinds of birds in their surroundings. On occasion the yellow-billed magpies compete with Lewis woodpeckers in winter for forage places, and frequent skirmishes may be seen between these two species. Magpies show an inclination to nest close to occupied nests of large raptorial birds when there is opportunity.

Along with its near relatives, the jays and crows, this bird has a widespread reputation for destruction of small birds. Examples are few, but they indicate that nestling magpies are sometimes fed eggs or young of small birds. However, the possible losses are restricted by the circumstance that the magpie nests earlier than do most species of birds within its range. Colonies of water birds often suffer reduction from the raids of magpies. That the damage is localized is shown by the fact that only eight out of three hundred and thirteen stomachs examined by Kalmbach contained remains of birds. The magpies usually eat small eggs where they find them, but they may carry off large ones.

Other kinds of animals find many uses for magpie nests. In the range of the yellow-billed form, sparrow hawks commonly nest in these structures. The long-eared owl is a frequent nester in the American black-billed magpie nests; many other species occupy them in other parts of the range. The nests are used as temporary retreats by such birds as robins, blackbirds, bluebirds, and warblers. A gray fox was once found in the daytime in a magpie nest. Another report concerns a brood of house cats reared in one.

Relations of magpies to large mammals, including domestic stock, are important in the lives of magpies. It is well known that they come frequently to pastures and stockyards where forage conditions are favorable. There are many records of their perching upon the backs of animals—sheep, cattle, horses, hogs—where they dig into the flesh. The habit is of long standing, for they troubled horses of early explorers in America. There is evidence that the buffalo exerted an important influence upon magpies.

The great spotted cuckoo, in Spain, and the koël, in India, deposit eggs in magpies' nests, which are fostered by the latter birds.

Many allusions to the magpie in folk lore and the superstitions concerning it demonstrate widespread familiarity with it in early times. The same quality of the group is reflected in the large number of vernacular names, more than four hundred, that have been applied to the magpie.

A few of the problems mentioned in the introduction require further comment. Some progress, though not so much as was hoped for, resulted from the attempt to detect racial traits in behavior and adaptive significance of peculiarities in structure. Certain items in the natural history of magpies seem to warrant emphasis for their general significance. However, it seems likely that the significance of many other items will be recognized only when enough kinds of birds are analyzed to make possible close comparisons.

No extensive comparison with other types of birds is made, partly because of the

dearth of basic detail. It seemed more profitable to collect and arrange materials which bear upon this one kind of bird in such a way as to make them usable in some later comparison than to enlarge the scope of this undertaking so as to make it include general avian biology. However, the second type of use has been kept in mind during the preparation. It is not to be expected that conclusions of widespread application would result from a study of one kind of bird, although such a study well might suggest or modify general inferences.

As to the question of usefulness of local faunal lists, studies of hundreds of them for their contribution to the life story of one kind of bird brings the opinion that they have been worth all the effort they have involved. However, it seems just as plain that in the future, effort spent in this manner will not be so valuable as it has been in the past. This opinion does not imply that publications in the form of local lists should not be continued, but it supports the suggestion that emphasis can be shifted to advantage into other channels. For example, it has been urged often that serious bird students might profit by giving their attention to planning and carrying out studies which concentrate upon some small phase of bird life such as a single item in the life of an individual or species. But for the person whose preference or opportunity dictates that he make general miscellaneous observations when he watches birds, every encouragement should be given for him to organize and report upon them in printed form. For a long time this will continue to be an important method of building our knowledge of natural history. And, in my opinion, it in no way hinders any bird watcher from indulging in the art of thinking.

I have been asked the question: What good is such a report as the present one or the type of study involved in it? To this a reply may be made somewhat as follows. It is probably an axiom that just as species differ in structure and, on a different order, individuals differ in structure, these variations are accompanied by corresponding differences in habits and behavior. In fact, the latter may be more easily detected than structural contrasts. Possibly, because it is more easily modified, behavior may be a more delicate indicator of response to environment than gross anatomy. Hence, studies of adaptation need to employ the facts of both behavior and structure.

The conviction that every kind of vertebrate animal should be studied extensively may be a valid one. At any rate, as rapidly as possible an invoice should be made of what has been learned by all observers concerning representative kinds of birds. The present compilation concerns one genus. At the same time that it provides a foundation for further, more discriminating work on the magpie, it supplies items that can be used in comparison with other groups of birds. The first provision leads to correlation of field studies of behavior with laboratory or controlled studies of the functions of organs and organ systems. Because of it, physiological studies can make use of results of field studies in the natural history of magpies. The second leads to determination of the phylogenetic order of traits of behavior. It should be known what actions go along with change in time, individual, geographic race, species, genus, family, or order.

It is doubtless not desirable to study every kind of bird on the same basis as suggested here. An accumulation of studies would probably reveal needs for change of procedure. However, the present indications are that the type of material assembled in this report would be an aid to the synthesis which all workers agree is needed for an important advance in understanding of natural history.

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