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Regional Avifaunal Change

A CENTURY OF AVIFAUNAL CHANGE IN ALASKA

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Abstract. Avifaunal changes in Alaska have resulted from both natural and man-induced causes. The geographic ranges of eight North American species have expanded into Alaska, and the range of one (Barn Swallow) has contracted significantly—apparently all naturally. Most changes in distribution and numbers, however, have been man-induced, either through over-harvesting or through environmental alterations (Short-tailed Albatross, swans, geese, Peregrine Falcon, Bald Eagle). Through management efforts, declines in some species appear to have been stemmed, even reversed, but declines in others are only now being detected (two Beringian eiders and six Central Alaska passerines).

Key Words: Alaska; avian population changes; avian range expansions; albatrosses; cormorants; waterfowl; raptors; passerines.

Apparent changes in Alaska's avifauna in the last 100 years fall into several categories—those we believe are real changes; those that merely reflect our increased knowledge of the avifauna, especially over the last 30 years; those that may be natural long-term fluctuations; and those attributable to confused species identifications. It is almost impossible to distinguish, today, whether some perceived changes are real directional changes or just fluctuations, and some species seem to fall into more than one of the above categories.

The erratic pre-World War II history of exploration of Alaska's avifauna is well summarized in a 29-page introductory chapter of Gabrielson and Lincoln's (1959) *The Birds of Alaska.* Before the development of overland transportation in Alaska, exploration was largely by water. Hence, most early knowledge of the avifauna came from coastal areas and from the vicinity of the Yukon River (Fig. 1), and winter and spring observations were few, because ice blocked boat travel on the Yukon River and in the Bering, Chukchi, and Beaufort seas. Overland transportation was primitive until the Richardson Highway, between Valdez and Fairbanks, became regularly passable, after 1913, and until the Alaska Railroad, from Seward to Fairbanks, was completed in 1925. Even today, however, ground transportation in Alaska is limited in extent. Air transportation, inaugurated in Alaska in 1924, has provided a critical platform for ornithological exploration, especially in the last 40–50 years.

A number of events 40–50 years ago contributed to the beginning of a real foundation against which future avifaunal changes could be compared: the stationing of World War II troops, including some ornithologists, in Southwestern Alaska in the 1940s; the opening of the Naval Arctic Research Laboratory at Barrow in 1949; the growth of biological disciplines at the University of Alaska Fairbanks, including, in 1950–1951, establishment of the Alaska Cooperative Wildlife Research Unit, and Kessel's arrival there; and the inauguration of U.S. Fish and Wildlife Service (USFWS) aerial Waterfowl Breeding Population Surveys in the mid-1950s. Interest in and knowledge of the avifauna has increased ever since, and in recent years it has been increasing almost exponentially.

Few databases are yet good enough, however, to use in detecting or measuring change—the exceptions being some species of waterfowl, seabirds, and raptors. For most species we have only either sporadic, often vague comments on status in the historical literature or data too recent or too incomplete to be a basis for evaluating change.

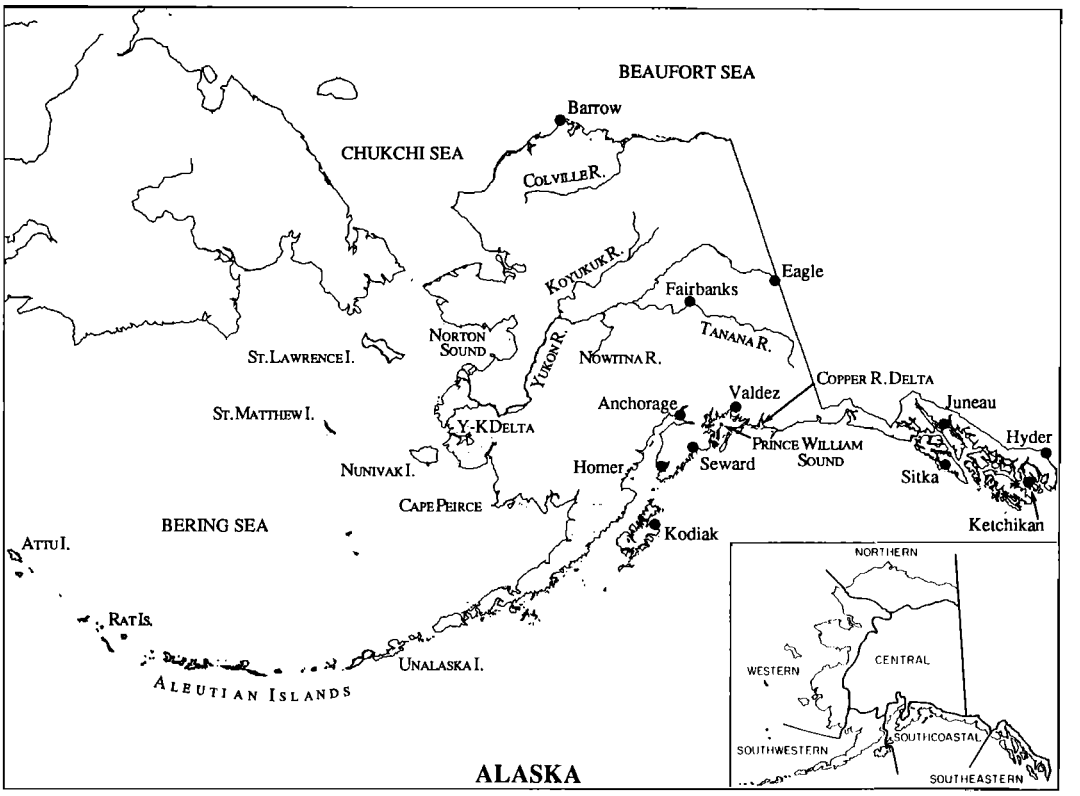

FIGURE 1. Alaska map showing selected place names and geographic features. The inset outlines Alaska's six biogeographic regions as recognized by Kessel and Gibson (1978).

Thus we have based our assessments of avifaunal change on information of variable quality from a variety of sources.

SEABIRDS: CONFUSED IDENTITIES?

ALBATROSSES

To an extent, problems of identification might be involved in the historic record of the abundance and distribution of the two white-bodied albatrosses in Alaska, Short-tailed (*Diomedea albatrus*) and Laysan (*D. immutabilis*). The precipitous decline of the Short-tailed Albatross during the 19th and in the early 20th century, at the hands of feather hunters on its breeding islands, from "over 100,000 birds on Torishima Island during the busiest time of feather gathering" to "at least 250 individuals" has been discussed recently by Hasegawa and DeGange (1982). Since the Laysan Albatross, which superficially resembles the Short-tailed, was not described until 1893 (when the Short-tailed had been known to ornithology for 124 years), it is possible that some Laysan Albatrosses were present among the many Short-tailed Albatrosses in Alaska waters.

In June 1911 Bent (1922) saw so few white-bodied albatrosses in the Aleutians that he was unable to confirm that they were Short-tailed, the expected species. His estimate that the range of the Laysan Albatross did not extend north of 40°N was the last word on the subject for many years. The Laysan Albatross was first identified in Alaska from a specimen collected in the Aleutians in summer 1937 (Kenyon 1950). Today this species is an uncommon to fairly common summer visitant in the Aleutians (Kessel and Gibson 1978)—a conspicuous member of the avifauna. Yesner (1976) found that most of the (abundant) albatross

remains in Aleutian archeological sites were of Short-tailed Albatrosses and that the remains of Laysan Albatrosses "were restricted to the upper levels" of these sites. We agree with his inference that increased reports of the Laysan are due to its recent expansion into the range formerly occupied by the Short-tailed Albatross.

Cormorants

Historically, there has been considerable confusion about the distribution and abundance of the several cormorant species in Alaska, apparently in part because of identification errors (see below; also Preble and McAtee 1923) and perhaps because of nomenclatorial confusion (Stejneger 1885). Cormorant populations have fluctuated over the years and breeding colonies have shifted, but we find no good basis for concluding that the overall status here of the Double-crested Cormorant (*Phalacrocorax auritus*), the Pelagic Cormorant (*P. pelagicus*), or the Red-faced Cormorant (*P. urile*) has changed significantly since the mid-1880s (contra Gabrielson and Lincoln 1959, Murie 1959, Sowl 1979).

Because not all information surfaces in a timely fashion, it can be hazardous to historical accuracy to infer from a few, contemporary data that a phenomenon itself is contemporary, e.g., the occurrence of Red-faced Cormorant in Southcoastal Alaska. As long ago as 1843 a Red-faced Cormorant was collected as far east as Kodiak (Russian Zoological Museum [ZIAN], St. Petersburg, list—*19*43 in Gabrielson and Lincoln [1959] is a typo), where the species also occurs today. For a complex of reasons, however, this information on the eastern extent of this bird's distribution in the North Pacific was not reflected in an AOU Check-list until 140 years later, in 1983.

In 1843–1844 the Russians (ZIAN list) also collected Red-faced Cormorants at Attu and at Unalaska islands; in 1873, Dall (1874) found them resident throughout the Aleutians; and in 1881–1883, Stejneger (1885) observed a population in the Commander Islands. Fifty years later, in the 1930s, Murie (1959) also found them throughout the Aleutians. One must question, therefore, the identifications of Turner (1885), who did not list this species in the western Aleutians—its present center of abundance—in 1880–1881, but who reported Double-crested Cormorants to be abundant breeders there. (Like the Double-crested Cormorant, of course, Red-faced and Pelagic cormorants are also double-crested.)

Since no specimens were collected and no subsequent observers have reported the Double-crested Cormorant in the western Aleutians, early reports of them there (Turner 1885, Clark 1910) appear to be erroneous identifications. Turner (1886) also reported Double-crested Cormorants breeding abundantly on Besboro Island, Norton Sound, northeastern Bering Sea, although neither Dall and Bannister (1869) nor Nelson (1883, 1887) reported this species anywhere in the Bering Sea. Nelson (1883) reported Pelagic Cormorants nesting in large numbers toward the head of Norton Sound, however. Pelagic Cormorants currently breed on Besboro Island (Sowls et al. 1978), and Double-crested Cormorants are not known farther north than Cape Peirce and Nunivak Island.

Confusion was also caused by Nelson (1887:66), who outlined for the Red-faced Cormorant a wide distribution in the central and northern Bering Sea, including St. Matthew and St. Lawrence islands and both sides of the Bering Strait, an outline that reads remarkably like his earlier description (Nelson 1883:103) of the Pelagic Cormorant's range. Is this an error introduced during editing by H. W. Henshaw, after Nelson's retirement? Identity of bones from middens on St. Lawrence Island, ascribed to the Red-faced Cormorant by Friedmann (1934), is open to question.

And, finally, some recent work on Alaska cormorants by Siegel-Causey (1991)—work that described a new and contemporary species named "Kenyon's Shag (*Stictocarbo kenyoni*)"—must be viewed with skepti-

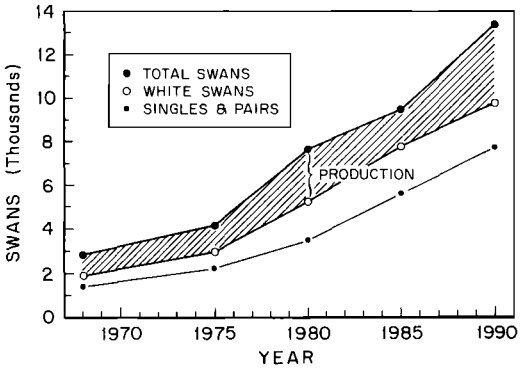

FIGURE 2. Trumpeter Swans recorded in Alaska during five statewide summer censuses 1968–1990 (from Conant et al. 1991).

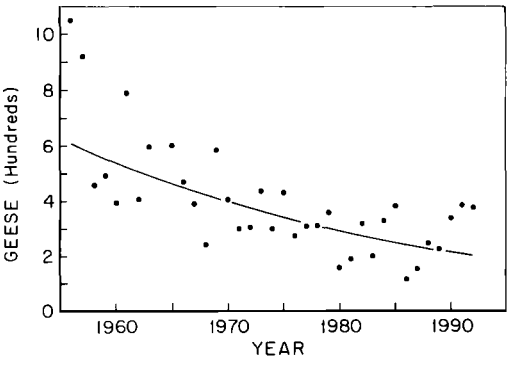

FIGURE 3. Decline of all geese recorded on the five segments of U.S. Fish and Wildlife Service Waterfowl Breeding Population Surveys within the coastal zone of the Yukon Delta (from Conant and Groves 1992). Species include the Emperor Goose, Greater White-fronted Goose, Brant, and Cackling Canada Goose, all of which have declined, mainly because of over-harvesting.

cism, in part because a number of the Red-faced Cormorant skeletons used in establishing a comparison for the diagnosis of "*S. kenyoni*" (for which no external characters are known) are from localities beyond the geographic range of *P. urile*.

WATERFOWL: UPS AND DOWNS

Swans

Early knowledge of the occurrence of Trumpeter Swans (*Cygnus buccinator*) in Alaska was hampered by identification problems, inaccessibility of their nesting marshes, and perhaps small numbers caused by hunting on portions of their wintering grounds. There is limited evidence of their presence, however, throughout most of the geographic area where they currently breed (Banko 1960, Hansen et al. 1971). Substantial breeding populations were "rediscovered" in several parts of Southcoastal Alaska between 1949 and 1957 and in Central Alaska—where the swans had been erroneously assumed to be Tundra Swans (*C. columbianus*)—in 1958–1960 (ibid.). Since then, the U.S. Fish and Wildlife Service has searched for and monitored through aerial surveys Alaska Trumpeter Swan populations. Five complete aerial censuses were flown from 1968 to 1990 (Fig. 2). During this period, the censuses showed a steady increase, from a total of 2847 in 1968 to 13,337 in 1990, and there is evidence that available habitat in Southcoastal Alaska is now saturated and that peripheral habitat is being pioneered in Central Alaska (Conant et al. 1991).

In the past few years, too, Tundra Swans, previously thought to summer only on the coastal tundras along the Bering, Chukchi, and Beaufort seas, have also nested in some of the Yukon River drainages of Central Alaska. About 90% of swans in the lower Koyukuk river drainage and 50% in the lower Nowitna River are Tundra Swans (Loranger and Lons 1988), as are about 40% (11 pairs) in the upper Koyukuk drainages (Wilk 1989). In addition, up to four pairs have been identified at Minto Flats west of Fairbanks (K. S. Bollinger and R. J. King, USFWS unpubl.). The Tundra Swans in the lower Koyukuk and Nowitna rivers have probably been there for many years, but those on Minto Flats and in the upper Koyukuk apparently represent range expansion.

Geese

In contrast to swans, there has been a long-term population decline of geese, especially in Southwestern and Western Alaska, mainly because of varied human influences (King and Derksen 1986; also, Fig. 3). Except for the Aleutian Canada Goose

(*Branta canadensis leucopareia*), whose populations were nearly annihilated by Arctic Foxes (*Alopex lagopus*) introduced for fox farming numerous times between 1750 and 1930, most declines have occurred over the last 40 years and have ranged from 35% to over 90%.

The Emperor Goose (*Chen canagica*), an endemic form restricted primarily to the southern Chukchi and Bering sea region—Beringia—declined an estimated 34% between the 1960s (when 140,000–150,000 were reported by King and Lensink [1971]) and 1981 (Petersen and Gill 1982), and the population continued to decline through 1986 (USFWS 1988). The main cause was apparently "subsistence harvest," which was restricted beginning in 1984; also, fall hunting was reduced, and was closed completely in 1986 (ibid.). As a result, the population has begun to increase from its lows of about 50,000 adults and in 1991 was up again to 71,000–75,000 (USFWS 1992).

Other geese, especially those on the famous goose-producing Yukon-Kuskokwim Delta, have suffered from over-harvesting, including spring hunting, egging, and molt drives on their breeding grounds and fall hunting on their wintering grounds, mostly in Oregon, California, and western Mexico. Brant (*Branta bernicla*), Cackling Canada Geese (*B. c. minima*), and Greater White-fronted Geese (*Anser albifrons*) all declined significantly between the mid-1960s and the mid-1980s (King and Derksen 1986; USFWS 1986, 1987). The implementation in 1984 of a cooperative conservation program, known as the Yukon-Kuskokwim Delta Goose Management Plan (Pamplin 1986), seems to have allowed for some recovery, but population levels are still far below those of the 1940s–1960s (Migr. Bird Manage., USFWS unpubl.).

Beringian Eiders

Populations of two species of eiders endemic to Beringia, Spectacled Eider (*Somateria fischeri*) and Steller's Eider (*Polysticta stelleri*), have shown steep declines. The worldwide population of Steller's Eiders may have declined by 50–75% in the last 25 years; and on the Yukon–Kuskokwim Delta, where half of the world's population of Spectacled Eiders has nested, numbers may have dropped over 90%, from perhaps 47,700 pairs in the early 1970s to 2700 pairs today (Federal Register 57[90]:19852–19856, 8 May 1992). While the U.S. Fish and Wildlife Service agreed in 1992 that both eiders warranted listing as "threatened," listing for the Steller's Eider was "precluded by listing actions of higher priority" (ibid.), i.e., other species were in more imminent danger of extinction.

RAPTORS: RECOVERED POPULATIONS

Peregrine Falcon and Bald Eagle

Population changes in two falconiforms have occurred over the past 40 years. Those of the Peregrine Falcon (*Falco peregrinus*) have been well-documented (Cade et al. 1988, White 1994). Suffice it here to say, peregrines hit population lows along the Colville River in Northern Alaska and along the upper Yukon River in eastern Central Alaska in the early 1970s (Ambrose et al. 1988) as a result of pesticide contamination. Since then numbers have increased annually, with peak numbers reached in 1990, when there were 58 pairs, 37 of which produced 103 chicks, on the Colville River and 28 pairs, with 76 young, on the upper Yukon River (R. E. Ambrose and T. Swem, USFWS unpubl.). Ambrose and Swem's data for 1991 and 1992 suggest that the number of breeding birds is stabilizing at about 30 breeding pairs on the Colville and 25 on the upper Yukon.

Bald Eagle (*Haliaeetus leucocephalus*) numbers have increased in some regions of Alaska, especially in Southeastern Alaska, where their numbers were depressed by a predator-control bounty between 1917 and 1952. More than 128,000 Bald Eagles were destroyed for bounty during this period, over 100,000 of them from Southeastern Alaska (Robards and King 1966). Five aerial sur-

veys of breeding eagles in Southeastern Alaska over a span of 25 years have shown a significant increase, from 7230 ± 896 adults in 1967 to 12,074 ± 2516 in 1987 and 13,341 ± 2348 in 1992 (Fig. 4). The total number of Bald Eagles in 1987, including immatures, was 14,000–16,000 (M. J. Jacobson, USFWS unpubl).

Especially since 1970, there also seem to have been increases in Central Alaska, where the current estimate is 525–725 nesting pairs (R. J. Ritchie and R. E. Ambrose, unpubl. MS), and in the Kodiak archipelago, where the current estimate is 600–800 nesting pairs (D. Zwiefelhofer, USFWS pers. comm.).

On the other hand, there has been a historical decline in westernmost Alaska. Formerly occupying a range that reached into the eastern Palearctic, the Bald Eagle was described in the mid-1880s as "not so abundant on Bering Island [Commander Islands] as it used to be" (Stejneger 1885), and by the 1930s it was "scarce in the Near Islands," the westernmost group of the Aleutians (Murie 1959). Today the Bald Eagle does not breed west of the Rat Islands, west-central Aleutians. Reasons for this range reduction are unknown.

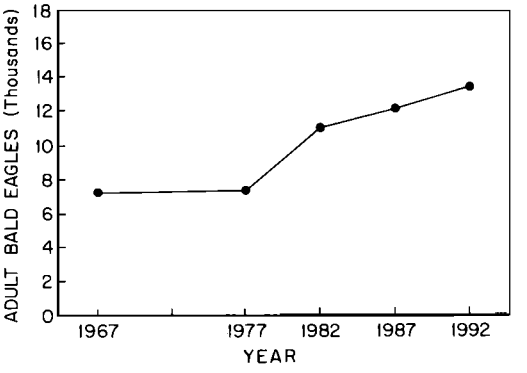

FIGURE 4. Population trend in adult Bald Eagles in Southeastern Alaska, 1967–1992 (from M. J. Jacobsen, USFWS unpubl.).

PASSERINES: DECLINES AND FLUCTUATIONS

Emberizids and Turdinae

At least six of the common to abundant passerines in Central Alaska appear to have declined in numbers in recent years: Orange-crowned (*Vermivora c. celata*) and Yellow (*Dendroica petechia amnicola*) warblers and Fox (*Passerella iliaca zaboria*) and White-crowned (*Zonotrichia leucophrys gambelii*) sparrows—all shrub thicket birds—and the Yellow-rumped Warbler (*Dendroica coronata hooveri*) and Swainson's Thrush (*Catharus ustulatus incanus*), of deciduous and mixed deciduous-coniferous forests. It is difficult to detect declines in common species, partly because of well-known problems of percentage acoustical detections of numerous versus less numerous birds and partly because annual variations of 25–50% are not unusual in passerines, at least in Central Alaska. But based on roadside counts that Kessel has run for over 20 years, and on casual observations of Fairbanks birders, including the authors, that the woods and thickets about our homes have been almost devoid of bird song since 1990, we believe that significant declines have occurred, at least in the above species. On the other hand, some species, such as the Alder Flycatcher (*Empidonax alnorum*) and American Robin (*Turdus m. migratorius*), do not appear to have declined.

Most of these declines have occurred since 1977. Of the shrub birds, the White-crowned Sparrow has shown a decline of over 50% since 1977, including a 52% drop from 1990 to 1992. Yellow Warbler populations declined more than 30% between 1977 and 1985, oscillated a few years, and then crashed another 45% between 1991 and 1992. The Orange-crowned Warbler declined 45% between 1980 and 1985 and has continued to decline since then, dropping 59% between 1987 and 1992. The Fox Sparrow has declined steadily since 1982, with a total loss of 77% by 1991 and 1992. The two deciduous forest birds have both shown sharp declines since 1989, the Yellow-rumped Warbler dropping 75% and the Swainson's Thrush at least 33%. As a result, the Swainson's Thrush, formerly the second most numerous passerine at Fairbanks, has

slipped to third most numerous (behind Alder Flycatcher and American Robin) and has dropped from a relative abundance of "abundant" to "common."

The reasons for the population declines in these passerines remain obscure, and they may differ among species, since these birds have differing food habits, habitats, wintering grounds, and migration routes.

Swallows

Changes in swallow populations in Alaska have been varied. The geographic range of the Cliff Swallow (*Hirundo pyrrhonota*), a species that, under natural conditions, usually affixes its nest to a rock cliff face, has probably not changed significantly over the years—its range apparently limited by environmental temperatures, especially the amount of summer warmth and availability of flying insects for food (Kessel 1989). Abundances have increased, however, with the availability of artificial nesting sites provided by human construction, e.g., buildings, mining dredges, and bridges. Colonies of 350–425 nests are known on bridges in Central Alaska.

Barn Swallow (*H. rustica*) populations, on the other hand, have declined dramatically since the early 1900s. The bird was common and widespread in the late 1800s–early 1900s (Dall and Bannister 1869, Turner 1886, McLenegan 1887, Nelson 1883, Grinnell 1900, McGregor 1902), but today it is largely restricted to Southeastern Alaska, where it is fairly common, and to Southcoastal Alaska, where it is uncommon as far west as Prince William Sound. The species is very rare or casual elsewhere. The cause of its decline since the turn of the century is unknown, but Western and Northern Alaska, with harsh environmental conditions, are at the extreme periphery of habitable range for this species. The increase of Cliff Swallows in these same regions in recent years is probably unrelated, since there appears to be no competition between the two species (McCann 1936, Samuel 1971).

Tree and Violet-green swallows (*Tachycineta bicolor* and *T. thalassina*) have shown unexplained long-term fluctuations. At Fairbanks, from 1951 to 1962, Violet-greens were more numerous than Trees, but in 1963 there was an increase in Trees to where they were about equal in numbers to Violet-greens. Numbers remained about equal through 1968, after which Tree Swallows began to predominate. By 1972 most swallows in the bird houses at Fairbanks were Trees. Violet-green Swallows increased somewhat in 1975, but were still outnumbered by Trees in 1976–1978. In 1979, however, even though Violet-green migration began early and continued normally through May, something severely affected Tree Swallow migration, and none was seen in Fairbanks until after 18 May. As a result, apparently, Violet-greens were more numerous than Trees in 1979, but numbers were again similar in 1980–1989. A major reversal occurred in 1990, however, when 80% of breeding *Tachycineta* in Fairbanks were again Violet-green Swallows.

SPECIES RANGE EXPANSIONS

Into Alaska

The first Alaska records of the Wilson's Phalarope (*Phalaropus tricolor*) were made in 1962, near Eagle (Kessel and Springer 1966) and at Barrow (Pitelka 1974). Its breeding range reached as far northwest as southwestern Yukon Territory by the late 1970s, when a pair appeared to be "defending the nest" near Haines Junction in 1977 (Am. Birds 31:1161, 1977) and as many as 14 adults, a nest with eggs, and two young were recorded near Whitehorse in 1978 (Am. Birds 32:1185, 1978). The species now occurs erratically and in small numbers in late spring and summer in Central, Southcoastal, Southeastern (and even Northern and Western) Alaska, and circumstantial evidence of local breeding has been recorded once each in the Anchorage and in the Fairbanks areas. In recent years the species has occurred as a casual fall migrant in Southeastern Alaska—perhaps birds that

just moved due south from Yukon Territory.

The Caspian Tern (*Sterna caspia*) is a recent invader from lower latitudes via the eastern North Pacific coast (Gibson and Kessel 1992). The species was added to the Alaska avifauna in summer 1981, when up to four birds were seen at Ketchikan and two were seen in Sitka Sound. Since then the species has occurred annually in Southeastern and Southcoastal Alaska; adults feeding begging, flying juveniles pointed to probably breeding on the western Copper River Delta by 1989 (ibid.). Beyond Prince William Sound, Caspian Terns are now casual summer visitants as far west as Anchorage and Homer and in eastern Central Alaska.

The Band-tailed Pigeon (*Columba fasciata*) was unknown in Alaska until 1965 (Olson 1974). It occurs only at the southeastern periphery of the state, and in small numbers (Kessel and Gibson 1978). Despite sketchy information from adjacent sections of British Columbia (Campbell et al. 1990), it seems clear that the species is only a recent arrival in central British Columbia and in Southeastern Alaska.

The Barred Owl (*Strix varia*) was first recorded in Alaska in 1977, and its current status and distribution here—a scarce but conspicuous resident the length of the Southeastern Alaska mainland (Gibson and Kessel 1992)—is surely a development since that time, rather than an overlooked phenomenon. First noted in British Columbia in 1943, the species slowly expanded its range across that province, reaching the Pacific coast of Canada in 1966 (Campbell et al. 1990).

Anna's Hummingbird (*Calypte anna*) was unknown in Alaska until the late 1960s (Kessel and Gibson 1978), but it is possible that the paucity of observers, or the paucity of hummingbird feeders (since this species is unknown in Alaska away from sugar-water feeders), might account for the absence of records in Southeastern Alaska during the decade following the first certain records in coastal southern British Columbia, in 1958 (Guiguet 1959).

Known in Alaska prior to 1982 from a single sight report, the Least Flycatcher (*Empidonax minimus*) has been recorded all but annually since 1986 along a broad front, from the Interior to Southeastern Alaska, and the species is now regarded as a rare probable breeder at Hyder, the easternmost community in the state (Gibson and Kessel 1992).

Continuing the expansion of its North American range, the European Starling (*Sturnus vulgaris*) was first recorded in Alaska at Juneau in 1952 and was not known beyond Southeastern Alaska until 1960 (Kessel and Gibson 1978). We now consider it an uncommon to fairly common resident about towns and agricultural areas of Southeastern Alaska, and it is regular in small numbers in similar habitats in Southcoastal and Central Alaska east of about 149°W. It leaves Alaska's cold interior for the winter, and it is generally more numerous in Southcoastal Alaska in winter than summer, although it breeds regularly about farms in the Matanuska Valley, north of Anchorage.

It seems to have reached the limits of its breeding range at 65°N in the lower Tanana River Valley, where at Fairbanks in 1978 at least six successful nests were found and where a flock of up to 26 nonbreeders spent the summer (Kessel 1979). Since that time, however, while still of annual occurrence, only a few birds (including juveniles) have been recorded each season.

Note that all these range expansions have been by species from elsewhere in North America. We lack historical data on Asiatic taxa, because information from the western Aleutians was notably sparse until the 1970s, when the regular passage of Asiatic migrants in the Near Islands was discovered by Gibson (1981), and because most detailed information on the status and distribution of birds in northeasternmost Asia is also recent. Thus we have no basis from which to infer that any range expansion from Asia to Alaska has taken place in the last century.

WITHIN ALASKA

The Black Guillemot (*Cepphus grylle*) was first found breeding in Northern Alaska in 1966, in man-made debris at Point Barrow (MacLean and Verbeek 1968); a few years later, it was found breeding in man-made debris on barrier islands to the west and east of Barrow (Divoky et al. 1974). Subsequent expansion along the Beaufort Sea coast into Canada has been entirely man-effected, the result of guillemot "farming" by G. J. Divoky (pers. comm.) at Cooper Island, just east of Point Barrow, where he has provided nesting sites and where he has been able to study, by color-banding over 2000 Black Guillemots since 1976, the life cycle of these birds.

CONCLUSIONS

Some of the avifaunal changes outlined above, such as the Barn Swallow decline and the species that have recently expanded their ranges into Alaska, may just reflect the natural ebb and flow of mobile organisms. The changed status of all species for which we know causes, however, has been the result of human activities: over-harvesting; introduction of pesticides or predators into the environment; habitat changes; and, as in the starling, the introduction of an entirely new form into the biological community. Causes of the most recent precipitous declines in the Beringian eiders and the Fairbanks passerines are yet unknown.

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