

except on the sides of the breast, where there is an encroachment of the pure ash gray of the nape. The top of the head is quite uniform gray, except anteriorly, where the feathers are bordered with white, producing a distinct squamation. The wings are entirely concolor on their outer surface, and the inner web of the outer tail-feather is wholly pure white.

The synonymy of *Æ. fisheri* is as follows :—

- Æstrelata fisheri* RIDGWAY, Proc. U. S. Nat. Mus. V, June 26, 1883, 656 (Kadiak, Alaska; U. S. Nat. Mus.); VIII, 1885, 17, 18 (comparison with *Æ. defilippiana*).—BAIRD, BREWER, & RIDGWAY, Water B. N. Am. II, 1884, 396.—COUES, Key, 2d ed. 1884, 780.
- Æstrelata fisheri* AMERICAN ORNITHOLOGISTS' UNION, Check-List, 1886, No. 100.—RIDGWAY, Man. N. Am. B. 1887, 68.
- ? *Fregetta grallaria* (nec *Procellaria grallaria* VIEILLOT) NELSON, Cruise Corwin in 1881 (1883), 113 (Aleutian Islands southward).

GÄTKE'S HELIGOLAND.¹

BY ELLIOTT COUES.

There is no Heligoland but Heligoland, and Gätke is its prophet. The name means "holy land," and this island in the North Sea is a sort of Mecca to which all good birds must make their pilgrimage or perish in the attempt. Heligoland may more literally be called the magnetic pole of the bird-world, so irresistibly does it seem to attract birds to deviate from ordinary Zugstrassen (flight-lines)—either in isolated wanderings from Asia, Africa or America, or in vast mass-migrations that overshadow the land like clouds crossing the skies. Heligoland is the most peculiarly favored, longest

¹ Heligoland | as an | Ornithological Observatory | the Result of Fifty Years' Experience | by Heinrich Gätke | [etc., 5 lines] | translated by | Rudolph Rosenstock, M. A. Oxon. | [Vignette and motto] | Edinburgh: David Douglas, 10 Castle Street | 1895 | 1 vol., roy. 8vo. pp. xii, 599, 2 portraits of author and various figs. in text.

established and successfully operated ornithological observatory in the world. Gätke's figure is unique in our annals; not one of us can remember a time when he has not stood alone for all we know of the subject to which his life has been devoted, like a veritable Pharos, throwing a steady light upon the dense darkness of our ignorance. The veteran is now in his eighty-third year; he has kept ceaseless watch for half a century; and this volume gives the ripe fruit of his long vigilance, without a sign of failing powers, with the enthusiasm of youth unabated, with scrupulous fidelity to facts, and with scientific precision of statement. It is one of the most original, most remarkable, and most valuable books ever written about birds. I am sure no reader of 'The Auk' can fail to be interested, if I succeed in reflecting upon these pages anything like an adequate representation of Gätke's results.

About one-fourth of the work is devoted to a treatise upon migration in general, as viewed from the Heligoland standpoint, and this is followed by one chapter on color-changes without moult, or what I have called aptosochromatism. The main body of the work is occupied with the systematic consideration of the 397 or 398 species which occur or have occurred on this island, the whole record being given in minute detail. I will revert to the first-mentioned matters in the sequel, when we shall find that some of Gätke's results are nothing short of astounding. But first, let us proceed to some analysis of this extraordinary local list.

To appreciate the situation, we must know that Heligoland is a little island in the German Ocean, due east of the mouth of the Humber in England. It is a mere islet, in fact—a sea-girt red rock of triangular shape, with a flat top and steep sides, practically inaccessible except at one end, where there is a low sand-spit and a broken escarpment; the total length is 5,700 feet, or little over a mile. The rock is bare except for the green turf—so bare that the "throstle bushes," or contrivances made of brush and network to catch thrushes, are among the conspicuous features of the surface. There is a little town, whose buildings are mainly at one corner of the island, and a lighthouse. Such is the scene of Gätke's lifelong labors, to which billions of birds fly regularly; and among them his watchful eye has found astrays from every quarter of the globe.

The first thing that strikes us, on ciphering out the extraordinary list, is the preponderance of land-birds over water-birds which visit the sea-girt rock. The figures are 248 of the former to 150 of the latter, or almost precisely as 3 : 2—that is to say, three-fifths of the population are land-birds, and two-fifths are waders and swimmers. Such a proportion, for such a place, is altogether exceptional; we should expect only a fair sprinkling of land-birds in an avifauna mainly represented by aquatic species.

Another curious thing is, that Heligoland is the home of hardly any birds. The natives cut no figure whatever in the society of this very select spot—no more than New York's 'Four Hundred' do in the real life of that metropolis. Thus Gätke says (p. 577) : "Of the nearly 400 species of birds comprised in the avifauna of Heligoland only three species regularly, year after year, have made their breeding home upon this island rock, these being the Guillemots,¹ a few pairs of the Razorbill, and about twenty pairs of Sparrows; but these have been joined within the last few years by a few pairs of Starlings and House Martins." Nevertheless, there are a few others which have been known to breed occasionally, or which formerly did so and do not now. Considering these, I make out the following list :—

1. *Sturnus vulgaris*. Properly a migrant, in profusion, with migrations peculiar in several respects; but a few pairs have bred, as above said.
2. *Hypolais icterina*. Migrant, formerly common, now rare; a pair bred, summer of 1876.
3. *Saxicola œnanthe*. Properly a migrant, common; but has (probably) bred occasionally.
4. *Motacilla alba*. Migrant, but mainly a summer bird which breeds occasionally or tries to do so.
5. *Motacilla rayi*. Migrant, early and regular, not common; known to have bred twice.
6. *Anthus arboreus*. Migrant, May and August, September, common; nested once, but the eggs were destroyed.

¹ *Uria troile* and *U. ringvia*. In Gätke's list these count as two species, Nos. 384 and 385. His total numeration is ostensibly 396; to which add No. 248a, *Otis tarda*, given in preface but not numbered, and No. 254a, *Platalea leucorodia*, interpolated in the list, making in all 398—or 397 without counting *U. ringvia*.

7. *Alauda arvensis*. Almost resident; only common in migration; breeds occasionally.

8. *Fringilla cœlebs*. Migrant, chiefly April and September, October; breeds now and then.

9. *Acanthis rufescens*. Occasional. A pair bred in 1872.

10. *Passer domesticus*. The only land-bird which is a resident and regular breeder.

11. *Chelidon urbica*. Common, chiefly in migration; a small colony breeding.

12. *Hæmatopus ostralegus*. Common; chiefly in migration, but seen at any season; has bred occasionally.

13. *Larus argentatus*. Commonest Gull at any season; formerly bred, when protected—up to about 80 years ago.

14. *Uria troile* (and *ringvia*). Regular breeder; now about 2,000 birds, formerly more; protected by law to July 25.

15. *Alca torda*. A few, regularly breeding with the Murres.

16. *Fratercula arctica*. A few, usually seen among the Murres; formerly bred.

This finishes the few species ever known to be native to Heligoland; and most of these are only fortuitous in this relation, their real character being that of migrants, thus requiring to be reconsidered in another connection.¹

Proceeding now to further analysis of the list, we at once encounter a difficulty; for Gätke's birds are often non-conformists, which do not fit well in the several categories we are accustomed to. When we speak of summer visitants, we generally mean breeders, which few of Gätke's are. Many of his winter visitants are genuine migrants of that season. Various other vagaries, or what seem so to us, develop as we scan the record. I will venture, however, upon a second list which shall include species that are neither breeders, nor regular spring and fall migrants only, nor yet belong to the astonishing array of mere astrays. It would be a short one, were it not for Sea-ducks and Sea-gulls:—

¹Herr Gätke is an ornithologist of the old school which includes such honored names as those of Blasius and Naumann in Germany, and too well founded in the faith of bygone days to yield to innovations in classification and nomenclature upon which some of us boys plume ourselves. In the above list, and others to follow, I use in the main the modern names which his translator, Rosenstock, supplies in footnotes, unless I know some other name which seems to suit our code better. The present occasion is not one of canonical scrupulosity in terminology—it is simply ornithological.

1. *Haliaeetus albicilla*. Irregular winter visitant; mostly young birds; one adult taken Feb. 3, 1875; another one seen.
2. *Pandion haliaëtus*. Regular summer visitant, chiefly April to Sept., but no breeding record.
3. *Buteo buteo*. Common at any season, except in June and July.
4. *Archibuteo lagopus*. Resident, *i. e.*, may occur at any season — not that any one individual necessarily stays the year around; common in migration; casual in winter; not a breeder.
5. *Troglodytes parvulus* (*Anorthura troglodytes*). Resident, except in summer; no breeding record.
6. *Anthus rupestris* (*obscurus*). Common all the year, except in summer.
7. *Emberiza citrinella*. Resident in varying numbers; no breeding record; common in migration.
8. *Plectrophenax nivalis*. Chiefly and most properly winter visitant, but some as early as Aug. and Sept.; later abundant; 3 specimens in full dress.
9. *Acanthis cannabina*. Chiefly migrant, but winters; common during most of the year — Aug. to Apr.
10. *Acanthis flavirostris* (*montium*). Chiefly migrant, but common Oct. to Apr.
11. *Acanthis linaria*. (Mealy Redpoll of the European writers.) Irregular winter visitant, sometimes in innumerable multitudes in the fall; always rare in spring.
12. *Chloris chloris*. Great numbers migrating through winter of 1884-5; some seen till end of May.
13. *Gallinago gallinago*. Common, and only absent in June and July; great flights sometimes in winter.
14. *Tringa maritima*. Mainly and properly winter visitant; some in Aug., Sept., and in spring.
15. *Calidris arenaria*. Mainly winter visitant; common from end of July; only stragglers in May.
16. *Cygnus musicus*. Flights of 10, 20 or more migrating every winter.
17. *Bernicla brenta*. Flights every winter, like those of the Swans.
18. *Mareca penelope*. Fairly frequent in winter.
19. *Tadorna cornuta*. Rare; mostly young birds in Aug., Sept.; some old ones in winter.
20. *Oidemia nigra*. Myriads in winter on the sea.
21. *Oidemia fusca*. Myriads in winter on the sea.
22. *Aythya marila*. Very common, especially in severe winters.
23. *Aythya cristata*. Rare, in severe winters.
24. *Aythya ferina*. Rare, in severe winters.
25. *Glaucionetta clangula*. Common, especially in severe winters; mostly females and young males.
26. *Clangula hyemalis*. Common, especially in severe winters; earliest Duck to arrive.

27. *Somateria mollissima*. Common in autumn and winter, irrespective of the weather.
28. *Mergus merganser*. Common in severe winters, rare in mild ones.
29. *Mergus serrator*. Very common in severe winters.
30. *Mergellus albellus*. Rare, in winter—hardly more than a straggler.
31. *Phalacrocorax carbo*. Rare and irregular, in winter; only one ever taken in full dress.
32. *Phalacrocorax graculus*. Like the last, but rarer.
33. *Sula bassana*. Occasional at any season, except Jan. and Feb. of hard winters; but no breeding record.
34. *Rissa tridactyla*. Commonest Gull, from Oct. to Feb.; much killed for food and ornament.
35. *Larus glaucus*. Frequent, in late fall and winter; never seen in full dress.
36. *Larus leucopterus*. Rare in winter—hardly to be seen every winter.
37. *Larus marinus*. Common, in autumn and winter, but extremely rare in full dress.
38. *Larus fuscus*. Not common; chiefly young birds in Sept.
39. *Larus canus*. Common in winter.
40. *Larus ridibundus*. Rare, especially old birds; young ones in sporadic flocks.
41. *Larus minutus*. Common in migration, from Sept. onward, but many also winter. Only twice taken in full dress (once Nov. 15, 1861).
42. *Fulmarus glacialis*. Irregular, mostly isolated cases; sometimes common in Nov. and Dec.
43. *Procellaria pelagica*. Taken almost every winter, but hardly regular; 8 or 10 in Nov., Dec. 1879.
44. *Urinator immer*, better known as *Colymbus torquatus*. Common in late fall and winter; rarely seen in full dress.
45. *Urinator arcticus*. Frequent in winter; only one specimen ever taken in full dress.
46. *Urinator lumme*. Commonest Diver in winter; immense flights occasionally.
47. *Cepphus grylle*. Common, in Aug., fall, and winter; rarely seen in full dress.
48. *Alle alle*. Common late in autumn and in winter.
49. *Colymbus griseigena*. Frequent in fall, rare in winter, no bird in full dress seen for 20 years.
50. *Colymbus auritus* (*cornutus* Auct.). Common in fall and winter.

This list of 50 species includes a few "irregulars," and a few others which are "resident" after a fashion; for the rest it is the list of regular winterers of Heligoland. In this category, the land-list is only about one-fifth; and if we except roving flocks of some of these species, the numbers of individuals bear no calcu-

lable proportion to those of the water-birds. Of the latter, the main body is composed of marine Anatidæ and Laridæ. The implication of "severe" winters is, when the Baltic and other waters, which would ordinarily have their quota of sea-birds, are frozen up to an extent which drives hordes of such birds elsewhere.

Elimination of the foregoing $16 + 50 = 66$ species leaves us the main bulk of the Heligoland list to be considered under the two categories of (1) regular migrants and (2) accidental visitants. Singular as it may seem, the latter are largely in excess of the former. Though it be quite true that a hard and fast line cannot be drawn in every case between these two categories, yet it is easy to separate them in most instances. The number of species which seem to have no business in Heligoland, or which ought to have business there but seldom attend to it, is the phenomenal result of Gätke's career as an ornithological detective. I find that a round 200 birds—one-half of the entire ornis, and one or two more for good measure—have been found in Heligoland in violation of law and order. If this shocks our conventional ideas of propriety, there is still worse to be said, and we will let the veteran say it at once. He is speaking of meteorological conditions which had yielded him a batch of rarities, and continues (p. 331): "I myself feel convinced that such material as comes under our observation forms only a small fraction of what is really abroad under these conditions; indeed I have frequently expressed myself as ready to exchange the whole of my collection, wonderful as it is, for all the birds which have occurred here without having been seen or killed, if that were possible; the only reservation which I would make in this exchange being the splendid example of *Larus rossii*, of which I am the fortunate owner." To feel the full force of these words, we must remember that his collection is the result of 50 years' work, and represents almost every capture ever made on the island. We will proceed with the list, which I will annotate in the briefest possible terms, according to Gätke's indications; and it will be convenient to set in double column with it the corresponding list of the regular migrants, similarly annotated, for comparison of related species as far as possible. I follow the same sequence in which Gätke treats the species:—

MIGRANTS.

1. *Falco gyrfalco*. Every fall, Oct. and Nov.; 6 or 8 specimens in all.

2. *Falco peregrinus*. Spring and fall, regular, not common.

3. *Falco subbuteo*. Spring and fall, regular, common.

4. *Falco æsalon*. Spring and fall, regular, commonest Hawk.

5. *Falco tinnunculus*. Spring and fall, regular, common; casual at other seasons.

6. *Fernis apivorus*. Regularly; very common in May, and in Aug. and Sept.

7. *Accipiter nisus*. Common, chiefly Aug. to Nov.

8. *Circus æruginosus*. } Rare or
9. *Circus cyaneus*. } casual—
10. *Circus cineraceus*. } hardly
more than stragglers.

STRAGGLERS.

1. *Falco candicans*. Specimen Oct., 1843; seen, Sept. 19, 1843, and in two or three other cases.

2. *Falco sacer*. One specimen, 1839 or 1840.

3. *Falco feldeggii*. One specimen, summer of 1840.

4. *Falco eleonoræ*. One seen, May 26, 1879.

5. *Falco cenchris*. Three cases; two specimens, one in summer of 1839 or 1840.

6. *Falco vespertinus*. Six cases, five specimens, 1840 to 1887, mostly May and June.

7. *Aquila chrysaetos*. Four cases in 40 years; one taken Nov. 18, 1867.

8. *Aquila pomarina*. Two cases; one taken in 1838.

9. *Circaetus gallicus*. Two cases; one taken in 1835.

10. *Accipiter palumbarius*. Four or five cases in 50 years; two taken, one of them Mar. 8, 1880.

11. *Milvus iclinus*. Once or twice a year; 3 specimens in 50 years.

12. *Milvus ater*. One specimen, many years ago.

13. *Circus swainsoni*. One visitation of seven individuals (?); one specimen, Aug. 12, 1858.

14. *Strix flammea*. Casual; 10 or 11 individuals in Oct. 1876.

15. *Syrnium aluco*. One specimen.

16. *Athene noctua*. One specimen, many years ago.

17. *Nyctala tengmalmi*. About 30 cases in 50 years.

18. *Megascops giu*. One specimen, May 16, 1862.

MIGRANTS.

11. *Asio otus*. Spring and fall, not rare.

12. *Asio accipitrinus*. Spring and fall; the commonest Owl by far.

13. *Corvus corone*. Rare and exceptional, among countless flocks of *C. cornix*.

14. *Corvus cornix*.
15. *Corvus frugilegus*.
16. *Corvus monedula*. } In profusion in migration; astonishing flights, many thousands a day in spring and fall.

17. *Garrulus glandarius*. Millions sometimes in fall; some years none.

18. *Lanius excubitor*. Rare and isolated cases, in spring and fall.

19. *Lanius "borealis Vieill."* (*major* Pall.) More frequent than the last, under same circumstances.

20. *Muscicapa atricapilla*. Commonest Flycatcher, especially in fall.

21. *Muscicapa grisola*. Common, especially in May, June and July; no breeding record.

22. *Muscicapa parva*. Formerly common, in fall; rare 1875 to 1880; none seen since.

STRAGGLERS.

19. *Nyctea nyctea*. One specimen, fall of 1839 or 1840; probably one other seen.

20. *Surnia ulula*. One specimen, in the '30's; two seen afterward.

21. *Corvus corax*. One specimen, fall of 1841; two seen afterward.

22. *Pica pica*. Two cases; one specimen, Nov. 11, 1876.

23. *Nucifraga caryocatactes*. Three specimens, Aug. 1844, Oct. 17, 1853, and one later.

24. *Perisoreus infaustus*. Once seen, Apr. 14, 1849.

25. *Pyrrhocorax alpinus*. One specimen, long ago; one seen, Sept. 14, 1868, and two afterward.

26. *Pyrrhocorax graculus*. Two cases, May 1871 or '72, and Mar. 28, 1877.

27. *Lanius meridionalis* (Temm.). One specimen thus identified.

28. *Lanius minor*. Isolated cases of late years, formerly less rare, in spring.

29. *Lanius rufus*. Five specimens in 40 years, May and June.

30. *Lanius collaris*. Isolated cases of late years, formerly less rare, Apr. and May.

31. *Lanius isabellinus*. One specimen, Oct. 25, 1854.

32. *Muscicapa collaris*. One specimen, June 3, 1860.

33. *Ampelis garrulus*. Sporadic; small flights in Sept. 1847 and Jan. 1850; most years none.

MIGRANTS.

23. *Pastor roseus*. About 40 cases in 50 years, chiefly in June.

24. *Turdus viscivorus*. Rare, but regular; perhaps 20 a year could be taken.

25. *Turdus musicus*. Commonest Thrush; 100 to 1,000 taken some days.

26. *Turdus iliacus*. Common; fall migration extends into winter.

27. *Turdus pilaris*. Common.

28. *Merula merula*. Very common; migrates early in spring, late in fall.

29. *Merula torquata*. Common; migrates late in spring, early in fall.

30. *Daulias lusciniæ*. [Regular, Apr. and May; rarely if ever seen in fall; song never heard.

31. *Cyanecula suecica*. Common; sometimes 30 to 60 specimens a day, in May.

32. *Cyanecula leucocyanea*. Rare; 8 or 10 shot in 50 years; a flight in Apr. 1877.

STRAGGLERS.

34. *Oriolus galbula*. One specimen in 50 years.

35. *Turdus varius* (Pall.). Shot 13 times, 1827 to 1884, chiefly in Oct.; seen 6 or 8 other times.

36. *Turdus dauma*. One specimen, about 1836.

37. *Turdus obscurus* Gm. (*pallens* Pall.). One seen, not taken, June 3, 1881.

38. *Turdus swainsoni*. One specimen, Oct. 2, 1869.

39. *Turdus pallasi* (Cab.). One specimen, Oct. 1836

40. *Turdus fuscescens*. One specimen, about 1833.

41. *Turdus fuscatus* (Pall.). One specimen, Oct. 10, 1880.

42. *Turdus ruficollis* (Pall.). One specimen, Oct. 1836.

43. *Turdus atrigularis* (Temm.). One seen near the Island in May.

44. *Merula migratoria*. One specimen, Oct. 14, 1894.

45. *Monticola saxatilis*. Three specimens, May 9, 1851, May 17, 1860, Nov. 12, 1874; a few others seen.

46. *Monticola cyanus*. One specimen, about 1830-32.

47. *Galeoscoptes carolinensis*. One specimen, Oct. 28, 1840.

48. *Harporhynchus rufus*. One specimen, fall of 1836.

49. *Pycnonotus xanthopygus*. One specimen, May, 1837

50. *Daulias philomela*. One specimen, caught at light-house, night of May 4-5.

51. *Aëdon familiaris*. One specimen, in the 30's; two other supposed cases.

52. *Cyanecula wolffi*. One specimen, Mar. 30, 1848; 3 other cases.

MIGRANTS.

33. *Erithacus rubecula*. Very common in early spring and late fall migrations; sometimes winters.

34. *Ruticilla phœnicurus*. Very common in late spring and early fall migration.

35. *Ruticilla tithys*. Common in early spring and late fall migration, sometimes to Dec.

36. *Sylvia cinerea*. Common, Apr., May, and Aug., Sept.

37. *Sylvia curruca*. Regular, not common, Apr., May, and Sept., Oct.

38. *Sylvia hortensis*. Common, Apr., May, and Aug., Sept.

39. *Sylvia atricapilla*. Regular, not common, Apr., May, and Oct., Nov., even Dec.

40. *Sylvia nisoria*. Rare, and hardly regular; chiefly in May.

41. *Phylloscopus sibilatrix*. Rare, hardly regular, in May, July, and Aug.

42. *Phylloscopus trochilus*. Commonest Warbler, especially in May, and Aug., Sept.

43. *Phylloscopus rufus*. Next commonest Warbler; earliest spring and latest fall migrant of the genus.

STRAGGLERS.

53. *Ruticilla mesoleuca*. One specimen, June 12, 1864.

54. *Ruticilla moussieri*. One specimen, summer of 1842.

55. *Sylvia orphea*. One specimen, July 8, 1876; two other cases reported many years ago.

56. *Sylvia melanocephala* (Gm.). One specimen, many years ago.

57. *Melizophilus undatus*. One specimen, no date; also one seen, May 31, 1851.

58. *Phylloscopus bonellii*. Two specimens, Oct. 8, 1861, and Oct. 9, 1874.

59. *Phylloscopus tristis* (Blyth). One specimen, Oct. 1846; a few others seen.

60. *Luscinola fuscata* (Blyth). One specimen, Oct. 24, 1876.

61. *Phylloscopus superciliosus*. Over 80 seen and 32 or 33 taken from 1846 to 1886, all but two in the fall.

62. *Phylloscopus proregulus*. Specimen taken Oct. 6, 1845; one seen Oct. 29, 1875.

63. *Phylloscopus coronatus*. One specimen, Oct. 4, 1843.

64. *Phylloscopus borealis*. Specimen taken, Oct. 6, 1854; one seen, June 1, 1859.

65. *Phylloscopus viridanus*. Three specimens, Sept. 25, 1878, May 30, 1879, June 3, 1880.

66. *Phylloscopus nitidus*. One specimen, Oct. 11, 1867.

67. *Hypolais polyglotta*. One specimen, May 23, 1846.

MIGRANTS.

44. *Acrocephalus streperus*. Formerly almost regular, now rare, little more than a straggler.

45. *Acrocephalus palustris*. Rare, but regular; formerly less rare; very early fall migration.

46. *Acrocephalus phragmitis*. Common, Mar. to May, and Aug. to Oct.

47. *Acrocephalus aquaticus*. Rare, hardly every year; common in 1855 and 1856.

48. *Locustella nævia*. Rare, and irregular; oftenest in May and Aug.

49. *Regulus cristatus*. Common, some years in profusion, Mar., Apr. and Sept.-Nov.

50. *Regulus ignicapillus*. Regular, not common; earlier in spring, later in fall than the last.

51. *Accentor modularis*. Regular, common.

52. *Pratincola rubetra*. Common, regular migrant, in May, and Aug., Sept., perhaps in summer.

53. *Pratincola rubicola*. Less common but regular migrant, from end of Feb., and again in the fall.

STRAGGLERS.

68. *Hypolais olivetorum*. One specimen, in 1860.

69. *Hypolais pallida*. One specimen, Sept. 20, 1883.

70. *Hypolais caligata*. One specimen, Sept. 28, 1851.

71. *Acrocephalus turdoides*. One specimen, about 50 years ago.

72. *Acrocephalus agricola*. One specimen, June 12, 1864.

73. *Locustella certhiola*. One specimen taken at light-house, Aug. 12 of 1858 or an earlier year.

74. *Locustella fluviatilis*. One seen May 9, 1854.

75. *Dendroica virens*. One specimen, Nov. 19, 1858.

76. *Accentor alpinus*. Three specimens, May 1852, May 1870, and Oct. 1862; others seen.

77. *Cinclus melanogaster*. Five specimens.

78. *Cinclus pallasi*. Seen, 1847 and later.

79. *Saxicola albicollis (aurita* Temm.). Two specimens, Oct. 26, 1851, May 12, 1860.

80. *Saxicola stapazina*. One specimen, about 1840.

81. *Saxicola deserti*. Three specimens, Oct. 4, 1856, Oct. 26, 1857, June 23, 1880.

82. *Saxicola capistrata (morio* Ehr.). Two specimens, May 9, 1867, June 6, 1882.

83. *Saxicola leucura*. One seen Aug. 11, 1880.

MIGRANTS.

54. *Motacilla lugubris* (*yarrelli*). Earliest migrant, in Feb. and Mar.; seldom seen in the fall.

55. *Motacilla flava*. Regular, and common, especially in the fall.

56. *Motacilla melanocephala*. Regular, and probably common.

57. *Anthus pratensis*. Common, chiefly migrant, Feb. to May, and Aug. to Nov.; a few may winter.

58. *Anthus cervinus*. Rare, irregular, chiefly noticed in Sept., especially of 1884.

59. *Anthus campestris*. Rare, irregular, in May and Aug.

60. *Anthus richardi*. Common, especially in Sept. and Oct. of certain years.

61. *Alauda arborea*. Irregularly common, chiefly in Feb., Mar., and Oct., Nov.

62. *Calandrella brachydactyla*. Rare, hardly more than a straggler; about 60 cases in 50 years, in May, June, and Sept. to Nov. inclusive.

63. *Otocoris alpestris*. In steadily increasing profusion since 1847.

64. *Emberiza miliaria*. Irregular, usually rare, in Mar. and Nov.; common Nov. 1883.

65. *Emberiza hortulana*. Commonest Bunting, in May, and in Aug., Sept.

66. *Emberiza schœniclus*. Usually rare; common in fall of 1884.

STRAGGLERS.

84. *Motacilla melanope* (*sulphurea*). About once in 5 years, in first half of Mar.

85. *Motacilla citreola*. Five cases in 40 years, all in early fall plumage.

86. *Anthus aquaticus*. Two cases; one taken.

87. *Anthus pensilvanicus*. Two specimens, Nov. 6, 1851, and May 17, 1858.

88. *Calandrella pispoletta*. One specimen, May 26, 1879.

89. *Melanocorypha calandra*. One specimen, early in June of 1839 or 1840.

90. *Melanocorypha sibirica*. Two specimens, Aug. 2, 1861, June 2, 1886.

91. *Melanocorypha yeltoniensis*. Two specimens, Apr. 27, 1874, July 27, 1892.

92. *Galerita cristata*. Scarcely one every three or four years.

93. *Emberiza aureola*. Three specimens, Sept. 18, 1852, Nov. 5, 1864, July 8, 1870.

94. *Emberiza cirius*. Two specimens, Apr. 27, 1862, Mar. 31, 1883.

95. *Emberiza cinerea*. One identified, not taken, June, 1877.

96. *Emberiza cœsia*. Formerly, nearly every May or June; only one seen in past 20 years.

MIGRANTS.

67. *Fringilla montifringilla*. Common, chiefly in Apr. and Sept., Oct.

68. *Carduelis carduelis*. In Apr., May and Oct., seldom 3 to 5 a day.

69. *Spinus spinus*. Irregular, sometimes in profusion in fall, usually rare in spring.

70. *Coccothraustes coccothraustes*. Not common, and only in

STRAGGLERS.

97. *Emberiza cia*. Two specimens, one about 50 years ago, one Mar. 8, 1882.

98. *Emberiza leucocephala*. One specimen, Apr. 16, 1881.

99. *Emberiza pusilla*. Some 25 or 30 specimens since 1845, especially in 1879; all in the fall.

100. *Emberiza rustica*. Some 16 cases since 1839 or 1840, mostly in the fall.

101. *Emberiza pyrrhuloides*. One taken and others seen, Apr. 24, 1879.

102. *Emberiza melanocephala*. Some 15 cases since 1845, all in May or June but one in Aug.

103. *Emberiza luteola*. Two specimens, June 20, 1860, and in Sept. of a later year.

104. *Calcarius lapponicus*. Casual, chiefly in Sept. and Oct.; one taken in full plumage. (Perhaps better in the migrant list.)

105. *Dolichonyx oryzivorus*. Two specimens, each in summer, dates not given.

106. *Montifringilla nivalis*. One specimen, Mar. 30, 1849; another seen late in fall.

107. *Acanthis hornemanni*. One specimen, Oct. 24, 1879.

108. *Acanthis exilipes*. Occasional, with *L. linaria*; common in fall of 1847; one specimen since then, Dec. 1, 1891.

109. *Spinus citrinella*. One specimen, many years ago; one seen Mar. 19, 1849.

110. *Serinus serinus*. Specimens July 14, 1860, June 8, 1879, 5 gray young seen June 28, 1879, and one adult seen July 11, 1879; may have bred that year.

111. *Serinus pusillus*. One seen May 7, 1886.

MIGRANTS.

spring and fall; many in Apr. 1881.

71. *Passer montanus*. Common, and likely to become a breeder.

72. *Pyrrhula pyrrhula*. Irregular, usually rare; common in fall of 1847.

73. *Parus major*. Formerly in profusion, Feb., Mar. and especially Sept. to Dec.; later less common most years, sometimes none.

74. *Parus ater*. Irregular; like the last, but less common; only some 15 specimens for last 25 years.

75. *Parus cœruleus*. Regular, not rare; later in spring and earlier in fall than *P. major*.

76. *Acredula caudata*. Sporadic, sometimes common, especially in fall, as of 1847 and 1878.

77. *Cuculus canorus*. Regular, but rare, and peculiar in times of migration.

78. *Iynx torquilla*. Common, during regular migration.

79. *Certhia familiaris*. Not common, and chiefly in the fall migration.

80. *Cypselus apus*. Common.

STRAGGLERS.

112. *Pyrrhula europæa*. One case.

113. *Pinicola enucleator*. Two specimens, many years ago.

114. *Carpodacus roseus*. One specimen. (See Blasius, Nachträge, p. 195.)

115. *Carpodacus erythrinus*. Four specimens from 1851 to 1884; other cases noted.

116. *Loxia pityopsittacus*. One specimen, many years ago.

117. *Loxia curvirostra*. Formerly frequent, but hardly ever seen since certain poplar trees were destroyed.

118. *Loxia bifasciata*. Occasional, with the preceding; frequent in fall of 1889.

119. *Parus palustris*. One specimen, many years ago.

120. *Parus borealis*. One specimen, Nov. 10, 1881.

121. *Parus kamtschatkensis*. One seen Nov. 1, 1876.

122. *Parus cristatus*. Once taken, twice seen.

123. *Panurus biarmicus*. One taken 50 years ago, one Nov. 8, 1847, one Apr. 5, 1849; seen on a few other occasions.

124. *Alcedo ispida*. Once or twice a year, usually; some years none.

125. *Merops apiaster*. One specimen, many years ago.

126. *Coracias garrulus*. Three specimens first about 50 years ago, last May 25, 1881.

127. *Dryobates major*. Isolated cases, not every year.

128. *Dryobates leuconotus*. One specimen, Sept. 21, 1879.

129. *Gecinus viridis*. Once seen.

130. *Cypselus melba*. One specimen; two other cases.

MIGRANTS.

81. *Hirundo rustica*. Common, sometimes hundreds of thousands, in Apr., May, Sept., Oct., into Nov.

82. *Cotile riparia*. Common, sometimes many thousands with *H. rustica*.

83. *Caprimulgus europæus*. Regular, not common, May, June, and Aug.

84. *Upupa epops*. Almost regular, but rare, some years none.

85. *Coturnix coturnix*. Very rare as a rule; common in Aug. 1878.

86. *Columba palumbus*. Regular, not common, Mar., Apr., and Sept., Oct., Nov.

87. *Columba œnas*. Rare, but usually a few each spring.

88. *Turtur turtur*. Common, May and June; especially so in 1885.

89. *Ciconia alba*. Rare, two or three individuals each spring.

90. *Ardea cinerea*. Rare, chiefly young, in fall.

STRAGGLERS.

131. *Hirundo savignyi* (*cahirica* Licht.). Once seen, May 20 and 21, 1881.

132. *Hirundo rufula*. One specimen, May 31, 1855.

133. *Caprimulgus ægyptius*. One specimen, Aug. 1876.

134. *Syrnhaptes paradoxus*. Common during the great irruption of 1863, also in 1872, again in 1876, greatest irruption of all in 1888, Apr. to July inclusive.

135. *Perdix perdix*. Occasionally reported, but only one specimen, July 17, 1889.

136. *Columba livia*. Taken at irreg. intervals, about once in ten years.

137. *Turtur risorius*. One specimen, many years ago.

138. *Otis tarda*. One specimen, Apr. 18, 1895. (See Gätke's Preface.)

139. *Otis tetrax*. Two specimens, about 50 years ago; a third June 27, 1882.

140. *Cursorius gallicus*. One specimen in 1835 or 1836.

141. *Grus grus*. Once seen, Apr. 1867.

142. *Anthropoides virgo*. One specimen, May, 1837.

143. *Ciconia nigra*. Thrice seen; never taken.

144. *Platalea leucorodia*. (No data.)

145. *Ardea purpurea*. One specimen, June 9, 1847.

146. *Botaurus stellaris*. One or two specimens in 60 years.

147. *Ardetta minuta*. One specimen, before 1847.

MIGRANTS.

91. *Numenius arquata*. Myriads in regular migration from Feb. on, and from July on; some vast E. to W. flights in Dec. and Jan.

92. *Numenius phæopus*. In profusion in regular migration, later in spring and earlier in fall than *N. arquata*.

93. *Limosa lapponica (rufa)*. Rare, hardly more than a straggler, seldom seen in spring.

94. *Charadrius pluvialis*. Very common, especially in fall migration, Aug. to Nov.

95. *Charadrius squatarola*. Common in migration.

96. *Vanellus vanellus*. Common in migration.

97. *Eudromias morinellus*. Common, less so than formerly, chiefly May, and Aug., Sept.

98. *Ægialitis hiaticula*. Common, Mar. and Apr., returning from end of June on.

99. *Ægialitis cantiana*. Rare, hardly regular, but more than a mere straggler.

100. *Scolopax rusticola*. Common; some phenomenal flights; over 1,100 killed Oct. 21, 1823.

101. *Gallinago major*. Rare in spring, hardly common in fall.

102. *Gallinago gallinula*. Common, late in spring and early in fall.

103. *Totanus calidris*. Common in migration, in Apr. and again from end of June on.

104. *Totanus canescens (glottis)*. Regular, but only common in the all.

105. *Totanus ochropus*. Regular, but only common in fall; in spring from end of Mar. through Apr.

STRAGGLERS.

148. *Plegadis autumnalis*. One specimen, summer of 1824.

149. *Numenius tenuirostris*. One specimen, about 1839.

150. *Limosa belgica (melanura)*. Three specimens in all Gätke's experience.

151. *Charadrius fulvus*. Three specimens, June 25, 1857, June 18, 1860, July 11, 1867.

152. *Charadrius dominicus*. One specimen, Dec. 20, 1847.

153. *Ædicnemus scolopax*. Six specimens in 50 years, Apr., May.

154. *Ægialitis asiatica (caspia)*. Two specimens, Nov. 16, 1850, May 19, 1859.

155. *Ægialitis minor*. Two specimens in 50 years, one of them June 1866.

156. *Totanus fuscus*. About 12 specimens in 50 years; only perfect male June 11, 1847.

157. *Totanus stagnatilis*. One specimen, May 7, 1862.

MIGRANTS.

106 *Totanus glareola*. Regular, but very rare in fall; in spring, middle of Apr. to end of May.

107. *Actitis hypoleucos*. Commonest Sandpiper. (Periods not given.)

108. *Tringa canutus*. Regular, rather rare in spring, numerous in Aug. Sept.

109. *Tringa alpina* (including "*schinzi*"). Commonest of its genus, especially in Aug., Sept.; some winter.

110. *Tringa minuta*. Very rare in spring (one May specimen in 50 years); common in Aug., Sept.

111. *Tringatemmincki*. Like the last, but rather oftener in spring, less often in fall.

112. *Arenaria interpres*. Mainly migrant, common in Aug., Sept.; occasional in winter.

113. *Pavoncella pugnax*. Only regular in fall, young birds; adults straggling in summer.

114. *Crymophilus fulcarius*. Not common, but young shot on the sea every fall.

115. *Rallus aquaticus*. Regular, but rare, early in spring and late in fall.

116. *Crex crex*. Common, Apr., May, and Aug., Sept.

117. *Porzana maruetta*. Rare; the few cases, chiefly in May and Aug.

STRAGGLERS.

158. *Actitis macularia*. One specimen, about 1837, in May; one seen May 1847.

159. *Himantopus candidus*. One specimen, about 50 years ago; one seen, June 25, 1879.

160. *Recurvirostra avocetta*. A few cases; last specimen in June 1871.

161. *Tringa subarquata*. One perfect specimen; a few young birds every autumn. (Perhaps rather belonging to the migrant list.)

162. *Limicola pygmæa*. One specimen, May 29, 1855.

163. *Tryngites subruficollis*. One specimen, May 9, 1847.

164. *Phalaropus lobatus*. Four specimens; first Nov. 1837, second May 15, 1870.

165. *Porzana parva* (*pusilla* Licht.). One specimen, Apr. 22, 1854.

166. *Porzana bailloni* (*pygmæa* Naum.). Two specimens, both May, the second one May 28, 1890.

167. *Gallinula chloropus*. Ten specimens in 50 years.

168. *Fulica atra*. Six or eight specimens in 50 years.

MIGRANTS.

118. *Anser cinereus*. Regular migrant each season.

119. *Anser segetum*. Commonest Goose.

120. *Anas boschas*. Not common in migration; emaciated birds occasional in winter.

121. *Querquedula crecca*. Common in both migrations.

STRAGGLERS.

169. *Cygnus olor*. One specimen many years ago, another Feb. 21, 1881.

170. *Cygnus bewicki*. One specimen, Mar. 17, 1875.

171. *Anser brachyrhynchus*. Two specimens, Mar. 30, 1880, a third in Oct. 1880.

172. *Anser albifrons*. One specimen about 40 years ago, another about 1888.

173. *Anser minutus*. One fall specimen, about 50 years ago.

174. *Chen hyperboreus*. None taken, but several cases, in winter and May.

175. *Bernicla leucopsis*. Two specimens in 50 years.

176. *Dafila acuta*. Five or six cases in 50 years.

177. *Chaulelasmus streperus*. One specimen, many years ago.

178. *Querquedula ciria*. Three specimens in 50 years.

179. *Spatula clypeata*. One specimen, many years ago.

180. *Oidemia perspicillata*. One specimen, Oct. 9, 1855.

181. *Nyroca nyroca*. One specimen about 50 years ago.

182. *Somateria spectabilis*. One specimen, Jan. 11, 1879.

183. *Eniconetta stelleri*. Three young specimens, winter of 1844-45; a fourth Feb. 11, 1855.

184. *Larus affinis*. One specimen Aug. 20, 1870.

185. *Larus ichthyætus*. One case before Gütke's time, and probably one other.

186. *Larus philadelphia*. One specimen, "winter of 1845," qu. 1844-45, or 1845-46?

187. *Xema sabinei*. Two young specimens, Oct. 25, 1847, Oct. 28, 1883; another seen Nov. 10, 1883.

MIGRANTS.

122. *Sterna cantiaca*. Commonest Tern, Apr. to end of summer (no breeders).

123. *Sterna paradisæa (macrura)*. Common, last half of May, again in Aug.

124. *Sterna hirundo*. Common Apr. to end of summer (no breeders).

125. *Gelochelidon nilotica*. Chiefly May to July, rare, over the land, not fishing at sea.

126. *Hydrochelidon nigra*. Rare or irregular, in migration, sometimes common in fall.

127. *Stercorarius pomatorinus*. Very rare in spring, young frequent or numerous in Oct. Nov.

128. *Stercorarius parasiticus*. Commonest Jaeger in migrations, less so now than formerly.

129. *Stercorarius longicaudus (buffoni)* Boie. Hardly more than a straggler, but seen almost every fall; two adults taken in summer.

130. *Puffinus anglorum*. Formerly common; has totally disappeared within 25 years.

131. *Colymbus minor*. Frequent; periods not given.

STRAGGLERS.

188. *Rhodostethia rosea*. One specimen, Feb. 5, 1858.

189. *Gavia alba*. One adult identified, Jan. 20, 1850.

190. *Sterna dougalli*. Two specimens in 50 years, old summer birds.

191. *Sterna minuta*. None seen for past 10 years.

192. *Sterna tschegrava (caspia)* Pall.) Exceptional; only one specimen ever taken, June 22, 1880.

193. *Megalestris skua*. Several cases; only specimen Nov. 6, 1885.

194. *Puffinus major*. Probably two cases; one specimen.

195. *Puffinus fuliginosus* (given as "*griseus* Gm."). One specimen, Oct. 25, 1888.

196. *Cymochorea leucorhoa*. Several cases; 3 specimens in Dec. 1850, 4 in Nov. 1888.

197. *Uria lomvia*. One specimen, many years ago.

198. *Cephus mandti?* One specimen, probably of this species.

199. *Colymbus cristatus*. Casual in winter; two cases in spring.

200. *Colymbus nigricollis*. One specimen, date not given.

Taking the four preceding lists as they stand, we have the following summary:—

Stragglers, for the most part entirely beyond their normal range.	200
Migrants, more or less regular, mainly in spring and fall.	131
Winterers, in some cases appearing at other seasons.	50
Breeders, but in most cases not regularly so.	16
	<hr/>
Total	397

This exhibit is simply phenomenal. In the first place the total is enormous, for such an apparently ineleigible and even forbidding spot in comparison with almost any fairly favored locality of such restricted extent, say in Germany, Great Britain, or the United States, where a list of 300 species would be a pretty large one. In the next place, and especially, the relative proportions of stragglers, migrants, winterers, and breeders are far and away from what is known of any other locality. There is no question of the approximate accuracy of the lists, whatever be the requisite rectification of Gätke's determinations in a very few cases, or any little readjustment of the figures for the four categories I have made out. No doubt Herr Gätke has been imposed upon in certain cases which he admitted upon hear-say evidence, and perhaps neither J. A. Harvie-Brown nor W. E. Clarke has compared Rosenstock's translation with the original German. But no such changes as these points may involve can affect the result materially. We have therefore to seek some explanation of the anomalous Heligolandish ornithology.

The most obvious factor in the case is of course Herr Gätke himself and the very unusual length of time which he has devoted to an extremely close scrutiny of the avifauna of a little bare island where birds cannot easily escape observation. We have thus a remarkable man, working under exceptionally favorable circumstances. Moreover, the record goes back of him — to 1827 at least — and in the general result we have the coöperation and contributions of several expert gunners, fowlers and taxidermists, to say nothing of a generation or two of boys with their peashooters. We should therefore expect a large total, and a large proportion of rarities. But after making all due allowances to eliminate the "personal equation," the main features of the case appear to be intrinsic, attributable to Heligoland itself, in its

physiography, its environment, and especially its geographical position with reference to flight-lines. It may be called a Mecca, metaphorically, and with scarcely a figure of speech a magnetic pole, so powerfully does it seem to attract birds. No wonder that Herr Gätke speaks with enthusiasm of "Heligoland whose superior rank in the domain of bird-life is uncontested by the proudest empire," and of what he calls the "honorary citizenship" he has had the pleasure of conferring upon so many feathered representatives of Asia, Africa, and North America.

The slight annotations of the foregoing lists to which I am almost necessarily restricted in an article like the present give but a hint of the wealth of detail which Gätke's work embodies. Those who would pursue the subject beyond this wholly inadequate outline must of course read the book itself — say rather, study it carefully. But it is somewhat expensive, very special, and unlikely to be widely known in this country beyond ornithological centers; and I have not yet touched upon some matters it includes, which will be for many readers of 'The Auk' still more surprising than anything that has preceded thus far in the present sketch. For such an enormous and apparently fortuitous concourse of birds upon a single rock in the sea excites our curiosity to know how they get there; and this of course raises the whole question of migration-flight.

Gätke probably knows more about the ways of birds in the air than any other person now living, possibly than any person who has ever lived; consequently, he is modest in expressing his views, and simple in stating his facts. He makes none of the hasty generalizations and valiant asseverations to which the conceit of youthful ignorance is prone, and never dogmatizes — though no one else could be so easily forgiven excathedration. The most conspicuous result of his insistence upon the facts in the case is rank iconoclasm. He smashes our idols right and left; he leaves us at the mercy of our fables, helpless for lack of gods to supplicate, for he sets up none of his own in their places. He pushes explanation to the inexplicable; flight remains for him an "insoluble problem," and migration, a "wondrous mystery." Gätke knows too much about these things for our peace of mind, especially if we have ever plumed ourselves on our opinions to

the superfluous extent of strenuously insisting upon them in print. He files a general caveat we shall do well to heed. Isepipteses and magnetic meridians, coast-lines and river-channels, food-supply and sex-impulses, hunger and love, homing instincts and inherited or acquired memory, thermometer, barometer and hygrometer, may all be factors in the problem, good as far as they function; but none of them, and not all such together, can satisfy the whole equation. The subject has engaged the attention of many able writers; but the very excellence of Gätke's contribution to the scientific aspects of the case certifies that he has not said the last word, for it is sure to stimulate further research and excite renewed discussion. He devotes a chapter to each one of the following subjects: The course of migration generally in Heligoland; direction of the migration flight; altitude of the migration flight; velocity of the migration flight; meteorological conditions which influence migration; order of migration according to sex and age; exceptional migration phenomena; what guides birds during their migrations; and finally, the cause of the migratory movement. To go into any particulars here would be to slight others equally interesting and often equally surprising; but some points may be merely mentioned. Instead of north and south movements in all cases, there are some east and west, at right angles with meridians, independent of coast-lines. Instead of the thousands of migrants we may see, or the hundreds of thousands we may estimate, we are told of the millions and billions — such incalculable myriads flying past a single rock that all the destruction human agency could effect in all time would be inappreciable. Some of the distances, altitudes, and velocities of which migrating birds are proved to be capable would be incredible were they not so well attested; and such capacities for flight are shown in some instances of birds we are not accustomed to consider very good fliers. Meteorological conditions influence migration more profoundly than we commonly suppose; the alternation of day and night has some unsuspected effects. Birds are really better weather-prophets than our official 'forecasters' always show themselves to be, if not quite as good as the Roman haruspices supposed avian augury was. Birds in the water can in some

cases alter their specific gravity to an extent which Gätke witnesses without pretending to explain; but it would seem that they can do the same in the air, and that some of their modes of flight, notably their sailing, are absolutely in defiance of much that has been alleged and believed. Instead of answering the question, "What guides birds during their migrations?" Gätke says (p. 142):—

"Having thus examined the various attempts made to explain the wonderful faculty possessed by migrants of discovering the right path of their migrations, and shown how insufficient most of them are when confronted with actual facts, observed directly in nature, in the course of more than fifty years' investigations and at a spot so favored as Heligoland, I cannot say that I feel encouraged to add further to the number of such attempts by others of my own."

And for another modest disclaimer, which can be commended to any who show symptoms of omniscience in the pleasing paths of ornithology (p. 148):—

"Both in regard to this question as to the immediate departure of birds on their migrations, as well as in reference to that propounded in the previous chapter [just cited], we are confronted with a riddle which has hitherto defied every attempt at a solution, and which indeed we may hardly expect will ever be likely to receive a final explanation. Long and profound study has been devoted to this subject in many quarters, and has resulted in the enunciation of several very ingenious and plausible hypotheses. None of these, however, will stand their ground when the actual facts, which the life of birds in nature presents in such abundance, are marshalled against them. . . . In treating of the various momenta of the migratory flight, we have striven as much as possible to place before the reader only such facts as are beyond question or criticism, but no attempt has been made to furnish a solution of the wide problems which they involve. In thus abstaining from setting forth new theories, I have been guided by the conviction, rendered firmer with increasing knowledge of the phenomena, that what at present has been ascertained in reference to the migration of birds furnishes us with no clue by the aid of which we are enabled to penetrate the depths of this wondrous mystery."

This conclusion concerning "the way of the eagle in the air" is identical with that ascribed to the old Hebrew ornithologist, who had a great reputation for sagacity, in spite of his comprehensive connubialities; and may be aspired to by some of the present gentile generation.

Yet one other chapter of Gätke's remarkable book should not be passed without remark in the present review. This is in a different field of research, as it treats of changes in the coloration of plumage without the loss or gain of any feathers. To this phenomenon, for which I lately coined the word aptosochromatism, Schlegel called particular attention in 1852, and the novelty of his views excited much attention. The subject is better known now, but is far from being exhausted, and Gätke's contribution to its elucidation is extremely valuable. The two main factors in the case, namely, variation in pigmentation and alteration in texture and shape with wear and tear, are understood; but the processes are more complicated than would appear at first sight, and there are several ways in which the observed changes may be brought about, in different species, in the same bird at different seasons, in different feathers of the same bird, and finally, in different parts of the same feather. Some of the modes in which fresh pigment may be deposited in and spread through a feather, and then be modified or withdrawn, are curious, and not less so are the ways in which an optical effect is produced by a sort of exuviation in the feather itself, aside from any such simple process as the wearing away of a tip or an edge — in other words, it is a vital rather than merely mechanical matter, which is probably much more concerned than we are fully aware in freshening coloration. Aptosochromatism would not seem to be a subject of special difficulty, or one requiring particular training for its successful study. It is simply a matter of precise and patient examination of a large amount of material, and offers an inviting field of research, in which some bright young ornithologist might win enviable laurels.