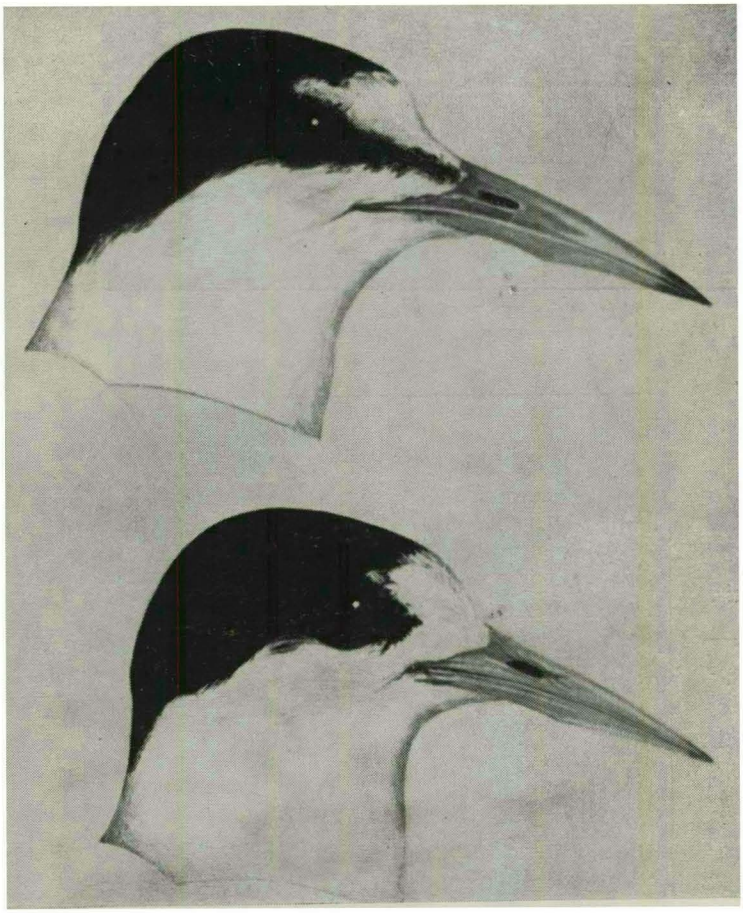

Plate I—Cover picture: Little Tern *(Sterna albifrons)*, (upper); Fairy Tern *(Sterna nereis)*, (lower). Showing diagnostic features of head in nuptial plumage. Natural size.

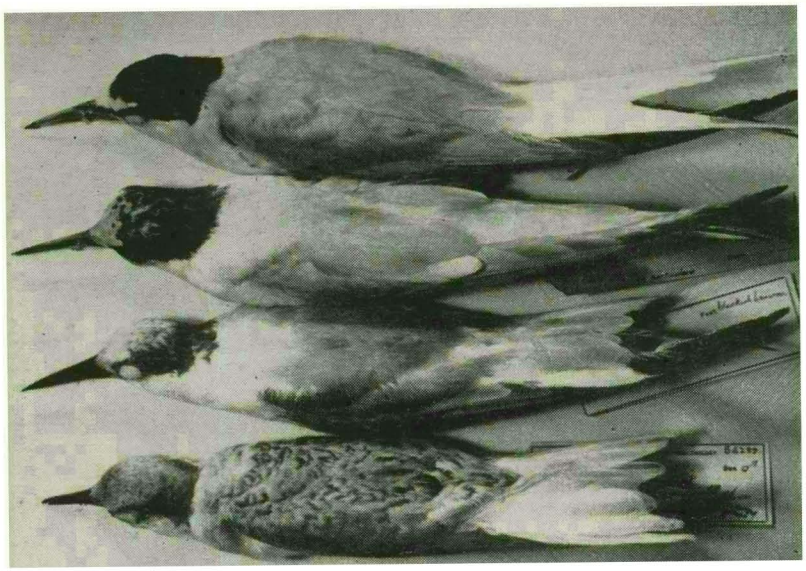

Plate II:

Sterna albifrons sinensis.

Top to bottom—adult summer (nuptial), adult winter, first winter, juvenal. (Specimens in National Museum, Melbourne.)

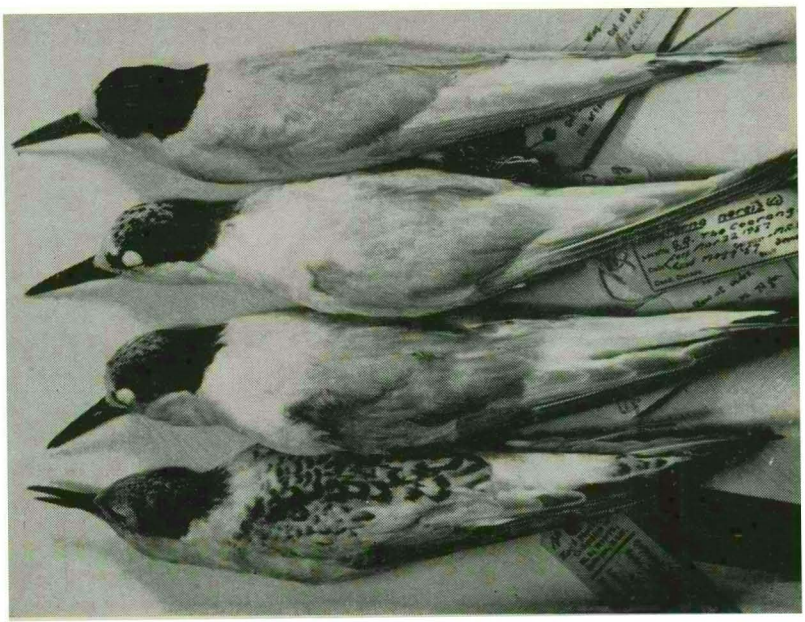

Plate III:

Sterna nereis nereis.

Top to bottom—adult summer (nuptial), adult winter, first winter, juvenal. (Specimens in National Museum, Melbourne.)

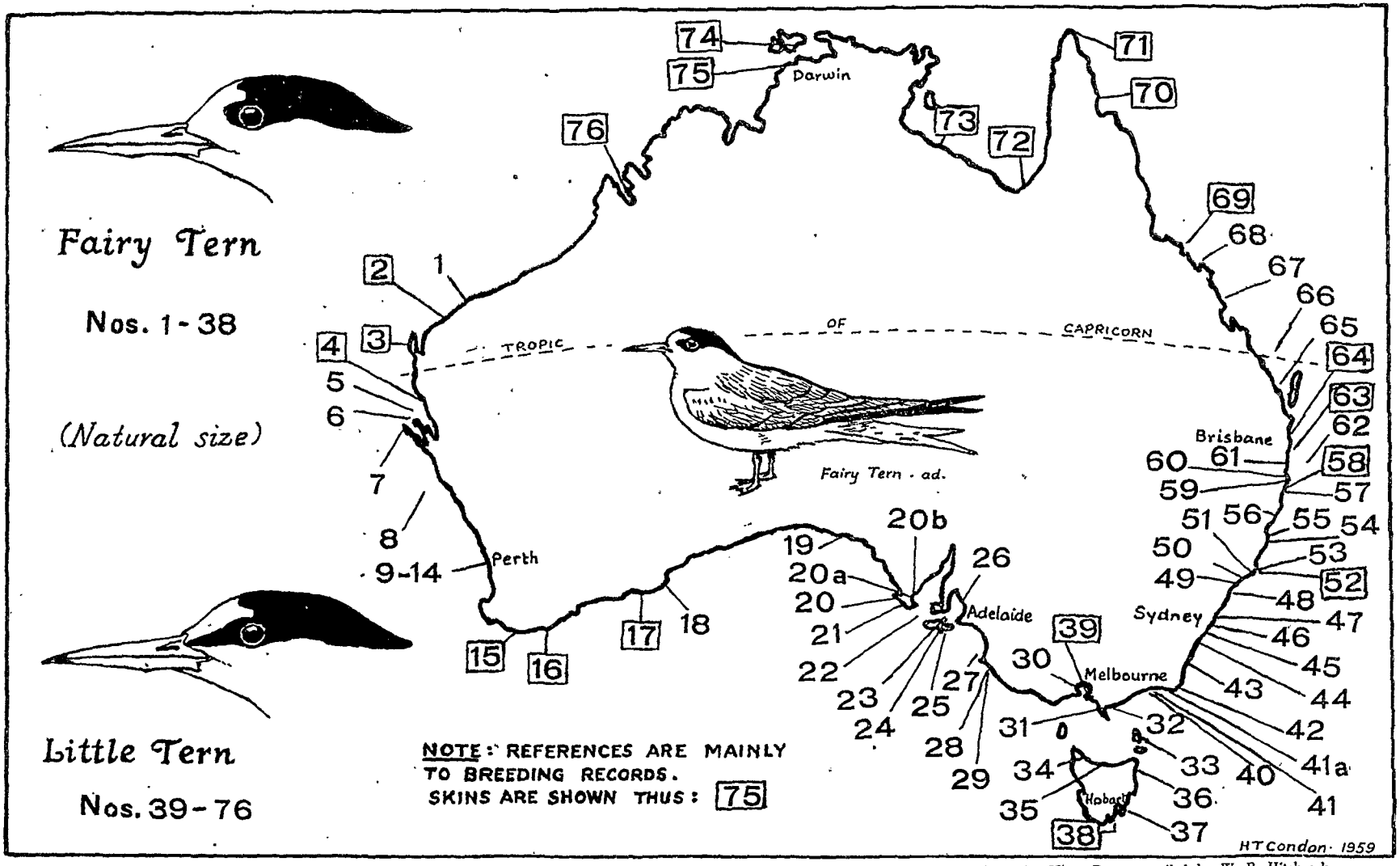

Fig. 4.—Occurrence of Fairy Tern *(Sterna nereis)* and Little Tern *(Sterna albifrons)* in Australia. The numbers refer to localities (see Appendix II). Data compiled by W. B. Hitchcock.

A REVIEW OF 'LEAST' TERNS IN AUSTRALIAN WATERS

By W. B. HITCHCOCK

INTRODUCTION

This study was undertaken to clarify certain minor distributional problems concerning the Fairy Tern (*Sterna nereis* Gould) and the Little Tern *(Sterna albifrons* Pallas) in Australia. However, after reviewing the literature, and examining all available specimens in Australia, the scope of the paper was widened to include taxonomic and ecological notes on the Australian and certain extra-limital forms of each species.

The aesthetic appeal of these diminutive terns has doubtless prompted much that has been published about them in Australian natural history journals during the past fifty years. They have been frequently photographed, but rarely studied and seldom collected; consequently there still tends to be a lack of appreciation of their several diagnostic characters—in the hand and in the field—and of their respective geographical ranges.

Sterna nereis is relatively sedentary and localised in western and southern Australia and Tasmania; elsewhere it occurs only in New Zealand and New Caledonia. *S. albifrons,* on the other hand, is highly migratory, of almost cosmopolitan distribution, and its breeding range does not overlap, or coincide with, that of *nereis.*

In north-western Australia the exact limits of the breeding range of each species are still not known, but there are no records of *nereis* north of the Dampier Archipelago. In south-eastern Australia the known breeding limits are Port Albert *(nereis)* and Lakes Entrance *(albifrons)* in Victoria.

Only a single Australian race of *nereis* is recognisable, but at least two races of *albifrons* are known to occur: (1) *S. a. sinensis* (the 'Asiatic Little Tern,' or 'White-shafted Ternlet'), which ranges from Japan and Korea, south along the coast of eastern China and Indo-China to the Malay Peninsula, Ceylon, Andaman Islands and eastward through the Philippines, Celebes and Lesser Sunda Islands to the Bismarck Archipelago, New Guinea and Australia (north, east and south-east coasts), and probably New Zealand (see below); and (2) *S. a. saundersi,* the race breeding on the shores of north-east Africa, the Red Sea, Persian Gulf, and rivers of northern India, and possibly Burma. This has been collected once near Sydney (at Wollongong, May 30, 1903—specimen in National Museum, Melbourne). It is thought possible that some individuals of this race winter regularly in Australia, but this is not supported by the evidence of further specimens, or banding records.

The recently reported occurrence of *albifrons* in the North Island of New Zealand—Firth of Thames (McKenzie and Sibson, 1957)—is of considerable interest. Small numbers have been seen over the period 1949 to 1957, and between the months of November and June; in May and June some birds were observed to assume breeding plumage. This would seem to indicate that New Zealand birds are 'winter' visitors of a population with nesting grounds north of the Equator.

PLUMAGES AND MOULTS

There is still insufficient properly documented material in Australia of both *nereis* and *albifrons.* to enable a full understanding of their sequence of plumages and moults; the following statements, therefore, must be regarded as purely tentative.

1. NATAL

Acquired before hatching, and probably identical in the two species. I have not examined a chick of *nereis,* but Hall (1901) described a nestling (about four days old) from Snake Island, Victoria.

2. JUVENAL

Acquired by a complete post-natal moult over a period of about one month. Similar in both species but *nereis* is perhaps slightly darker on the fore- and hind-crown and with wider, darker edgings to the feathers of mantle and tertials; the primaries are also a paler grey. In *nereis.* the bill is "yellowish-horn,"

the feet "yellow-flesh" (Carter, from field-label of skin collected Albany, W.A., March 22, 1910). In *albifrons* the bill is "brownish-black, lower mandible light-brown, tip darker," and the feet "yellowish-brown" (Favaloro, from field-label of skin collected Lakes Entrance, Victoria, January 25, 1953).

3. FIRST-WINTER (Eclipse)

Acquired (normally) by a complete post-juvenal moult in first autumn. It is distinguished from the adult winter plumage in both species by the following characters: (a) a darker cubital band; (b) some dark feathers along front edge of wing; (c) a pale-grey crown with dark shaft-streaks to the feathers; (d) the more brownish-black ("washed-out") appearance of hind-crown, occiput and nape; (e) the dark (relatively uniform brownish-black) bill and feet, and (f) the greyer tail-feathers.

It is very doubtful whether the two species can be certainly distinguished in this plumage, even in the hand, except on the grounds of distribution and, possibly, also on weight (see below). Both species exhibit the band of black on the inner webs of the primaries (see 6(c) below) in juvenal and first-winter plumage.

4. FIRST-SUMMER (Eclipse)

Palmer (1941) established that *Sterna hirundo* (and probably, also, *macrura* and *dougallii)* rarely breeds in its first year; instead, it moults into a 'summer-eclipse' plumage, to all appearances identical with the first-winter eclipse. Although I have not seen a skin of either *nereis* or *albifrons* that can be referred to such a plumage, there is a good deal of evidence to show that *albifrons,* at least, does not acquire a nuptial plumage in its first year (see *albifrons* distribution New South Wales, *post).*

With regard to the nominate race of *albifrons,* Witherby, *et al.* (1941) state: "First-summer—complete moult takes place as in adult after which bird apparently becomes like adult, but those birds with three outer primaries blackish, lesser coverts rather dull, blue-grey, and some dark feathers along edge of wing may be first-summer."

5. ADULT WINTER (Eclipse)

The features of this plumage, in both species, are: (a) crown-feathers white (or very pale grey), tipped black, and the feathers of occiput and nape are quite black (not brown-black); (b) the retention of colour in the bill—*nereis,* base and tip blackish with a yellow centre; *albifrons,* apical third, or half, black with yellow base; (c) a paler (less obvious) cubital band, compared with first-winter birds, and (d) the absence of dark feathers along front edge of wing.

In *albifrons* the dark lores are lost (? by wear), leaving only a black spot in front of the eye, exactly similar to *nereis.*

6. ADULT SUMMER (Nuptial)

Probably acquired at the second-spring moult, and in this plumage *albifrons* may be easily distinguished by the following characters (see plate 2): (a) the completely black lores; (b) the extension of white over the eyes to about the posterior border, and (c) the well-defined strip of black—narrow at base but widening distad to cover the whole tip—next the shaft on the inner web of the two outer primaries.

Another character, not so constant as the above three, is the presence of a black tip to the bill; the significance of this is, at present, obscure but it may have something to do with age. For birds in nuptial plumage only, 39% (of 46 skins) of *nereis* and 90% (of 41 skins) of *albifrons* had a dark tip.

A further distinction may be the colour of the bill in nuptial plumage; in *nereis* it varies from bright orange to orange-yellow, in *albifrons (sinensis)* from honey-yellow to olive-ochre.

TAXONOMY

Sterna nereis and *S. albifrons,* in nuptial plumage, can always be separated on the three characters given above—6(a), (b), and (c). An additional character, probably applicable irrespective of age, is weight. For eleven Australian specimens of *nereis* the weight varied from 65–80 gms. (mean 73.4), and for thirteen specimens of *a. sinensis* (all Australian) it ranged from 48–60 gms. (mean 56.6). In spite of the small samples these weights are a good indication of the comparative over-all sizes of the two species, and it will be noted that there is a difference of five grammes between the heaviest *albifrons* and the lightest *nereis,* plus a difference of nearly 17 grammes in the mean weights.

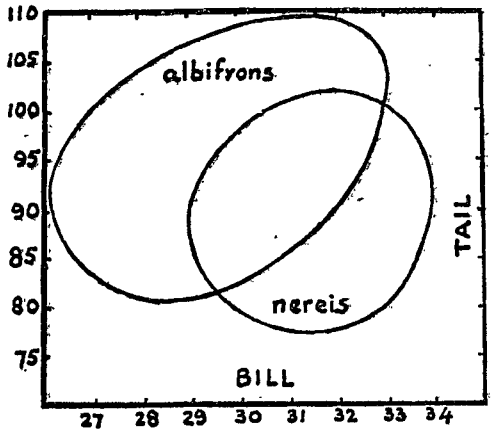

Fig. 1.—Range of bill/tail ratios in Australian specimens of *Sterna albifrons* and *Sterna nereis*.

Amadon (1943) has discussed the taxonomic significance of bird weights.

The range of bill/tail ratios in Australian specimens of *nereis* (sample: 23) and *albifrons* (sample: 20) is illustrated in fig. 1.

Measurements are given (Table I) only for adult summer birds (male and female combined) because, in general, this was the only plumage for which a usable sample of measurements was available, and it was considered advisable only to compare specimens in equivalent plumage.

Bill length was measured, at the suggestion of Ernst Mayr, from the greatest extension of the feathering of the sides of the upper mandible to the tip; Dr. Mayr considered this a quite unequivocal method of measuring the bill in these two species. The full data for all specimens measured (Australia and elsewhere) are deposited in the National Museum, Melbourne.

C. M. N. White (1937) reviewed the races of *nereis* and concluded that only three were recognisable; I see no reason to dispute his findings. In fig. 2 bill length and tail length have been plotted against wing length for the three races; in spite of the relatively small samples of *exsul* and *davisae*, the distinctions are clear-cut.

Following are the valid races of *nereis* and their respective ranges:

nereis Gould 1842 (syn. *horni* Mathews 1912a): Western Australia (breeding as far north as Dampier Archipelago), south and east to Port Albert, Victoria; Bass Strait islands; north and east coasts of Tasmania.

LEAST TERNS

TABLE I

	Wing	Bill	Tail
S. n. exsul	160–175 (170) 6 measd.	28–31 (30) 5 measd.	75–83 (79) 6 measd.
S. n. nereis	172–194 (184) 51 measd.	28.5–35.5 (31) 54 measd.	76–103 (89) 26 measd.
S. n. davisae	187–199 (194) 8 measd.	27–34 (30) 8 measd.	76–86 (81) 6 measd.
S. a. sinensis (Aust.)	172–194 (183) 50 measd.	26–33 (29) 48 measd.	82–110 (96) 19 measd.
S. a. sinensis (Japanese)	169–186 (181) 11 measd.	25–31 (29) 11 measd.	84–115 (102) 6 measd.
S. a. saundersi (Aust. skin)	170 (male)	(broken)	78
S. a. saundersi (Ticehurst, 1924)	166–174 (males) 165–173 (females)	——	——

exsul Mathews 1912 b; New Caledonia and (?) Loyalty Group.

davisae Mathews and Iredale 1913: New Zealand (North and, formerly, South Islands).

After examining some 30 skins of *albifrons* from Australian localities, and comparing them with a small series of Japanese birds, I am unable to separate the former from *sinensis*. As can be seen from Table I, Japanese *sinensis* average slightly smaller in wing and bill length, slightly larger in tail length,

EGGS

There is a striking similarity in the eggs of the two species—in size, texture, colour and markings—and they certainly cannot be identified 'at a glance' as some collectors maintain. The only feature that may be of value in distinguishing the two, and that *only* in a large series, is the generally more rounded shape of those of *albifrons*, and this seems to be reflected in the measurements shown in Table II, in which are included

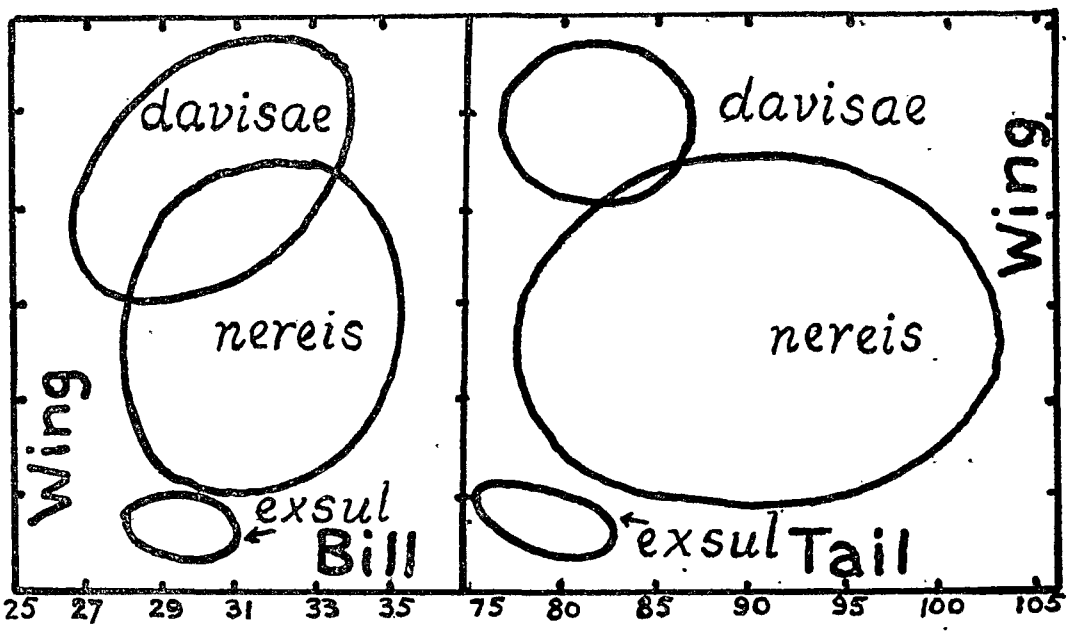

Fig. 2.—Ranges of bill/wing and tail/wing ratios in subspecies of *Sterna nereis*.

but there is considerable overlap. In every other respect Australian and Japanese birds are identical and there are, therefore, no valid grounds for retaining *placens* Gould 1871 (syn. *inconspicua* Masters 1876) for Australian birds. *S. a. tormenti* Mathews 1912 b, type locality Point Torment, North-west Australia, is a synonym of *sinensis*.

S. a. saundersi, of which there is one Australian specimen, has the outer primary shafts black (white in *sinensis)*, and the rump light-grey (white in *sinensis*) in adult summer plumage (Gibson-Hill, 1950). Wing-length also averages much less than *sinensis*, and never exceeds 180 mm.

measurements of eggs of *sinensis* from Malaya (Gibson-Hill, 1950).

ENVIRONMENT AND FOOD

If the principle so cogently established by Mayr (1942) and Lack (1944)—that new species of birds originate when forms of the parent species differentiate in geographical isolation and subsequently meet in the same area—holds good, then the two species under review would seem to exemplify it well.

As Lack states, two such differentiating forms, on meeting, will tend to compete ecologically, with one of four end-results:

LEAST TERNS

TABLE II

	Sample	Max.	Min.	Average
S. n. nereis	34	39.0 x 26.3 and 36.4 x 26.8	31.7 x 23.9 and 33.3 x 23.6	35.6 x 25.2
S. a. sinensis (Aust.)	69	38.0 x 24.9 and 32.3 x 25.5	30.0 x 23.2 and 32.7 x 22.6	32.8 x 24.2
S. a. sinensis (Malaya)	20	34.0 x 24.0 and 32.5 x 24.5	31.0 x 23.0 and 32.5 x 22.5	32.6 x 23.9

(1) one species may eliminate the other completely; (2) the two may withdraw to occupy separate but contiguous geographical areas; (3) the two may occupy different habitats in the same region, or (4) they may occupy the same ecological niche in the same region but eat different foods—or a different size-range of the same food. Fisher and Lockley (1954: 117) cite a beautiful example of the latter, which demonstrates the existence of a specific food-pattern in four species of terns (Sandwich, Common, Gull-billed and Little) nesting together on an island on the Crimean peninsula.

Existing knowledge of the ecology of *nereis* and *albifrons* is not adequate to state with certainty whether the two have reached the stable position of (2) above, or whether there is still active encroachment by one species on the range of the other. H. T. Condon *(pers.comm.)* is of the opinion that *albifrons* has only recently reached the Australian region, and this is supported by evidence of its apparently quite recent arrival in New Zealand (McKenzie and Sibson, *ibid.)*. It seems likely that *nereis* differentiated from the parent stock a very long time ago and successfully colonised western and southern Australia, Tasmania, New Caledonia and New Zealand. It either did not establish itself in northern and eastern Australia at all or, if Gause's Principle has operated in this case, it formerly inhabited these coasts but has since retreated in the face of ecological competition from *albifrons*. It seems tolerably certain that *nereis* has a precarious foothold at present in New Caledonia and New Zealand; in the latter region it is now confined as a breeding species to one small area of the North Island. It is not suggested that other factors have not contributed to the decline or disappearance of *nereis* in certain areas but, on present evidence, admittedly far from complete, its ecology is fundamentally similar to that of *albifrons*.

Field observations in many parts of Australia indicate that both species are largely piscivorous; both prey on about the same size-range of fishes; within the broad biotope common to both they forage over a comparatively wide range of similar micro-habitats; both choose exactly similar nesting sites: shingle and sand beaches, especially on low-lying barren islets in bays and inlets, and on islands *within the confines of the continental shelf* (200-metre depth-line). In general, therefore, the habitat preferences of both species in Australia are neritic, rather than pelagic, and estuarine rather than fluviatile.

Published data on gut contents of *nereis* have only revealed fish remains (Cleland, 1924; Sutton, 1927). However, analysis of two March specimens (Coorong, South Australia), and three October specimens (Hobart, Tasmania), revealed the presence of other aquatic organisms, viz.: small gasteropods (mollusca), crustaceans, and unidentifiable plant material.

Gut analysis of five breeding specimens of *albifrons* (collected at Mallacoota, Victoria, in January) disclosed only fish remains, including two whole examples of *Atherina microstoma*. Collinge (1926) lists the following animals from five specimens of *a. albifrons* collected at Norfolk, England (four in May, one in September): fish 1.87%; crustacea and annelida 96.88%; marine mol-

lusca 1.25%. From North America, Henderson (1934) quotes gut analyses of *a. antillarum*: 8 stomachs contained 72 grasshoppers and locusts, and 135 other insects; 49 stomachs contained crustacea 5% and fishes 95%; 75 stomachs (summer specimens) contained almost exclusively fishes, only four or five containing insects.

To sum up, the present, rather slender, evidence indicates that the fundamental ecology of *nereis* and *albifrons* is similar. Field observations, and to some extent gut analyses, point to a wholly fish diet, especially in summer, but both species undoubtedly vary their food seasonally.

BREEDING SEASONS

Baker (1938) attempted to show the relations between latitude and breeding seasons of birds, basing his conclusions on data provided by *egg-seasons*, that is, the seasons at which living eggs (fresh or incubated) are found. He concluded, *inter alia*, that, "the main proximate causes of the breeding seasons of birds are thought to be temperature and length of day in the boreal and temperate zones, and rain and/or intensity of insolation near the equator. The time of arrival from migration is often an important factor."

In a subsequent paper (Baker, 1939) he stated: "In the southern part of the Southern Hemisphere the re-analysis (of egg-season data presented earlier) confirms the expected conclusion that the further one goes south the later, in general, the start of the egg-season becomes. For example, selected members of the aquatic groups mostly start egg-laying in September and October in 30°—40° S., and in November in 40°—50° S."

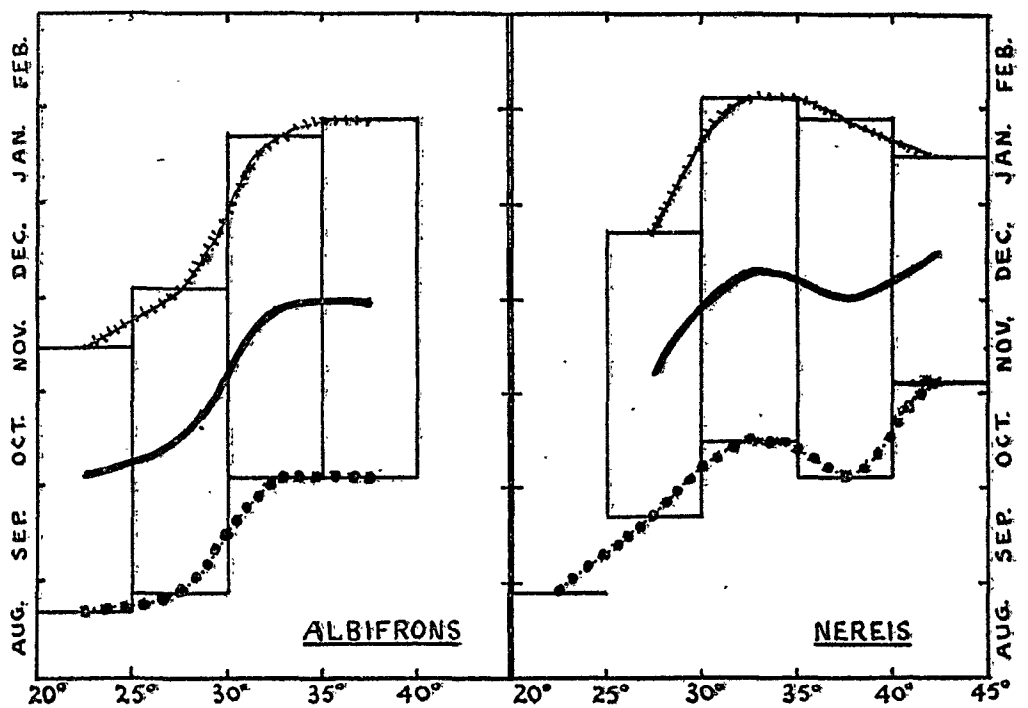

Fig. 3.—*Sterna albifrons* and *Sterna nereis*. Egg data for Australia (see Appendix I) plotted to show, for each five degrees of latitude, (a) latest (upper), mean (centre), and earliest (lower graph), (b) duration of egg seasons (rectangles).

Note: abscissae are plotted at mid-point of each latitude interval, months are divided into fifths to obtain ordinates. Note also: *albifrons* does not breed south of 38 deg. S.; there is only one *nereis* record for lat. 20-25 deg. S.

As reasonable samples of egg-data were available for *nereis* (43) and *albifrons* (57) from Australian localities, these were analysed, using the principles embodied in Baker's work. From the graphs (fig. 3) the following can be deduced: (1) going south from the equator, the egg-seasons of both start and finish progressively later, with *albifrons* showing more definite trends (smoother curves) than *nereis*; (2) the *duration* of the egg-seasons is approximately the same, irrespective of latitude—again more nearly constant for *albifrons* (between 40° and 45° the relatively short egg-season of *nereis* may be real, or it may be due to the paucity of data, but probably the latter); (3) in every case, except one (35°—40°), the egg-season of *albifrons* commences earlier than that of *nereis*, and (4) between 25° and 40° the *mean egg-dates* of *albifrons* are in every case earlier than those of *nereis*.

My interpretation of these data is that the breeding seasons of *nereis* and *albifrons*, insofar as they are expressed by the duration of the egg-seasons through at least 15° of latitude, have little or no relation to photoperiod. Secondly, that irrespective of latitude, the stimuli (whether internal, external, or both) that 'trigger off' egg-laying in *nereis* are slightly but significantly different to those for *albifrons*.

It is appropriate here to note the conclusions of some recent workers on avian breeding seasons. The complexity of the problems involved will be obvious from their remarks. Wagner and Stresemann (1950), writing of Mexican birds after a 14-years' field survey, concluded: "It was clearly seen that the breeding time of each species was dependent on the combined effect of several or many external factors. The same factor can have material significance for one species, and little or none for another. The periodicity of the length of day plays no appreciable part as a regulating factor. The beginning of the breeding cycle is in the final instance dependent on the emotional state of the female, which must be raised to a threshold value by the influence of external stimuli of the most varied kinds. Only then is the female emotionally and somatically ready for copulation and maturation of the ovum."

Marshall (1951), who studied the refractory period in avian testis rhythm, and its possible relation to breeding and migration, concluded: "No single over-all factor such as day-length or light-increment is responsible for the timing of avian breeding seasons. The breeding season is kept in step with the sun essentially by the external factors that permit nidification, ovulation and the survival of young on the habitual breeding ground. Of these, the most important may be a safe nesting site, mild weather, and an abundance of the food on which the young are traditionally fed."

GEOGRAPHICAL DISTRIBUTION

In the following discussion of the geographical ranges of *nereis* and *albifrons*, records have been listed by State, anticlockwise, starting with the most northerly *nereis* record in Western Australia. The following letters, in parentheses after the locality, have been used to indicate the assumed status of the various records:—

B—*breeding*: based either on egg-data or published nesting records, or both;

D—*doubtful sight record*: either because of atypical habitat, or probability of confusion with other species;

NA—*not admissible*: for reasons given in text;

S—*specimen*: skin or skeletal material.

All localities without notation are to be regarded as *admissible sight records*. A list of breeding and specimen records, numbered to correspond with numbers on the map (Fig. 4), will be found in Appendix II.

STERNA NEREIS

A. WESTERN AUSTRALIA

East Island, Lacepede Islands (D); Broome (D); Bird Island, Dampier Archipelago (B); Cossack; Anchor Island, near Onslow (S); Point Cloates (S); Carnarvon (S); Bernier Island (B); Peron Peninsula (B); Dirk Hartog Island (B); Murchison River Mouth; Houtman Abrolhos (S; B: Pelsart, Wooded, East and West Wallaby Islands); Dongara; Lancelin Island; Lake Yanchep; Swan River Estuary (S); Rottnest Island (B); Fremantle (S); Carnac Island (B); Garden Island (B); Safety Bay (B); Mandurah; Wilson Inlet (S; ?B); King George Sound (S; ?B); Pallinup Estuary; Bremer Bay; Hopetoun;

Esperance district; Mississippi Bay (S); Archipelago of the Recherche: Boxer Island; Israelite Bay (? B).

North of about latitude 20°S. its distribution, abundance and movements are practically unknown, and specimens are particularly desired from the area between Cossack and King Sound. From the latter area (Point Torment) there are two skins of *albifrons* (in the Mathews Collection, A.M.N.H.), but there are no specimen records of *nereis* north of Onslow, and no breeding records of the latter north of the Dampier Archipelago. For this reason the sight records of *nereis* from the Lacepedes (Serventy, 1952) and Broome (Crossman, 1910) have been listed as 'doubtful.'

Reports by D. L. Serventy (1938) and Serventy and Whittell (1951) indicate a seasonal movement of birds breeding in the more southerly areas.

There are no breeding records, based on egg-data, south of Warnbro Sound (Safety Bay), but two December skins from Wilson Inlet (National Museum of Victoria) are labelled 'breeding'; there is a juvenal skin (National Museum) collected at Albany, March 22, 1910, and from Israelite Bay, November 15-18, 1947, there is a record of several birds behaving as though nesting (J. H. Calaby, *pers. comm.).*

B. SOUTH AUSTRALIA

Nuyts Archipelago; Venus Bay (B); Port Lincoln (S); Spencer Gulf: Yadlamalka Station, 50 miles north of Port Augusta (D); Sir Joseph Banks Group (S; B: Kirkby, Langton and Stickney Islands), Lipson Cove (B), Taylor Island (B), Dangerous Reef, Gambier and Wedge Islands, and island near North Neptune Island (B); Yorke Peninsula: Corny Point, Edithburgh (B), Troubridge Island (B), Yorketown (S), Port Vincent, and Pondalowie Bay; Kangaroo Island: Beatrice Spit, near Kingscote (B; S); St. Vincent Gulf: Port Gawler, Buckland Park (B), Wakefield River, near Mintaro (D), and Encounter Bay (S); River Murray Estuary: Currency Creek, Hindmarsh Island, Middleton, Tauwitchere Island, Deep Creek, and Pelican Point; The Coorong: Wild Dog Islands (B; S), Salt Creek, Wood's Well (S), and Trevarrow's Island (B); Kingston; Robe (B; S); Beachport (B: Cowrie Island); Millicent (D); Naracoorte (D).

The largest, and probably the most regular breeding stations are located in the Sir Joseph Banks Group (Wood Jones, *et al.*, 1938), and on certain of the Coorong islands (Sutton, 1933). A small, but apparently stable breeding colony is also located near Kingscote, Kangaroo Island (Lashmar, 1935, 1946).

The River Murray Estuary and the Coorong may be regular wintering areas for birds breeding on Kangaroo Island and on the Coorong islands (Sutton, 1930 b, 1931). Elsewhere there are practically no winter records, and no opinion can at present be given as to the winter quarters of birds breeding west of St. Vincent Gulf.

Attention should be drawn to the four inland records: Cain (1937), Morgan (1919), and Mortlock (1945). These habitats are rather abnormal for *nereis* and, in each case, there is the strong possibility of confusion with *Chlidonias hybrida* in juvenal or eclipse plumage.

C. VICTORIA

Nelson; Portland district; River Hopkins Estuary; Barwon Heads; Lake Connewarre; Port Phillip: Corio Bay (B; S), Mud Island (B; S), Queenscliff (S), Little River (B), Altona Bay (B), and Hobson's Bay; Shallow Inlet; Snake Island (B; S); Port Albert (B); Mallacoota (NA).

Brown (1950), in a paper on the birds of 'Turkeith,' a pastoral property between Winchelsea and Colac, listed *nereis* as a local breeder (data from diary of Urquhart Ramsay); in response to my enquiry Dr. Brown kindly checked on the relevant data and it is clear, from the description given of the eggs by Ramsay, that the birds in question were almost certainly *Chlidonias hybrida* and not *Sterna nereis.*

Morgan (1952), reporting observations by members of the Bird Observers' Club of Victoria, recorded *nereis* breeding on the Goodwin Sands, Mallacoota Inlet, in December 1951. Subsequent collecting and observations in this locality have established beyond reasonable doubt that only *albifrons* breeds at Mallacoota.

In Victorian waters it is reasonably certain that *nereis* breeds regularly, in any numbers, only on Mud Island in Port Phillip, but recent attempts at nesting (all apparently unsuccessful) have been made at Corio Bay, Little River and Altona Bay (all in Port

Phillip). It has bred at least once on Snake Island (Hall, 1901), and once at Port Albert —the easternmost mainland breeding record.

Nothing conclusive is known of the movements of Victorian *nereis* in winter, but there is some slight evidence that it is less numerous in Port Phillip between about March and August. There may be, therefore, a dispersal of summer residents to the east or west (or both) during these months.

D. BASS STRAIT

Furneaux Group: Gould (1842) obtained the type specimen of *nereis* in Bass Strait. Later (1865) he wrote: 'Inhabits many of the low sandy islands in Bass's Straits . . . I observed several pairs on the small island (? Hummock Island—*W.B.H.)* opposite the settlement on Flinders Island, where they appeared to be breeding . . .'

Other records of *nereis* from Flinders Island are: Adelaide Bay (Mellor and White, 1913); Lady Barron and Whitemark (W. R. Wheeler, *pers. comm.)*.

From Walker Island, off the north-west tip of Tasmania (north-east of Cape Grim), there are two breeding records based on eggs in the Australian Museum, Sydney. The precise data are, respectively: c/1, Mosquito Sound, Walker Island, November 25, 1887, and two eggs from different nests, same locality, November 14, 1889. It is interesting to record the breeding of *nereis* in the same locality after a lapse of 68 years. Mr. Duncan McDonald *(pers. comm.)* found a colony, of about 30 pairs, nesting near the north-east tip of Robbins Island, which adjoins Walker Island to the south, on November 2, 1957. A specimen was taken for verification.

The only other record I can trace for Bass Strait is a set of two eggs in the S.A. Museum labelled "Bass Strait, November 20, 1898."

It is conceivable that there are still small resident colonies on several islands, but these are so rarely visited by ornithologists that it may be many years before its modern status in Bass Strait is determined.

E. TASMANIA

Port Sorell, Rubicon River estuary; Seven Mile Beach, east of Port Sorell (? B); Devonport Harbour mouth; Tamar River Estuary; Anson's Bay (B); Orford (B); Hobart District: Pitt Water (S), South Arm, Ralph Bay; Bruny Island.

The paucity of localised records makes it extremely difficult to assess the status of *nereis* in Tasmania; but the evidence suggests that it is comparatively rare and local on the north and east coasts. There appear to be many suitable micro-habitats for *nereis* along the upper-east coast, between Cape Naturaliste in the north and Oyster Bay in the south. There are also few published breeding records (Maddock, 1946; Sharland, 1958). I have to thank Mr. Duncan McDonald for an unpublished record from the north-east coast, Anson's Bay (41° 06′ S., 148° 25′ E), where seven birds were seen on January 14, 1952, and one nest with two chicks was found.

In the Hobart area it appears (H. M. Wilson, *pers. comm.)* to be most abundant between about September and January (and therefore must breed locally). It is evidently absent from about February to August, which suggests a seasonal movement of some kind.

F. NEW CALEDONIA

New Caledonia has some avifaunal affinities with Australia (Mayr, 1940), so perhaps it is not unexpected that *Sterna nereis* should occur there. However, it was not until 1878 that its occurrence was first brought to light (E. L. and E. L. C. Layard, 1878), and its subsequent history is of more than usual interest.

In a letter to the editor of *The Ibis* (1879), the Layards enlarged on the subject of their discovery: ". . . and that he (L. Layard) had seen a flock of very minute terns, which were quite new to him (on a sand-patch off Anse Vata, near Noumea). Next day he went after them with his gun and returned with a specimen . . . of *Sternula nereis* G., a female with the head speckled. This, as far as we can make out, is the first time this species has been recorded from here."

Canon Tristram (1879) commented further on the Layards' specimens: "This tern Mr. Layard also found breeding, and has sent home the eggs with the skins."

A little later, doubts as to the true identity of the specimens apparently arose. One of the Layards visited Sydney, where he conferred with George Masters of the Macleay Museum; this resulted in the birds being

ascribed (1881) to *Sternula placens (=Sterna albifrons)*. The black bill-tip of the New Caledonian birds was remarked on, also the difference in the head-markings to typical *placens*, both of which characters may be seen in *nereis* in certain plumages (see above).

In 1882 the Layards again wrote on this interesting form under *Sternula placens*, including the following records:—

3/9/1877: breeding on islands off Anse Vata; three nests.

3/11/1877: male shot, sitting on egg, at Anse Vata.

1/11/1881: flock of about 20 seen about 10 miles to the north of Noumea.

The possible occurrence of *nereis* in the Loyalty Group (at Lifou) is also due to the Layards (1880).

Sarasin (1913) made no mention of *nereis* nor, for that matter, of any other sea birds, in a nominal work on the avifauna of New Caledonia and the Loyalty Islands.

As nothing, apparently, had been reported since 1881 it was decided to try and glean some information on its modern status in New Caledonian waters. My special interest was aroused when Dr. Mayr informed me *(in litt.* 19/8/52) that there were no skins in the American Museum of Natural History —rather surprising in view of the fact that the Whitney South Sea expeditions were continuously in the field for nearly 20 years and that some of their collectors (notably Rollo Beck) were sea bird 'specialists.'

Help was sought from Dr. John Cumpston, then Australian Consul in Noumea. He kindly made exhaustive enquiries, especially in biological circles, without result. A local fisherman, E. Castex, was commissioned to collect terns in the precincts of Anse Vata; in August, 1954, he managed to secure seven terns, six *Sterna bergii* and one *S. sumatrana*. The Fairy Tern, however, was not sighted.

Following this, skins of *nereis* were sent to Dr. Cumpston, who showed them to a number of local people, some of whom claimed to have seen the species at various places in the Pacific, but the evidence for its presence in New Caledonian waters was not forthcoming.

Dr. Cumpston subsequently made several personal attempts to locate the Fairy Tern, and at last succeeded on April 7, 1957. At Ile Maitre, about a mile off Anse Vata, he observed about 60 small terns on a sandbank. He photographed them in company with Crested Terns, so that the size difference is obvious. Finally, on January 24, 1958, four specimens came into the possession of Dr. Cumpston at Ile Maitre: they were presented to him by a native who was shooting them for the pot! It may be assumed, therefore, that this diminutive race of *nereis (S. n. exsul)* is still extant.

Apart from the four above specimens (now in the National Museum, Melbourne), I have been able to locate only six skins of *exsul*, all collected between May 18 and December 21, 1877. There are four in the British Museum, one in the Museum of Comparative Zoology at Harvard College, and one in the Nattional Museum of Victoria *(ex* Howard Saunders collection). I would be glad to learn of any other museum specimens.

G. NEW ZEALAND

The Neozelanic race of *nereis, S. n. davisae*, is the largest and, probably, the darkest dorsally of the three races. The amount of black in front of the eye—one of the diagnostic characters given by Mathews and Iredale (1913)—is possibly greater than in most Australian specimens, but is variable in extent.

The Checklist of New Zealand Birds (1953) lists it as "rare and local, but resident and breeding," and recent locality records are cited.

The most recent account of the species in New Zealand is by Oliver (1955), who states: "Now rare everywhere, but single or few pairs known to breed in several localities in the North Island, mostly north of Auckland."

The measurements of *davisae* listed in Table I, and graphed in Text-fig. 2, are based on all known specimens in New Zealand collections, and on one skin in the Australian Museum, Sydney.

STERNA ALBIFRONS

A. NORTH-WEST AUSTRALIA

Broome (D); Point Torment, King Sound (S ?).

B. NORTHERN TERRITORY

Melville Island: Cooper's Camp (S); Buchanan's Islet (S); Darwin (S=type of *Sternula placens* Gould 1871); Melville Bay; Gulf of Carpentaria: Sir Edward Pellew Group (S); and Norman River (S).

Nothing substantial is known about the status and distribution of *albifrons* in northern Australia and, unfortunately, there are no recorded nesting localities west of Cape York, or north of Bowen on the Queensland coast.

From Point Torment (West Kimberley) there are two skins (in the American Museum of Natural History), collected February 28 and March 8, 1911, both in 'eclipse' plumage, with *black* bills. As remarked earlier, it is extremely difficult to distinguish first-winter eclipse *nereis* and *albifrons*, and, in my opinion, the identity of these two skins remains problematical.

From Melville Island, and nearby Buchanan's Islet, there are 13 skins (Mathews' Coll., A.M.N.H.), taken by J. P. Rogers, who collected for Mathews on Melville Island between August 1911 and September 1912 (Mathews, 1914). The significance of these specimens (all collected between February 17 and April 8, 1912), in relation to the breeding season of *albifrons* in tropical Australia, is not clear, because only two (collected April 5 and April 8) are in adult, i.e., breeding plumage. The species is possibly an autumn breeder in this latitude—a reasonable supposition by analogy with *Sterna bergii*, which, according to Baker (1938: 570), is at the height of its egg-season in tropical Australia in May and June.

On the other hand, a skin from Observation Island, in the Sir Edward Pellew Group (about 5 degrees south of Melville Island), collected October 21, is also in nuptial plumage, so that the evidence is both scanty and conflicting.

C. QUEENSLAND

Torres Strait Group: Horn Island and Wednesday Island; Cape York (S=type of *inconspicua* Masters 1876); Somerset; Cairncross Island; Bird Island (11° 47' S., 143° 5' E.); Hannibal Island; Port Stewart (S); Michaelmas Cay; Cairns; Dunk Island (?B); Rockingham Bay; Ingham-Mossman; Townsville; Inkerman (Beach Mount: S); Cape Upstart; Bowen (Port Denison: B); Mackay (Shoal Point and Victor Island: B); Capricorn Group: Heron Island (S; ?B), Lady Musgrave Island, Tryon Islet, North-west Island and Wilson Island; Rockhampton (Fitzroy River); Bundaberg (Pelican Island: B); Laguna Bay (S); Moreton Bay: Pumice Stone Channel, Brisbane River, Luggage Point, Oyster Point, Raby Bay (S), Stradbroke Island and Boat Passage.

One of the more puzzling features of the Queensland distribution of *albifrons* is the paucity of recorded nesting localities; one reason, of course, is the lack of observers over a relatively huge coast-length. Another reason may be the actual dearth of habitats particularly suited for the breeding requirements, although this is scarcely credible.

It would appear that certain areas—notably Cairns, Townsville and Moreton Bay—serve as 'staging camps' and some particularly interesting observations, over a period of about three years, have been made by Mr. L. Amiet, who, by virtue of his occupation, voyages regularly up and down the Queensland coast. Some of the results of his observations are illustrated in fig. 5. In the Moreton Bay area, for example, it may be seen (a) that *albifrons* is absent between about mid-May and mid-September; (b) that birds start arriving in late September, with maximum numbers in early November and late November to early December, when they start to fall off; (c) that, in autumn, there is a peak in early March, and then a rapid decrease through April to May. It is my opinion, as yet quite unsupported by more formal evidence, such as banding, that the November-December and March peaks relate to passage migrants *en route*, respectively, to and from southerly breeding grounds.

The pattern for Townsville and Cairns is not nearly so clear, but neither is a known breeding station and, on present evidence, records from each locality may refer purely to passage migrants.

D. NEW SOUTH WALES

Tweed Heads (B; S); Brunswick Heads (B); Byron Bay (B); Broadwater (S); Ballina (B); Yamba (B); Nambucca Heads (B); Port Macquarie (B); Camden Haven (B): Manning River Heads; Forster (Wallis

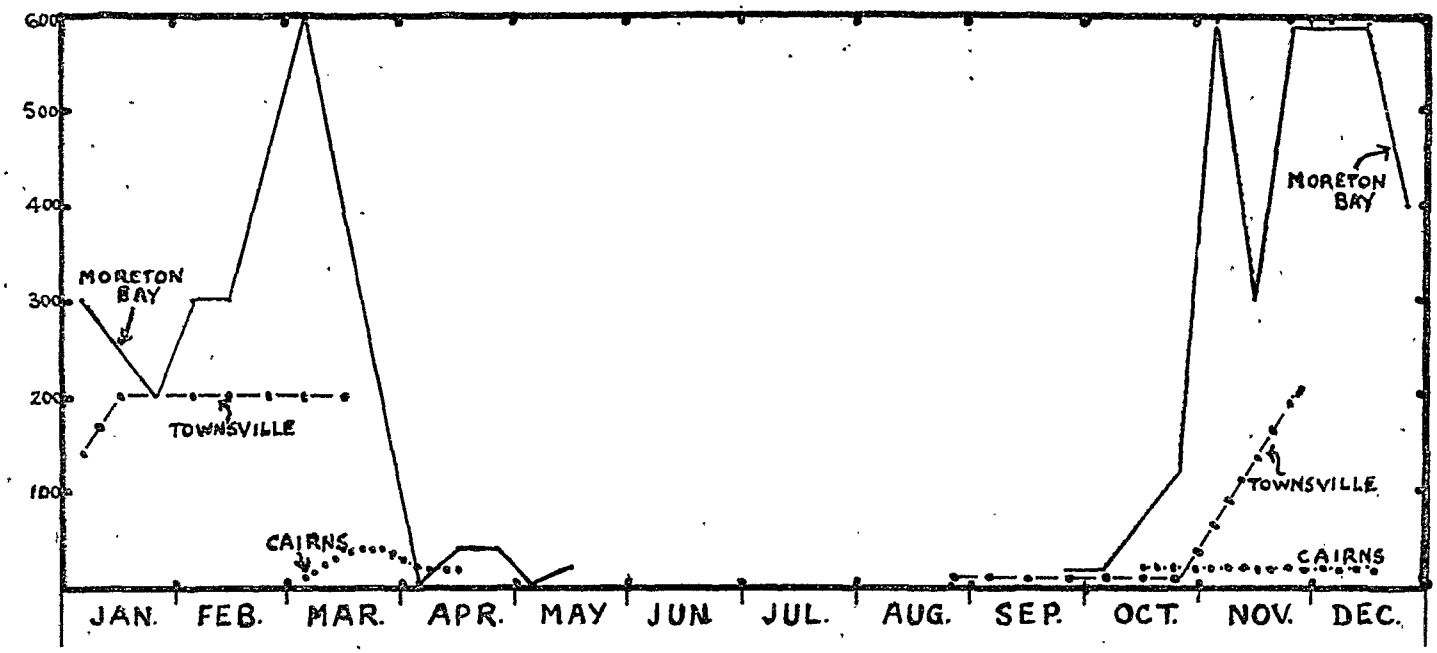

Fig. 5.—*Sterna albifrons*. Graphs showing fluctuations in numbers in relation to time of year at three Queensland localities—Moreton Bay, Townsville and Cairns. Based mainly on data supplied by L. Amiet.

Lake, B); Broughton Island (S); Corrie Island (B); Port Stephens (B; S); Hunter River Estuary: Smedmore (B), Walsh Island (B); Swansea (B); Botany Bay (B; S); Five Islands; Port Kembla (B); Lake Illawarra (B); Shellharbour (? B); Kinghorn, near Shoalhaven River mouth; Burrill Lakes, near Ulladulla (B); Meroo Lake (B).

Breeding from Tweed Heads in the north to Meroo Lake *(ca.* 150 miles south of Sydney) in the south. The earliest egg-date is August 26 (Ballina, Richmond River), and the latest January 19 (Port Macquarie).

There is good evidence that, in the Sydney area at least, *albifrons* is strictly a summer visitor only—arriving in late September (most years) and departing in late February (with passage-migrants slightly later: see fig. 6).

In the Hunter River Estuary, for which there are good breeding data, records by Gwynne (1933) indicate that birds arrive in early October and depart the last week in January. Present evidence strongly suggests that *albifrons* is absent from N.S.W. waters in winter, but there is one conflicting record by Gwynne (1933), who noted 'several' on the Clarence River in July 1932. I am inclined to think there was the possibility here of confusion with *Chlidonias hybrida* in eclipse plumage, and I feel the record is doubtful.

An unresolved problem in the Sydney area concerns the regular appearance of eclipse-plumaged birds with the locally breeding populations in October-November. Following are some relevant notes on these non-breeders, kindly supplied by Messrs. Hindwood and McGill, of Sydney:

"28/11/53. Boat Harbour, North Cronulla beach. Between 70 and 80 birds resting on rocks with Crested Terns and other birds. All but three were in eclipse plumage (or immature ?), i.e., forehead and front of crown white, bill entirely black, legs darkish. When disturbed they kept together in the air, and were very quiet, unlike the local breeding birds in summer plumage (there is a small breeding colony in the sand-hills about half-a-mile back from Boat Harbour). I noted on the card at the time that there was a distinct possibility that the Little Terns occurring here in the middle of summer are migrants from the Northern Hemisphere. When I say 'Little Terns' I mean those in eclipse or non-breeding plumage, not the local breeders." (Hindwood, *in litt.).* Again, on November 10, 1956, Hindwood observed 35 eclipse-plumaged *albifrons* resting on rocks at Boat Harbour.

McGill *(in litt.)* states: "Interesting observations with this species during spring and summer are of seeing large numbers, up to 150, on the sand at Botany and on the reef at Boat Harbour with black bills, whilst flying about and apparently courting and calling well are other birds in full breeding-plumage. Hindwood's theory, and mine too, is that these (the black-billed birds) represent arrivals from Asia (maybe) and that they are in winter plumage and apparently non-breeding, while the others are the local-breeding birds returned."

Additional pertinent observations are by McGill and Lane (1955): "About 40 were in that locality (Lake Illawarra, 14/11/54) and some, with small fish in their bills, were indulging in some form of courtship display. Most of the birds were in non-breeding plumage with black bills." It may be added that, at Mallacoota, south-eastern Victoria, on January 12, 1953, the author saw a flock of eight *albifrons* on the beach; these were all in some form of eclipse plumage, with black bills, and were quiet and shy, in sharp contrast to about five pairs of breeding *albifrons* in the same area. At that time, I was not aware of the possible significance of such birds, and no effort was made to collect them.

There are, I believe, three possible explanations of these apparent non-breeders: (a) they are 'winter' visitors of the race *saundersi,* which according to Gibson-Hill (1950) reaches the Malacca Straits in winter and, in view of the fact that there *is* a Sydney skin of *saundersi,* this is a possibility; (b) they may be wintering *sinensis* from, perhaps, Sino-Japanese waters, or, (c) Australian *sinensis,* but simply individuals not physiologically ready to breed; i.e., they are probably first-year birds which accompany (or follow) older birds to the southern nesting-grounds and are in a 'summer-eclipse' plumage (see Palmer, 1941, for pertinent remarks on this plumage in *Sterna hirundo).*

Whichever explanation is correct, the final

answer lies in the collection of an adequate series of such birds; without these speculation is interesting but fruitless.

E. VICTORIA

Mallacoota: Goodwin Sands (B; S), Mouth of Inlet (B), and Betka River bar (B; S); Tamboon Inlet (B); Marlo; Lake Tyers (B); Lakes Entrance (B; S); Port Phillip: Corio Bay (S), Altona Bay, and Mud Island (NA).

The first published record of the occurrence of *albifrons* in Victoria is by A. H. Chisholm (1915), who reported the R.A.O.U. Camp-Out at Mallacoota, November 1914: "Numbers of these graceful birds were nesting on a low sand-spit (Goodwin Sands). The slight depression in the sand contained from a single egg to the full clutch of three . . . This is, I believe, a new record for Victoria, as it had not previously been recorded for that State."

A set of three eggs, collected by A. Dwyer, October 5, 1912 (in the South Australian Museum), at Mallacoota is actually the earliest record I can trace, but it appears not to have been published.

The specimen from Port Phillip, listed above, was collected by the author, and was associated with a flock of eleven *nereis* resting on a sand-spit. It was shot on March 3, 1953, and proved to be a male with entirely black lores. The following year, on February 11 and March 3, the Altona Survey Group *(pers. comm.)* reported, respectively, two and six birds in Altona Bay, Port Phillip; three of these were noted as "adult" and therefore, presumably, were *albifrons*.

The above three autumn records of *albifrons*, from an area considerably west of the species' known Victorian breeding range, may be explicable as "wrong-way" migrants —strays that moved west instead of north from, presumably, an eastern Victorian nesting ground. Only further collecting, together with banding, will show whether there are regular westerly migrations in autumn, and whether there are nesting grounds of *albifrons* west of Lakes Entrance.

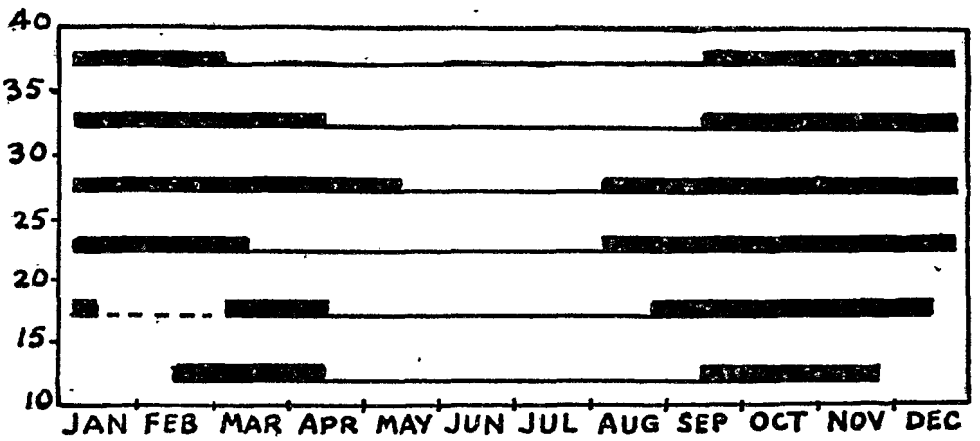

Fig. 6.—*Sterna albifrons*. Time-latitude diagram showing approximate arrival and departure times for each five degrees of latitude. Note: (a) months divided into thirds to obtain abscissae, (b) ordinates plotted at mid-point of each latitude interval, (c) where only egg-data is available the species is assumed to be present two-thirds of a month *prior* to earliest egg-date and one and one-third months *after* latest egg-date.

In the latter connection, reference must be made to a reputed set of *albifrons*' eggs from Mud Island, quoted by Howe (1928): "I have an undoubted set of three eggs taken on Mud Island, and among nests of the following species *(nereis)*." This set is in the

'F. E. Howe Collection' and was taken by E. W. Bunn on November 26, 1911. I have sighted the data-sheet accompanying the eggs but it contains nothing that makes the identification a certainty. The eggs, on colour and markings, could pass equally for *nereis* or *albifrons;* in size, they fall within the range for both species. In my opinion, the record should be discounted.

Apart from the indirect evidence provided by egg-dates, there is absolutely no information yet available on the spring and autumn movements of *albifrons* in relation to its known Victorian breeding grounds.

Finally, with regard to Victorian records of *albifrons,* it should be noted that the birds reported by Littlejohns (1934) at Lakes Entrance were *Sterna albifrons;* the evidence of the photographs establishes their identity. Sharland (1938) used one of Littlejohns' photographs in his paper, and this is wrongly labelled "Fairy Tern."

SUMMARY

1. *Sterna nereis* and *Sterna albifrons* are two morphologically similar, allopatric species. In the field they may be distinguished with certainty only in nuptial plumage.
2. On present evidence, *Sterna nereis* is relatively sedentary and localised, whereas *S. albifrons* is highly migratory and practically cosmopolitan.
3. Three populations of *nereis* are recognisable: *S.n.nereis* Gould (western and southern Australia, Bass Strait islands, and Tasmania); *S.n.davisae* Mathews and Iredale (New Zealand), and *S.n.exsul* Mathews (New Caledonia).
4. Australian breeding populations of *albifrons* belong to the race, *sinensis* Gmelin, but there is also one Australian skin of *S.a.saundersi* Hume.
5. Existing evidence, mainly observational, suggests that the ecology of the two species in Australian waters is fundamentally similar.
6. Data are presented graphically to show, for both species, the relations between egg-seasons and latitude and, for *albifrons,* arrival and departure times in relation to latitude, and also seasonal fluctuations in numbers at three Queensland localities.

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Mr. E. S. Hoskin, of Sydney, did the excellent drawings figured in Plate I, Mr. H. T. Condon drew the map (fig. 4), and Mr. N. A. Wakefield photographed the skins in Plates II and III.

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APPENDIX I

List of egg data used in the preparation of fig. 3. Full details of all sets of eggs are deposited in the National Museum, Melbourne.

1. *STERNA ALBIFRONS*

20°—25°S. Bowen: Oct. 24. Mackay: Oct. 15, 20; Nov. 2, 4, 13, 17. Bundaberg: Aug. 21, 23; Oct. 4, 17, 18.

25°—30°S. Tweed Heads: Oct. 7; Dec. 3. Brunswick Heads: Oct. 18, 24. Byron Bay: Oct. 20; Nov. 13, 27. Ballina: Aug. 26; Sept. 1, 25. Yamba: Oct. 16; Nov. 9.

30°—35°S. Nambucca Heads: Dec. 11. Port Macquarie: Nov. 3; Dec. 26; Jan. 19. Camden Haven: Oct. 18. Forster (Wallis Lake): Oct. 4; Nov. 12, 25. Corrie Island: Dec. 6. Port Stephens: Jan. 12. Hunter River Estuary: Oct. 24; Nov. 12, 16/19; Dec. 4, 13. Botany Bay: Oct. 18, 26; Nov. 12, 14, 19; Dec. 27; Jan. 4, 17. Port Kembla: Nov. 9, 22. Lake Illawarra: Nov. 14; Dec. 9.

35°—40°S. Ulladulla (Burrill Lakes): Dec. 9. Mallacoota: Oct. 5; Nov. 17, 21, 24; late Dec.; early Jan., Jan. 12/24. Tamboon Inlet: early Jan. Lake Tyers: Dec. 18; Jan. 3. Lakes Entrance: late Dec.; early Jan.

2. *STERNA NEREIS*

20°—25°S. Dampier Archipelago: Aug. 31.
25°—30°S. Shark Bay: Sept. 23, 24, 28. Houtman Abrolhos: Nov. 10, 15, 24; Dec. 23.

30°—35°S. Rottnest Island: Jan. 8, 15, 20, 24, 30; Feb. 5. Venus Bay: Oct. 18. Lipson Cove: late Dec. Taylor Island: late Dec. Sir Joseph Banks Group: Dec. 25. Buckland Park (Port Gawler): late Dec.

35°—40°S. Kangaroo Island: Oct. 24; Nov. 1, 9; Dec. 14; Jan. 1. Coorong Islands: Oct. 5/20; Jan. 12/20. Beachport (Cowrie Island): Dec. 26, 31. Mud Island: Nov. 3/8, 22, 26, 30; Dec. 2, 4, 8, 11, 12, 13, 19; Jan. 26/28. Little River: Jan. 25. Altona Bay: Dec. 23.

40°—45°S. Bass Strait (not localised): Nov. 20. Walker Island: Nov. 14, 25. Robbins Island: Nov. 2. Tasmania ('east coast'): mid-Jan.

APPENDIX II

List of breeding and specimen localities shown in fig. 4. The following abbreviations are used for the various museums, etc., where specimens are located:—

AMNH—American Museum of Natural History, New York.

AMS—Australian Museum, Sydney.

BM—British Museum (Natural History).

HLW—'H. L. White Collection,' National Museum of Victoria.

JBH—'J. B. Hood Collection,' Naracoorte, South Australia.

MCZ—Museum of Comparative Zoology at Harvard College.

MM—Macleay Museum, University of Sydney.

NJF—'N. J. Favaloro Collection,' Mildura, Victoria.

NMV—National Museum of Victoria, Melbourne.

QM—Queensland Museum, Brisbane.

RNHM—Royal Natural History Museum, Stockholm.

SAM—South Australian Museum, Adelaide.

S-W—'Serventy-Whittell Collection,' Perth.

TM—Tasmanian Museum, Hobart.

WAM—Western Australian Museum, Perth.

1. Bird Island, Dampier Archipelago: eggs (NMV).

2. Anchor Island, near Onslow: skin (S-W).

3. Point Cloates: skin (AMNH).

4. Carnarvon: skin (BM).
5. Bernier Island: Lipfert (1912).
6. Peron Peninsula: eggs (HLW).
7. Dirk Hartog Island: eggs (TM).
8. Houtman Abrolhos: skins (AMNH, MCZ, SAM, WAM); eggs (AM, NJF, NMV, SAM).
9. Perth (Wanneroo, Pelican Point): skins (S-W, WAM).
10. Fremantle: skin (RNHM).
11. Rottnest Island: eggs (NJF) and V. N. Serventy (1950).
12. Carnac Island: Serventy and Whittell (1951).
13. Garden Island: as above.
14. Safety Bay: Serventy and Whittell (1951); LeSouef (1902).
15. Wilson Inlet: skins (HLW, WAM).
16. King George Sound: skins (BM, HLW).
17. Mississippi Bay: skin (HLW).
18. Israelite Bay: J. H. Calaby *(pers. comm.)*.
19. Venus Bay: eggs (NJF, SAM).
20. Port Lincoln: skins (AM).

20a. Lipson Cove: W. C. Johnston *(pers. comm.)*.

20b. Taylor Island: W. C. Johnston *(pers. comm.)*.

21. Sir Joseph Banks Group: skins (NMV, SAM), and Wood Jones, *et al.* (1938).
22. Island near North Neptune Island: eggs (SAM).
23. Yorke Peninsula: Yorketown — skins (HLW, SAM); Edithburgh and Troubridge Island—Mathews (1912b) and C. L. McPherson *(pers.comm.)*.
24. Kangaroo Island (Kingscote): skins (AMNH, SAM); eggs (AM, HLW, SAM, TM).
25. Encounter Bay: skin (SAM).
26. Port Gawler (Buckland Park): A. H. Lendon *(pers. comm.)*.
27. The Coorong: skins (NMV, SAM); eggs (SAM and Sutton, 1930a, 1933).
28. Robe: skins (SAM); eggs (SAM).
29. Beachport (Cowrie Island): eggs (SAM).
30. Port Phillip: Mud Island — skins (AMNH, NMV); eggs (AM, JBH, NJF, NMV, SAM). Queenscliff—skin (NMV). Corio Bay—skins (NMV). Little River —Tarr (1952). Altona Bay—Watson (1955).
31. Snake Island (Corner Inlet): skins (TM) and Hall (1901).
32. Port Albert: eggs (AM, NMV).
33. Bass Strait (not localised): eggs (SAM) and Gould (1865).
34. Walker Island: eggs (AM), and Robbins Island (D. McDonald, *pers.comm.)*.
35. Seven Mile Beach (E. of Port Sorell): D. McDonald *(pers.comm.)*.
36. Anson's Bay: D. McDonald *(pers. comm.)*.
37. Orford: Sharland (1958).
38. Pitt Water: skins (NMV).
39. Corio Bay (Port Phillip): skin (NMV).
40. Lakes Entrance: skins (NMV) and Littlejohns (1934).
41. Lake Tyers: eggs (NMV).

41a. Tamboon Inlet: N. A. Wakefield *(pers. comm.)*.

42. Mallacoota: skins (NMV); eggs (AM, NJF, NMV, SAM).
43. Meroo Lake: K. A. Hindwood *(pers. comm.)*.
44. Ulladulla (Burrill Lakes): C. Humphries *(fide* K. A. Hindwood).
45. Lake Illawarra: L. Amiet *(pers.comm.)*, McGill and Lane (1955), and North (1913).
46. Port Kembla: S. G. Lane *(pers.comm.)*.
47. Botany Bay: skins (NMV), Sharland and Hindwood (1941), and K. A. Hindwood and A. R. McGill *(pers.comm.)*.
48. Swansea: Sharland (1938).

49. Hunter River Estuary: eggs (NJF, SAM) and Gwynne (1933).
50. Port Stephens: skins (AMNH, HLW); eggs (NMV).
51. Corrie Island: eggs (AM).
52. Broughton Island: skin (AM).
53. Forster (Wallis Lake): eggs (HLW, NJF), K. A. Hindwood *(pers.comm.)*, and S. A. White (1922).
54. Camden Haven: eggs (JBH).
55. Port Macquarie: eggs (JBH, NJF).
56. Nambucca Heads: M. T. Goddard *(fide* K. A. Hindwood).
57. Yamba (Clarence River mouth): eggs (HLW, NMV, TM).
58. Broadwater (Richmond River): skin (HLW).
59. Ballina (Richmond River): eggs (AM, NJF).
60. Byron Bay: eggs (NJF, SAM, TM).
61. Brunswick Heads: eggs (JBH).
62. Tweed Heads: skins (AM); eggs (AM).
63. Moreton Bay: skins (MM, QM).
64. Laguna Bay, Noosa: skins (QM, SAM).
65. Bundaberg (Pelican Island): eggs (JBH, NJF, NMV).
66. Capricorn Group (Heron Island): skins (AM) and E. Slater *(pers.comm.)*.
67. Mackay (Shoal Point and Victor Island): eggs (AM, HLW, NJF, NMV).
68. Bowen (Port Denison): eggs (HLW, NMV).
69. Inkerman (Beach Mount): skin (AMNH).
70. Port Stewart: skin (SAM).
71. Cape York: skins (AM, AMNH, BM, MM).
72. Norman River: Castelnau and Ramsay (1876).
73. Observation Island (Sir Edward Pellew Group): skin (NMV).
74. Melville Island and Buchanan's Islet: skins (AMNH).
75. Darwin: Gould (1871).
76. Point Torment (King Sound): skins (AMNH).

ADDENDUM

The following breeding localities are additional to those listed above and have not been included on the map:—

STERNA NEREIS: W.A.—Penguin Island, Safety Bay, and Walungup Lake (inland, about two miles east of Penguin Island). I am indebted to Mr. Julian Ford for these localities and for the following notes: '. . . I next visited the Walungup Lake colony on January 4, 1959, and found four nests, each with one egg . . . no Fairy Terns were seen on the lake, and also the lake a little to the north—Cooloongup Lake . . . It is interesting to speculate on the origin of this colony. Prior to being made a holiday resort, Penguin Island was a breeding station, so it is probable that human disturbance forced the birds to seek an alternative breeding centre. E. Sedgwick, when residing in this area, did not find the species nesting at Walungup Lake, so it appears quite possible that only over the last two to three years has the species moved inland from the Safety Bay area.'

STERNA ALBIFRONS: N.S.W.—Narooma (pair with young on wing seen on 13/1/59 by R. and C. Carrick).