SEASONAL ABUNDANCE AND BEHAVIOUR OF SEA BIRDS IN THE BAY OF PLENTY, NEW ZEALAND

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ABSTRACT

The seasonal patterns of the abundance of petrels and other birds at sea in the western Bay of Plenty, as observed in 1968 and 1969, are described and correlated with the existing data on breeding places and seasons. Inferences on seasonal migrations and on the feeding range of several species are drawn, and flocking and feeding behaviour are described.

INTRODUCTION

During a fisheries research programme from May 1968 to October 1969 I spent a few days at sea in almost every month aboard the research vessel *Ikatere* of the New Zealand Marine Department. The area traversed was off the east coast of the Coromandel Peninsula and in the western and central parts of the Bay of Plenty, mainly between Slipper Island and Plate Island, from about 5 miles off the mainland to the edge of the continental shelf (indicated by the 100-fathom isobath in Fig. 1). This area is the study area.

On a typical research cruise the vessel would leave Auckland in the morning and travel during daytime through Hauraki Gulf and Colville Channel to the vicinity of Slipper Island. After 4 or 5 days in the study area the vessel would return to Hauraki Gulf overnight. In my fisheries work I spent about 6 daylight hours on deck each day, during which I could observe sea birds more or less continuously. A pair of 10 x 50 binoculars was used in the observations, and the species were identified according to the descriptions by Oliver (1955), Moreland (1957), and Falla, Sibson & Turbott (1966). Some identifications were verified by examining specimens in the Dominion Museum, Wellington. For each cruise the abundance of the species as observed during at least one of the days in the study area was indicated according to the following scale:

0 = absent.
1 = scarce: 1-10 birds.
2 = common: 10-100 birds.
3 = very abundant: more than 100 birds.

By October 1968 I had become familiar with most species that occurred regularly in the study area, and the data collected between October 1968 and October 1969 are summarised in Fig. 2.

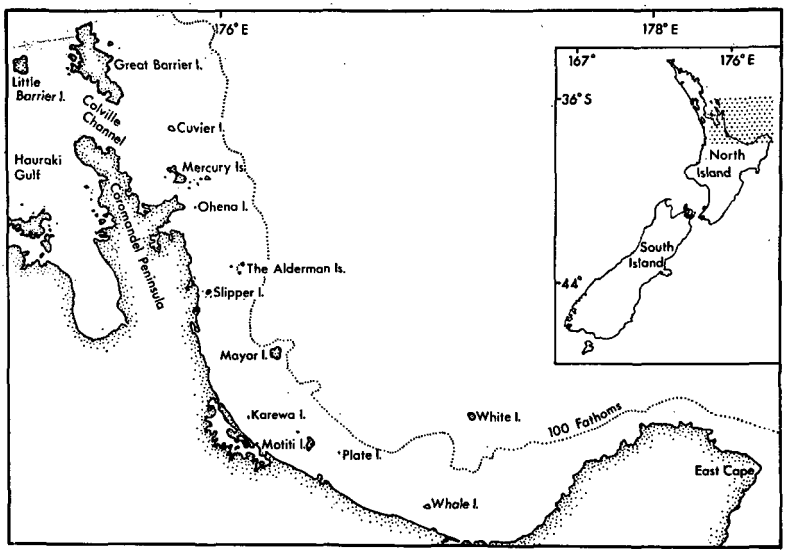

FIGURE 1: Localities mentioned in the text.

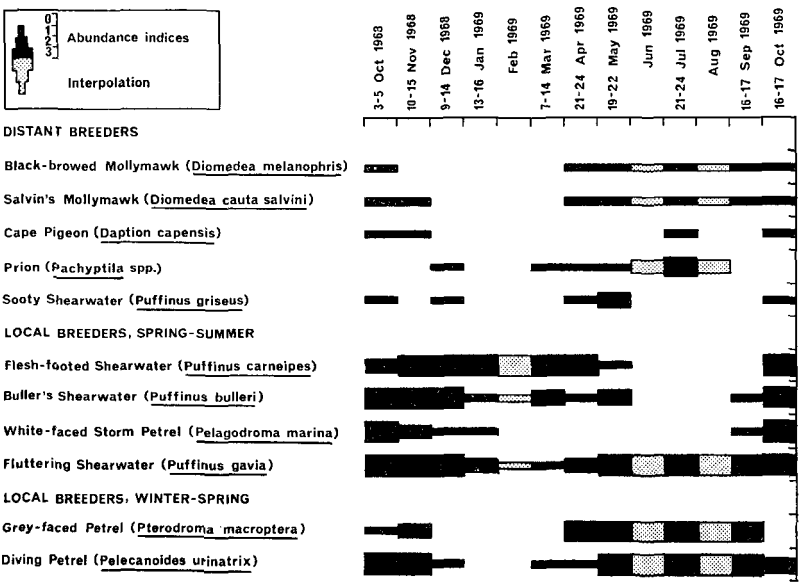

FIGURE 2: Monthly abundance indices of species in the study area. No observations were made in February, June and August 1969.

These data are discussed in detail below, with some occasional observations on abundance east of the study area and in Hauraki Gulf and Colville Channel.

" Petrels " indicates Procellariiformes in general. " In shore " indicates the waters less than 2 miles from the nearest shore, " off shore " the waters between 2 miles from the nearest shore and the 100-fathom isobath, and " far off shore " the waters outside the 100-fathom isobath. The seasons denote the following months: spring, September-November; summer, December-February; autumn, March-May; winter, June-August. The terms " unemployed birds " and " successful parents " are used as defined by Richdale (1963). One species that breeds in small numbers in summer in or near the study area is nevertheless listed as " distant breeder " because it was commonly seen in the study area only in autumn; the birds then seen were probably migrants from distant breeding grounds further south.

During the above period I was not able to distinguish in the field between the Royal Albatross, *Diomedea epomophora* Lesson, and the white adult form of the Wandering Albatross, *Diomedea exulans* Linnaeus, and between the Fluttering Shearwater, *Puffinus gavia* (Forster), and the Little Shearwater, *Puffinus assimilis* Gould. According to Falla (1934), the Little Shearwater is not common at any season in the study area and does not form flocks in coastal waters, and the Fluttering Shearwater is a very common breeder and is often seen in large flocks. It can therefore be safely assumed that the present data on feeding flocks and on large seasonal variations in the abundance of shearwaters of this type refer to the Fluttering Shearwater. Although many albatross sightings were of the easily recognisable dark phase of the Wandering Albatross, the two albatross species are treated together. No attempts were made to identify prions, *Pachyptila* spp., to the species level, so that they are dealt with as a group.

1. SEA BIRDS OTHER THAN PETRELS

1.1 At all times of the year a few Southern Black-backed Gulls, *Larus dominicanus* Lichtenstein, could be seen each day, attracted by the vessel and often following it for a while, but this species never occurred in large numbers off shore. This is in agreement with the description by Oliver (1955) of this bird as basically a shoreline species.

1.2 There are several breeding colonies of the Red-billed Gull, *Larus novaehollandiae scopulinus* Forster, inside and to the east of the study area (Gurr & Kinsky 1965). This species was, however, never abundant off shore, except in July 1969 off Motiti Island, where during 2 days several flocks containing up to 500 birds each were seen. Although the birds seem to stay close to their breeding colonies in summer, large off-shore concentrations may be a feature of the central Bay of Plenty in winter.

1.3 The White-fronted Tern, *Sterna striata* (Gmelin), was never observed far from shore. Flocks of the species were seen only in November-December 1968 and September 1969 near Motiti Island and Plate Island, which probably indicated the presence of breeding colonies in the area. The large flocks that were frequently seen in Hauraki Gulf are not a regular feature of the study area, so that the species does not seem to breed there in great numbers.

1.4 The Australian Gannet, *Sula bassana serrator* Gray, was usually common in Hauraki Gulf and Colville Channel and also east of the study area, but was seen within the study area only in small numbers on a few occasions. The birds of the nearby colony at White Island (Oliver 1955) apparently do not range much into the central and western Bay of Plenty.

2. PETRELS, DISTANT BREEDERS

2.1 Wandering Albatross, *Diomedea exulans* Linnaeus, and/or Royal Albatross, *Diomedea epomophora* Lesson, and Giant Petrel, *Macronectes giganteus* Gmelin:

These species were regularly seen all year round, but never in large numbers. The present data do not confirm the observation by Norris (1965) that in spring these birds leave the coastal waters to the east of the North Island.

2.2 Black-browed Mollymawk, *Diomedea melanophris* Temminck, Salvin's Mollymawk, *Diomedea cauta salvini* (Rothschild), and Cape Pigeon, *Daption capensis* (Linnaeus).

All three species were absent from the study area in summer and early autumn (December 1968-March 1969); at other times of the year they were regularly seen in small numbers, Salvin's Mollymawk being the least abundant species. In Cook Strait these species are also far less numerous in summer than at other times of the year (J. A. Bartle, pers. comm.), and Norris (1965) noted that Cape Pigeons disappeared from the Tasman Sea and the east coast of New Zealand during the first 2 weeks of November. The three species breed in summer on islands in latitudes south of New Zealand (Oliver 1955). Apparently the immature section of the populations also migrates in spring to more southern latitudes, if not to the parental breeding grounds.

2.3 Sooty Shearwater, *Puffinus griseus* (Gmelin):

The species breeds in small numbers on The Aldermen Islands, Whale Island, and White Island. " . . . the number of burrows of this species on any of the islands would not be more than a dozen " (Falla 1934: 251). The birds seen occasionally from October 1968 to April 1969 probably belonged to these small populations, and the increase in numbers that occurred in May 1969 is to be seen as a symptom of the massive northward migration from the Stewart Island

area and further south that takes place along the coasts of New Zealand in April-May (Richdale 1963). Apparently the Bay of Plenty lies outside the main path of the migration, or at its fringe, for even in May the species was not really abundant in the study area.

3. PETRELS, LOCAL SPRING-SUMMER BREEDERS

Of the local spring-summer breeders mentioned below, three species (Nos. 3.2-3.4) are transequatorial migrants (Falla 1934). The common feature of these three species was their complete absence in winter (see July 1969 in Fig. 2), but apart from this, there were important differences in their seasonal pattern of abundance at sea.

3.1 Prions, *Pachyptila* spp.:

During most of the year prions were seen only occasionally, but large flocks of up to several hundreds of birds were common in winter (July 1969). The Fairy Prion, *Pachyptila turtur* (Kuhl), breeds at the Poor Knights Islands, about 100 miles NW of the study area, and possibly at islands in the outer Hauraki Gulf (OSNZ Annotated Checklist 1970). The birds seen in summer and autumn may well belong to the populations on these islands. The Fairy Prion " appears to have a non-migratory regime merely dispersing over the Southern and Indian Oceans after breeding " (Serventy, Serventy & Warham 1971: 112). The large numbers of prions seen in winter may therefore include Fairy Prions from the Poor Knights Islands as well as migrants from more distant areas belonging to this and other species.

3.2 Flesh-footed Shearwater, *Puffinus carneipes hullianus* Mathews:

The main breeding station in the Bay of Plenty is Karewa Island (Oliver 1955). The birds begin to come ashore there in September (Falla 1934). Initially they stay ashore most of the time and go without food (R. A. Falla, pers. comm.). This would account for their absence at sea in September 1969. From October 1968 until the end of April 1969 they were very abundant at sea, but by May they had almost disappeared. This species simply appears to arrive *en masse* at the beginning of the breeding season and to depart equally abruptly at the end of it.

3.3 Buller's Shearwater, *Puffinus bulleri* Salvin:

The sole breeding station is north of the study area, at the Poor Knights Islands (Falla 1934); suppositions about breeding at other islands have never been confirmed (R. A. Falla pers. comm.). Buller's Shearwater was absent from the Bay of Plenty in mid-winter. The data indicate that these birds appear in moderate numbers in September (possibly August, but no observations were made in that month), and are very common from October to December. Most of the young hatch in the latter half of December (Falla 1934); therefore there should be much breeding activity in January. However, numbers declined considerably in January 1969; in the following autumn the birds became somewhat more common in the study area.

The unemployed Sooty Shearwaters migrate away from the breeding grounds much earlier than the successful parents do (Richdale 1963), and the decrease in numbers of Buller's Shearwater at sea in January suggests that a similar phenomenon may occur in this species. The subsequent increase in numbers in March-May would then be due to the appearance of the young-of-the-year; according to Falla (1934), the fledglings leave the nest in March.

3.4 White-faced Storm Petrel, *Pelagodroma marina* (Latham):

Near the study area this species breeds at the Mercury Islands; inside it, it breeds at The Aldermen Islands and possibly Mayor Island (Oliver 1955). The present data confirm the statement by Falla (1934) that the birds are very common at sea during daytime in October-November; they often occurred in large loose concentrations of several hundreds of individuals. Richdale (1965: 56) stated that in general " . . . Storm Petrels spend their daylight hours a long way from the breeding grounds," but this does not seem to apply to the earlier part of the breeding season in the Bay of Plenty. The eggs are laid during the last 10 days of October (Falla 1934). Many birds are therefore brooding the eggs in November, which accounts for the decrease in numbers at sea from October to November 1968. According to Falla (1934), hatching takes place towards the end of November, and I can confirm his statement that from then on the birds appear only in inshore waters after sunset. During that part of the breeding season the daytime activities (probably including feeding) seem to take place well off shore, outside the 100-fathom isobath.

In northern New Zealand the fledglings leave the nest in late February and early March (Oliver 1955). The present data suggest that the young birds leave the burrows after dark and make immediately for far off-shore waters, for no birds at all were seen within the 100-fathom isobath in March 1969 during daytime. The birds are absent from the breeding grounds from late March until the middle of August (Falla 1934), and no birds were seen at sea in those months during the study period.

At about 10 p.m. on 13 November 1968 three White-faced Storm Petrels were attracted by the ship's lights close to Slipper Island and were captured. This suggests that the species may breed on Slipper Island or the islets nearby, the captured specimens possibly having been on their way to breeding places on these islands.

3.5 Fluttering Shearwater, *Puffinus gavia gavia* (Forster):

Falla (1934) states that this species is the most common breeding petrel in northern New Zealand. In the Bay of Plenty it has been found breeding on The Aldermen Islands, Slipper Island, Plate Island, and Whale Island. Birds were present in the study area at all times of the year, as was also concluded by Imber & Crockett (1970) from data on beach wrecks. The present data show also marked seasonal variations in the abundance at sea.

The breeding period ends in late January, the young leaving the nest during the last 10 days of that month (Falla 1934). During the cruise of 13-16 January 1969 the breeding birds should still have been present in the study area. The numbers seen at sea at that time were nevertheless very low, compared with the vast numbers seen earlier in the breeding season. This may indicate a movement away from the area by the unemployed birds on their suspected migration to the eastern coast of Australia (Imber & Crockett 1970). The proportion of unemployed birds in breeding populations of shearwaters is quite high, e.g., about two-thirds in the population of the Sooty Shearwater (Richdale 1963). Movements of this component of a population should therefore have a noticeable effect on the abundance of the birds in a given area.

Fluttering Shearwaters remained scarce in the study area from January 1969 until the end of April 1969. Observations in the Hauraki Gulf and in Colville Channel at the same time gave the impression that peak numbers were reached there during these months. This suggests that after the possible migration across the Tasman Sea by the unemployed birds in summer, there is a northward movement from the Bay of Plenty towards Hauraki Gulf in early autumn. By May 1969 the birds have apparently returned again to the Bay of Plenty, although they were not present in such vast numbers as in October-December 1968. This may indicate that only last season's successful parents returned, the unemployed birds remaining elsewhere.

Although Falla (1934) and Oliver (1955) reported burrowing and courtship behaviour ashore as starting in September, the birds may begin to come ashore shortly after their return to the breeding area in May. Blackburn (1970: 298) saw " small numbers " coming ashore at Little Ohena Island (a small islet off Ohena Island) in June 1970.

The migration into Hauraki Gulf in early autumn may be connected with the annual moult of the adults, which starts in January and may continue until June (Falla 1934). Flight power is much reduced in this species during moult (R. A. Falla, pers. comm.). It is perhaps advantageous for the adults to spend the major part of the moulting period in an area such as Hauraki Gulf, which offers much shelter in the form of bays and islands in comparison with the Bay of Plenty, which is much more open and exposed.

4. PETRELS, LOCAL WINTER-SPRING BREEDERS

4.1 Grey-faced Petrel, *Pterodroma macroptera gouldi* (Hutton):

This species breeds on most islands off northern New Zealand (Falla 1934). The main breeding stations in the study area are The Aldermen Islands, Mayor Island, and Whale Island (Oliver 1955). From April to September 1969 the species was commonly seen at sea towards the evening near islands. The vessel was often stationed near Slipper Island in the late afternoon. From about 1½ hours before sunset onwards the waters nearby were occupied by a large

diffuse aggregation of birds, all on the wing and moving very fast; at any moment up to about 500 birds could be seen by scanning the whole horizon. On such occasions the birds did not form well-defined flocks moving in a co-ordinated way like, for instance, the Fluttering Shearwater. The only structure that was observed commonly was groups of two or three birds moving at great speed, one or two birds closely following another individual. If this were just a symptom of gregariousness, the groups could be expected to be larger, but since usually only small numbers of birds are involved, this behaviour probably reflects intraspecific communication at a higher level, such as courtship.

The young hatch in late August and September (Falla 1934). Large concentrations of birds near the nesting grounds in the late afternoon were not seen after September (both in 1968 and 1969). This indicates that the behaviour of the birds may change after the hatching of the young. Possibly the daylight hours are from then on more fully spent in gathering food for the nestling in off-shore waters, so that the birds arrive near the breeding grounds only after dark. A departure of unemployed birds may also be involved here.

During daytime the species was never seen close to land, but was occasionally observed over deep water near the edge of the continental shelf. In November 1968, for instance, a loose group of about 100 birds was seen at about 5 p.m. 3 miles east of The Aldermen Islands. In March and September 1969 many birds were also seen between noon and 3 p.m. 5 miles north of Plate Island. This suggests that when at sea the birds spend the daylight hours mostly over the deeper off-shore waters, but not as far from the breeding grounds as was, for instance, assumed by Oliver (1955: 163), who stated: " Probably . . . its feeding ground is some hundreds of miles from its breeding place." During research cruises in March 1970 and June 1971 I found the species to be common throughout the day at the western side of East Cape, where the continental shelf is very narrow, so that deep water is close to the shore.

4.2 Diving Petrel, *Pelecanoides urinatrix* (Gmelin):

In the study area this species has been found breeding at The Aldermen Islands, Karewa Island, Slipper Island and nearby islets, and Plate Island. Diving Petrels are common during most of the year, except that " . . . from January to March . . . they are rarely seen at sea in coastal waters " (Falla 1934: 246). The present data show a similar absence from December 1968 to April 1969, so that during much of summer and in early autumn the species seems to be absent from the more off-shore waters also. During that time of the year the annual moult of the adults takes place (Falla 1934, Thoresen 1969). In the Diving Petrel this is a drastic occurrence, the remiges and rectrices being moulted all at once (Watson 1968). R. A. Falla, in a paper read at the August 1969 Conference of the

New Zealand Marine Sciences Society, has suggested that during the moult the adults may remain for long periods in their burrows. If this were so, the question still remains of where the young-of-the-year go after they leave the nests in December, as stated by Falla (1934). A possible explanation is that during the period in question this small bird is still present at sea near the breeding grounds, probably as close to shore as usual, but making itself inconspicuous by not forming large groups and by living mostly on the water like the Blue Penguin, *Eudyptula minor* (Forster). This species is a very common breeder in the study area, judging from massive beach strandings mentioned by Oliver (1955), from the large number of penguin footprints observed on the beaches of Whale Island in December 1968, and from the frequency with which penguin calls were heard from islands at night during most of the study period. Yet penguins were only very rarely seen at sea.

5. PETRELS, OCCASIONAL VISITORS

5.1 Black Petrel, *Procellaria parkinsoni* Gray:

Of the several breeding places of this species, Little Barrier Island is the nearest to the study area (Oliver 1955). One specimen was seen in March 1969 during daytime, between Mayor Island and Motiti Island. Many Flesh-footed Shearwaters were around at the time. Since the Black Petrel has not often been identified at sea (OSNZ Annotated Checklist 1970), I give here the field notes made on the occasion: " Flight swooping and soaring, very high and fast compared with that of Flesh-footed Shearwater. Seems somewhat smaller than Flesh-footed Shearwater. Bird completely dark brown-black. Bill dark, upper mandible dark bluish grey, shiny." The absence of this species from beach wrecks in the Bay of Plenty in 1967 (Imber & Boeson 1969) suggests that it does not regularly occur in the area.

5.2 White-headed Petrel, *Pterodroma lessoni* (Garnot):

Two specimens were seen in July 1969 near the Mercury Islands, associating with an " evening flock " of Grey-faced Petrels. The White-headed Petrel is regularly cast ashore on New Zealand beaches in winter (Oliver 1955, Imber & Boeson 1969).

FLOCKING AND FEEDING

Throughout spring and summer, when Fluttering Shearwater and Buller's Shearwater were common, these species were often seen feeding together at the sea surface in large mixed flocks. Close to the shores of Motiti Island and Plate Island White-fronted Terns and Red-billed Gulls often formed part of such flocks as well, so that at that time of the year these four species may in some areas exploit the same sources of food. Fluttering Shearwater and Red-billed Gull also fed together in the central Bay of Plenty in flocks

in winter. As Belopol'skii (1961) pointed out, this type of occurrence does not necessarily indicate a high degree of competition between species for food. Where a certain kind of prey acceptable to several species is highly abundant, mixed feeding flocks may occur, whereas only the highly specialised species (stenobiotic *sensu* Belopol'skii) will pursue it where it is scarcer.

Sladden (*in* Oliver 1955: 129) and Norris (1965) said that the Flesh-footed Shearwater also often associates with the Fluttering Shearwater and Buller's Shearwater, but in the Bay of Plenty I have never seen this bird associating with any other bird species. Large flocks of several hundreds of Flesh-footed Shearwater were observed in November 1968. It was not clear whether or not these birds were feeding, but their presence was not related to discharged ship's offal. At other times of the year discharged offal usually attracted a large number of these birds, but apart from this the birds seemed to move in a solitary manner and occurred diffusely all over the area, many single birds showing up all around whenever one scanned the horizon.

The Sooty Shearwater occurred sometimes with Buller's Shearwater in flocks during autumn, but this association was not seen at other times of the year.

When prions were common in the study area during winter, they were mostly seen in feeding flocks, not associating with other bird species.

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