

Some Observations on the Gannet in Hauraki Gulf

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The gannet with a wingspread of seventy inches, is one of the largest seabirds in New Zealand. Only the giant petrel (span seven feet), and an occasional albatross visiting these waters, are larger. Its white plumage, with black wingtips and pastel yellow head make it a bird of outstanding beauty, and its skill as a diver cannot fail to impress the most casual observer.

The family of Sulidae to which it belongs includes the coloured boobies of the tropics and three sub-families of white "sea-geese" found in the temperate waters of the North Atlantic, the South Atlantic and the South Pacific. One of the earliest known colonies has built on the Bass Rock, off the coast of East Lothian, for many centuries; and so all three types of gannet are called *Sula bassana*. In the North Atlantic round Great Britain and Ireland, Iceland and in the Gulf of St. Lawrence we have *Sula bassana bassana*; near the Cape of Good Hope, *S.b. capensis* and in Australia and New Zealand, *S.b. serrator*. These sub-species differ slightly in size and in the tint of their yellow caps, but the most striking difference is in the number of coloured feathers in their tails. The North Atlantic gannet has all its tail feathers white, Cape gannets have all coloured feathers in their tails, while our gannets have the middle feathers coloured and the outer ones white. There is, however, a great variation in the number of coloured feathers from bird to bird, and in one particular bird they may vary from season to season. *S. bassana bassana* seems to have only the outer eleven feathers (first joint) wing feathers black, while our New Zealand birds have about thirty. When our gannet is seen in flight, most of the trailing edge of each wing appears black; only about five inches each side of the body is white.

A census of the gannets breeding in the North Atlantic completed just before World War II showed that there were some 90,000 pairs. In 1946 the New Zealand Census showed that we had over 20,000 pairs breeding in about 20 colonies round the coast. A request that two colonies be made the subject of intensive study resulted in Dr. K. A. Wodzicki's undertaking his work on the Plateau at Cape Kidnappers, while I started at Horuhoru in the Hauraki Gulf.

Three years were spent on counting eggs and chicks as often as once a week, to determine mortality; dozens of eggs were marked and numbered to find the incubation period, and all known chicks were measured to get an idea of their rate of growth, and their feathering cycle. We found that adult gannets spend six or seven months of the year in active work at their rookery. Upwards of a month was spent in preparing a nest, and laying one egg. Both birds shared hatching duties for at least 43 days. Most eggs hatched in between 43 and 43½ days and any egg unhatched after 44 days was found to be addled or to contain a fully mature chick that had died in hatching. Up to 97% of the eggs hatched but in a bad season up to 86% of the chicks died, leaving as few as 250 (from over 1500 nests) to fly away.

Chicks were found to take the same time to complete the various stages of the feathering, and the rate of growth of their tail feathers was found to be so constant that it gave the measure of their age dependable to within three days. At the end of 13 to 14 weeks the chicks had lost all their down and seemed as large as their parents, although their wingspan was found to be 66 instead of 70 inches. Instead of being white however, they were dark brown, with white

dots at the tips of most of their feathers.

For the next ten days or so the chicks stayed on the ground, but put in hours exercising their wings. Then suddenly on the 108th, 109th or 110th day they flew off to the north-west, continued flying for upwards of a mile, and finally crash-landed on the sea. Although they were unable to take off again, they flapped along and paddled in the original direction until they disappeared. No chick returned to Horuhoru. Where they went we did not know, but certainly away from New Zealand—for immature gannets are not found here except in the autumn months.

In 1951 we started to place numbered rings on one leg of some of the chicks, and within two months two birds ringed at the Plateau, were found in New South Wales. We have now ringed over 4000 and about 300 have been recovered, some in New Zealand as they made their way to Australia, but most in New South Wales. Many Plateau and Horuhoru chicks have made their way to Queensland. A number of Horuhoru birds have flown to Victoria, a few to South Australia and two each to Tasmania and to Western Australia. This last pair travelled over 4500 miles and reached the Indian Ocean. Some of the Tasman crossings have been very fast, several have been only six to seven days. One passage of 2400 miles to Adelaide was made in 12 days.

After growing up in Australian waters, ringed chicks start to return to New Zealand. Two have been found back at the home rookeries in three years, several in four years, and a large number are found laying at the age of five years. This year several were found laying for the first time at the age of six years and two were seven years old. Most of the birds manage to acquire a nesting site within a few yards of where they were hatched; some within three or four feet. When a ringed adult is recaptured for the first time an additional ring is placed on its other leg. In a number of cases birds given consecutive numbered rings as chicks (because they were in adjacent nests), now wear consecutive numbered rings on their other legs (because they occupy adjacent nests as adults). There is strong evidence of continuation of association among neighbouring chicks after they

fly away from Horuhoru, but so far we have no record of such companions pairing off as mates on return from Australia.

After they return to their home rookery, adult gannets spend seven months or more there. They disperse during May and June, or after their chicks have left for Australia. How far afield they go we do not know. An adult caught last January on Horuhoru lost its chick soon afterwards, and was found near Whangarei in March.

Some hundreds of adults have now been ringed, and a number of these have been caught season after season, some several times a season. Each time a bird is caught a number of observations are made and recorded. The most important are the exact position of its nest (co-ordinates from known reference points are used) and the contents, and the number and colour of its tail feathers. Although much remains to be done, we already have evidence enough to suggest that a gannet pair mates for life, that they endeavour to use the same nest each year, that birds that lay early one year do so the next, that they lay only one egg, but if it is lost early in the season they can lay a second egg about four weeks later. Two seasons ago "Gertie", a specially marked hen in her fifth year was visited ten times between August and January, and during this time she laid three eggs and lost two of them. The third one hatched, but the chick died when it was a few weeks old. So far she has not been seen this season, but her nest is occupied by a ringed bird which may of course be her husband; Gertie has two rings.

Textbooks credit adult gannets with having 12 tail feathers, the outer four on each side being white and the middle four dark brown or black. Quite early in our study we found that this was not true. Birds were found with three, five, seven and eight coloured feathers. When in 1954 we recovered a four-year-old ringed as a chick, we found it had the outer three on each side white, the middle four black and the fourth and ninth feathers mainly black but with a broad diagonal white stripe. I thought this variegated feather might be a characteristic of a sub-adult. Since then we have recorded the number and colour arrangement of the tail feathers of every adult caught. Some

adults have been caught several times. As a result we can say that the number of feathers is twelve or ten. The outer two feathers are always white but there may be up to ten coloured feathers. There are often variegated feathers (one or two each side) separating the whites from the all-blacks. The 4-4-4 arrangement does not indicate a very mature bird; birds showing this pattern one season have been found to revert to ten feathers the next with all three types of feather showing.

We have not yet enough records to venture an estimate as to how long a gannet may live. We have several ringed birds that we know are at least twelve years old. The mortality rate among chicks is so high, and breeding seems to begin so late, that it seems likely that a pair may be twenty years old before they have succeeded in raising two breeding adults to replace themselves. Our most complete record is of a pair which

raised a chick the first season, had a sturdy chick the second (but it had its neck broken in a landing accident), and did not occupy the nest the third. The fourth season the hen turned up alone and laid an egg in the same nest. After she had sat on it for over three months I found it was infertile. The fifth season she brought a new husband to the same nest and they hatched an egg but the chick died after a few weeks. Last season they succeeded in raising a chick but this season, at our last visit, the nest site was still vacant. The female must now be at least 12 years old. In six years, she and her mates have succeeded in raising two chicks to a stage where they could depart for Australia. We have no news of either returning to Horuhoru.* In spite of all this, our colonies are slowly increasing in size. Very long life of breeding pairs must be making up for the high mortality among their chicks.

Hydrology of Hauraki Gulf

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Most of the published data concerning the Hauraki Gulf are confined to surface temperatures (Cassie, 1956; Dellow, 1955; Marine Department, 1938; Skerman, 1958).

The only records of salinity are by Fuller (1953) and of subsurface temperature by Cassie (1957). I have collated the published data with unpublished data from various sources and it is possible to present a reasonably representative picture of conditions in the Gulf both for summer and winter. While my interpretation may seem rather a drastic oversimplification to the hydrologist, I feel that some interpretation is better than none, and that it will be quite adequate for the purposes of the ecologist. I will consider only the outer Gulf (north of an east-west line passing through the northern extremity of Waiheke). The inner Gulf, Firth of Thames and Waitemata Harbour will obviously be more heterogeneous in

character, depending on the influence of various freshwater sources. In general, salinities will be lower, particularly in winter, and temperatures will be several degrees higher in summer and lower in winter.

Surface temperatures tend to follow the trend of air temperature fairly closely, though with a lag of 2-4 weeks. Maximum temperature is in January-February, and minimum in July-August. Particularly in summer, surface temperatures alone are a poor index of underlying water temperatures owing to the tendency for a surface layer of a few feet depth to be heated by the sun to a temperature several degrees higher than the main body of water. Apart from abnormal temperatures in harbour or very shallow water, the maximum recorded annual range of surface temperature is from 9°C. to 23°C. An average range would be from 13°C. to 22°C., although these figures

* The nest site remained empty throughout the season. On 15 Jan. 1960 the female (No. 19860) was found sick at Warkworth, 40 miles north-west of Horuhoru—she died the following day.