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OBSERVATIONS ON THE BLACK-FOOTED ALBATROSS

WITH THREE ILLUSTRATIONS

By LOYE MILLER

A general paper on the maritime birds that occur off San Diego, California, was contributed by the present writer (Condor, vol. 38, 1936, pp. 9-16) several years ago. Some notes on the Black-footed Albatross (*Diomedea nigripes*) were there included. In the course of the following four years much time has been spent on the off-shore waters with the result that a large amount of additional information on this species has been assembled. The opportunity to do this work was afforded by the Scripps Institution of Oceanography during the many cruises of the "E. W. Scripps" and by the State Division of Fish and Game during one cruise of the "Bluefin" when the two organizations were cooperating in exploratory work. To both these organizations my sincere thanks are extended, not only for the opportunity to work this scientific field, but for the cordial cooperation in every way that added to the effectiveness and to the personal comfort of each day's work.

In addition to several shorter trips, I took five extended cruises into the albatross "territory" with ample time for careful check on the bird population. Three of these longer trips offered the advantage of visiting the same thirty stations at intervals of two to twelve months. At each of these stations the ship remained for a period of hydrographic work which lasted several hours and which offered unparalleled facility for observation on such birds as appeared during that time. Careful count of numbers, records of individuals either marked or recognizable by plumage, notes on behavior, social relations, experiments on feeding—all filled such periods with unflagging interest.

The area most critically studied was included within a rough quadrangle which extended along the coast from San Luis Obispo to San Diego and out to sea approximately two hundred miles. This area included the channel waters, the coastal islands of southern California, and the outside waters to distances well off the continental shelf. The area was transected along four parallel lines, at right angles to the coast, at San Luis Obispo, Santa Barbara, San Pedro, and San Diego. On each of these lines from seven to eight stations were occupied at intervals of fifteen or thirty miles, and a period of approximately two weeks was required for each cruise. South of the Mexican border a similar area was explored along lines running out from Ensenada three hundred and fifty miles, thence south along a line parallel to the coast, and again shoreward into Sebastiano Viscaino Bay south of Cedros Island. This cruise was taken but once. June, July, August and early September were the only periods when my academic duties allowed participation in the work, except for one February trip down the coast and into the Gulf of California. On this latter cruise we ran three hundred miles off shore to take advantage of prevailing winds. No albatross was seen in February. Most of the results here recorded consequently are derived from observation during the summer months—a time which finds the Black-footed Albatross in a non-breeding condition, dispersed most widely over the North Pacific Ocean, and entirely divorced from the land.

Much of the area which we cruised was outside the coastwise steamer lanes and far from the influence of chumming activity of commercial fishermen. Many of the albatrosses appeared to be unacquainted with man and his artifacts. I felt that I was studying wild birds that were relatively unspoiled.

While at sea the corps of oceanographers gathered most accurate data on subjects ranging from the bottom sediments to the bacterial flora of the air at the mast head ninety feet above the deck. The physics, chemistry, dynamics, and biology of the water were minutely examined and recorded. A great variety of conditions was encountered—surface currents, eddies, upwelling, floating organisms, drift masses, cetaceans, schools of larger fishes. All such phenomena were recorded, with the result that we felt that we had a fairly accurate picture of the stage setting for any avian actors that might pass across the boards.

Many former impressions had to be profoundly modified and some new convictions became pretty firmly established. The layman might easily entertain the impression that the ocean is just ocean and therefore satisfactory to any oceanic bird wherever he might chance to alight upon it. Quite the reverse concept is built up in the oceanographer's mind. He looks at his data sheet and says, "Here is a mass of oceanic water," or "This is all shore water" (with no land in sight), or "Here is a region of upwelling."

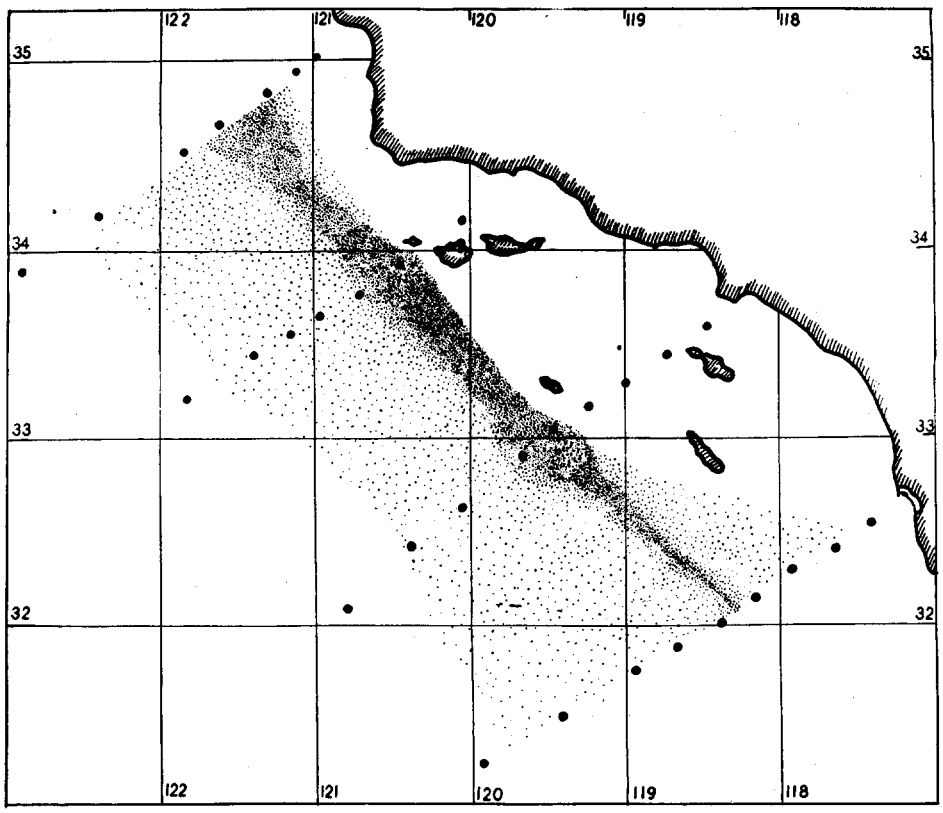

Fig. 65. Diagrammatic chart of the waters off southern California, showing by large dots the oceanographic stations visited. The stippling is designed to express relative concentrations of Black-footed Albatrosses in the years 1937 and 1938.

A definite cold "tongue" of water extends southward from the northern stations outside Point Concepcion and on past the outermost islands well beyond San Nicolas Island; it is even recognizable outside Cedros Island. Outside this zone the surface is warmer and within it the channel waters are relatively "balmy." This "tongue" proved to be of superior interest to the bird watcher. Here were the oceanic birds in greatest numbers.

Distribution.—The striking distributional pattern of the albatross and the factors that determine it furnish the chief impulse which has taken me to sea so persistently of late years. During my undergraduate days, more than forty years ago, parts of this pattern were recognized. Then it was learned that Black-footed Albatrosses were not found on channel waters but were immediately encountered after leaving Point Concepcion going north. That this fact was not due to latitude was proven ten years later by finding them not uncommon along the edge of the continental shelf west of San Diego. To this day I have never seen them well within the channel proper.

Once the species was seen fifteen miles south of Catalina Island and rarely it was seen over the deeper waters just out of San Diego. The scarcity of exceptions to the rule would establish rather definitely the fact that *nigripes* is not a channel bird. Quite in contrast appears to have been the habitat of the Short-tailed Albatross, *D. albatrus*. About 1889 I saw a specimen of that species that had come ashore on the Orange County coast. I have taken from the channel Indian mounds great numbers of their bones, but never any of *D. nigripes*.

Willett (Pac. Coast Avif. No. 21, 1933, p. 14) properly considers *albatrus* to be the common albatross on the channel waters a generation ago. Certainly *nigripes* was not absent from these latitudes at the time of his congener's abundance. The two birds seem to have divided the territory between them, as it were.

The cooler zone of water outside the channel seems to be the summer metropolis of the Black-foot. On passing out to sea into the warmer oceanic waters, one finds their number dropping down almost to zero. In fact, sometimes a whole day, or even two days, would pass without sight of a living creature over the sea surface. The return toward the edge of the shelf would again bring the birds in view in growing numbers. The maximum number of individuals seen at any one time was thirty-three. This record was made 45 miles southwest of San Nicolas Island. At this station my note book says, "Surface water 14° C., the coldest yet. We are in the cold 'tongue' of water coming down past Point Concepcion . . . for two hours after leaving this station albatrosses were all about us, some following and some in conclaves sitting on the sea surface off to one side or the other." A dozen to fifteen birds were commonly seen in the cold "tongue," though never more than five or six at stations outside this area.

There was no concentration about a single food supply, but the birds slowly drifted in from various quarters, apparently to look us over. The accompanying chart (fig. 65) is an attempt to indicate by stippling the relative abundance of the birds, as averaged from records of three trips during June and August of 1937 and 1938.

This area of concentration has no delimiting barriers other than those recognizable by the oceanographer. The term "cold tongue" by which this zone has been designated suggests that temperature might be the controlling factor. Distance from the land has also been considered to be of importance.

Both of these hypotheses had to be abandoned. In the open Gulf of California where surface waters were as cold as those off the southern California coast and where the storms drove us back into sheltered anchorage to escape the biting wind, there were no albatrosses. In the broad expanse of Sebastiano Viscaino Bay, with no land in sight,

they did not occur, but just as we crossed the 100-fathom line coming out, the water temperature dropped to 16° C., and the first albatross noted in several days was sighted. From this point on up the coast to Ensenada we had them in sight much as one sees them along the coast from Point Concepcion to Monterey off Alta California.

In all these instances of albatross concentration, we find bottom conditions practically the same, that is, the bottom rises fairly abruptly from extensive deep water to much shallower shelf waters. Within the channel there occur a number of deeps with shallower water adjacent. Likewise there are in the deep waters off the continental shelf (continental borderland) a number of limited submarine banks that do not come near the surface. In neither case are the conditions satisfactory for a concentration of albatrosses. In neither case is there produced that degree of turbulence that results in the "cold tongue" with its accompanying abundance of plant nutrients making for rich "pasturage of the sea." Micropasturage it may be, but nevertheless it is a powerful and fundamental link in that complex sequence of changes that convert solutes and sunlight into albatrosses, whales, or international crises.

Sverdrup and Flemming of the Scripps Institution have shown the "cold tongue" to be a zone of relative turbulence, rich in nutrient salts; Martin W. Johnson finds the zoöplankton to be derived in part (larvae of *Emerita*) from sand-dwelling species of the coastal strand line, thus completing a picture of turbulence that carries water from the shore outward for a distance of roughly a hundred miles. W. E. Allen finds in the "tongue" a wealth of phytoplankton early in the season that later is "grazed down" by the zoöplankton, producing bottom deposits very rich in diatomaceous remains. Here in this maelstrom of planktonic activity are found the greatest numbers, in fact almost the only specimens, of the Black-footed Albatross in southern California.

Individual territories.—As a species, the Black-footed Albatross ranges far, though irregularly, over the North Pacific. What can we learn of individuals? Has the nonbreeding bird a territorial consciousness? In a field, a marsh, a forest, or a plain that appears to human eyes to be practically uniform, a land bird recognizes certain barriers within which he feels at home and across which he resents a trespass. The oceanographer has learned to recognize water masses with more or less invisible boundaries. Is the albatross an astute oceanographer? Certainly he is a marvelous navigator and seemingly water conscious. Much time was spent in watching individual birds that were recognizable by plumage, molt, or peculiarities of behavior. On four occasions also, I was able to mark individuals by flinging red pigment upon them as they approached the ship's rail. Unfortunately, the birds almost invariably kept up wind from the ship and shunned the lee, which fact gave my efforts a strong tendency to backfire and spatter the pigment over the wrong organism.

Notes on recognizable individuals were recorded at each station, with the result that some definite impressions were derived. One red spattered bird reported at a subsequent station fifteen miles removed. Other recognizable birds were traced for thirty miles, but no farther. As many as two or three birds might attend the ship for a brief period and then desert us through lack of interest presumably, but commonly they were replaced by others. Did they follow until they felt they were far enough "away from home" and drop out in order to return? The impression was repeatedly given that such was the case. Unfortunately, my revisiting of the various stations came at such long intervals that I could not expect to find paint-marked birds on a subsequent cruise.

In attempts at marking, an oil and distillate flux for vermilion pigment was employed for two reasons. First, it would not wash off, and second, only an oil would adhere to the plumage of this aquatic species. The pigment, when it struck the lighter

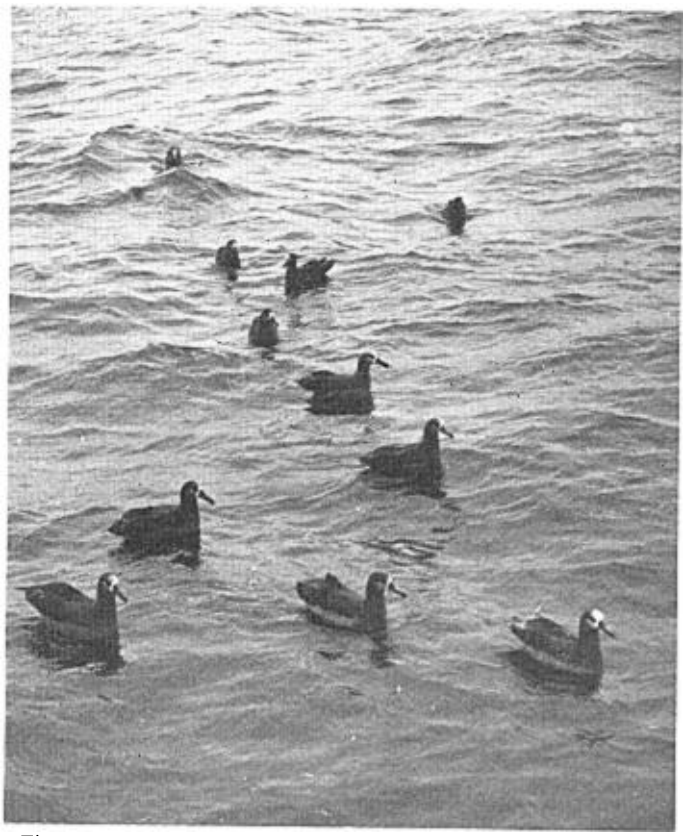

Fig. 66. Black-footed Albatrosses that assembled about the ship.

colored zone about the bird's beak produced an easily recognized mark that must have remained for some time before wearing away. It was out of reach of any preening activity of the beak, but was not infrequently bathed as the bird dipped into the water for food or toilet making.

Where birds have become habitual hangers-on in the regular steamer lanes, it is possible that they travel fairly long distances in the wake of a ship. Our vessel was not in continuous transit, neither was it a source of much food material. I feel quite confident that the birds were acting fairly "naturally" and that they showed a tendency to forage over a restricted area of perhaps thirty miles' diameter.

Other species noted.—Though this report is mainly devoted to the albatross, it perhaps would be permitted to note the presence of other species in the area. Black Petrels (*Oceanodroma melania*) were never seen outside the island barrier, whereas the smaller Kaeding Petrel (*Oceanodroma leucorhoa kaedingi*) and another species, probably *O. homochroa*, were seen and *kaedingi* was collected as far as one hundred and forty miles west of San Miguel Island. A Long-tailed Jaeger (*Stercorarius longicaudus*) was collected near the same point. One small tern and a Mourning Dove (*Zenaidura macroura*) were the only other birds seen far off shore. Surprisingly, the shearwaters seemed not to be interested in the area as a rule.

Gulls came into association with the albatrosses only when we were close in to the seaward side of the islands. On these occasions it was interesting to see how the rough

and tumble gulls bullied the big, mild-mannered albatrosses who did not seem to understand the street-gamin tactics of the smaller birds.

A species that surprised me by its abundance was the Red-billed Tropic-bird (*Phaëton aethereus*). More tropic-birds were identified in the channel and just outside than were seen in an equal period of time spent along the two coasts of Panama. I am strongly of the impression that the Red-billed Tropic-bird, like so many of our marine species of southern California, indulges in a post-breeding dispersal movement that may take it many hundreds of miles north of its breeding range.

Plumages.—Much interest was found in the great variety of plumages seen in *D. nigripes* during the summer. (1) The whitish area about the bill was found in all specimens. This area, however, varied enormously in the degree to which it expanded backward in all planes, that is, over the crown, brow, cheeks and throat. (2) The general body color was dark, but the tone might be slaty, fawn color with much yellow in it, or even ashy bordering on bluish. (3) The upper tail coverts might be almost entirely white, narrowly white, streaked with white, or wholly dark. (4) The under tail coverts might be entirely white (extending forward onto the belly proper), or marked by a transverse band of white not more than a half inch wide back of the vent, or they might likewise be wholly dark. (5) Flecks of dull white might appear on the occiput, hind neck, and throat. One such bird was even dubbed "Old Dominecker" and was fairly certainly recognized at a subsequent station fifteen miles distant. What basis of age, sex, or season can we find for this variability? I confess myself at a loss. Eight birds were dissected, three were white-rumped individuals and five were dark rumped. Only one bird was a male, all but one had gonads that showed previous activity. The virgin bird was dark colored with no white on the tail coverts. Independent counts were made by Dr. Roger Revelle and myself while at sea on different cruises. Without knowledge of the other's count, each estimated that white-rumped birds made up ten per cent of the population. If we credit the current literature and look upon the white rump as typical adult plumage, ten per cent would seem a small proportion of adults in a species raising but one chick per year. Furthermore, it would seem that the species commonly breeds in the subadult plumage. Possibly there is a concentration of subadult individuals along this coast, still only one virgin bird was found among the four dark birds dissected. A possible coincidence may have been responsible for the fact that more white-rumped birds were found in the northern half of our quardangle than in the southern half during one cruise. Still, such was not the general rule and white-rumped birds were found far down the Mexican coast.

There appeared to be no correlation between whiteness of rump and either the paleness of body color or the backward extension of the light facial ring. In some individuals the paleness of crown and face is due in part to bleaching out of the feather pigments. A female with swelling ovaries was in the midst of its molt, with new dark feathers coming into the extensively bleached crown. The body plumage, which is not age bleached, is given a "scaled" effect by the abruptly paler margins of the feathers. This scaled effect was repeatedly seen among the many visitors that came close under the rail. It was not a weathering effect, nor could it be correlated with any other plumage character beyond a general lightness of body color. Paleness of body color was sometimes accompanied by paleness of the beak. Only the blackness of the feet seemed constant.

I am inclined to believe that this species, like so many other "tube-noses," has a wide range of color that is independent of sex, season, or age.

Food.—The impression which was gained from stomach examinations and from long days of watching the hundreds of birds that visited us during the several seasons would brand the Black-footed Albatross as a "feathered pig" insofar as the nature of his food is concerned. In table manners, on the other hand, one might say, he is a gentleman. In every stomach examined there were found squid beaks. Fish bones of good size were found in one stomach, great masses of fish eggs in two stomachs, and sea weed tips (*Macrocystis*) in another. On one of the cruises large numbers of a brick-red decapod crustacean were observed coming to the surface, presumably from deeper waters. These animals swam slowly about at or near the surface either in spawning activity or perhaps as victims of an infection that reduced their specific gravity to a point less than that of sea water. In the course of this decapod swarming an albatross was seen to void a great volume of excrement of brick-red color that could surely have had no other source than the crustaceans for its "carotenoid" pigment.

Fig. 67. Albatrosses come in close to feed. A white-rumped bird is in the foreground.

As to their preferences in galley waste, I found the albatrosses not without a certain discriminative judgment. Fats of all sorts appealed strongly. Plain bread was scorned, but the slight flavor of butter or crisco brought it into instant favor. Excess griddle cakes from the mess table were eagerly seized, presumably for the trace of fat they bore. Masses of congealed bacon fat that had been drained from the cook's kettles caused the greatest excitement among the birds as soon as the flavor was tested. One bird gulped a great mass of cocoa butter. Fat meat appeared to rate higher than lean meat. Never-

theless, pieces of watermelon rind sometimes appeared to attract them. I wondered if the fresh-water content was what appealed in this case.

Behavior during feeding was a matter of much interest. Except when greatly excited, which is seldom, they are most deliberate. A group of gulls would wheel and scream, and dip down to snatch food, then make off if a fellow gull were too close by, but these big, self-contained birds always settled on the surface and moved up to the floating morsel. If it started to sink through the clear water, the bird might reach down the length of the neck, but never farther than could be reached by the tip-up method of surface-feeding ducks.

Food was taken in the extreme tip of the beak where very sensitive taste buds must be situated, so quickly was the recognition of desirability of the object tested. There seldom seemed to be any conflict between individuals. If one fellow lost out, he watched with equanimity as his more fortunate neighbor took advantage of a nearer position. On the rare occasion when gull and albatross came into the same picture on the outer side of the islands, the albatrosses seemed astonished and quite disconcerted by the aggressive manner of the gulls. Certainly an albatross would not seem capable of taking an active prey. The squid beaks and the sizeable fish bones found in stomachs must have come from dead or moribund animals that were floating at the surface.

Birds were not infrequently seen to pick at floating, barnacle-infested bits of drift as well as at the basking sunfish (*Mola mola*). One of these sunfishes that was gaffed had a tremendous infestation of fish lice over its body and there were scratched lines on the skin that might readily have been marks of the sharp nail that terminates the albatross' beak. A sunfish was actually seen to swim toward a pair of resting albatrosses and turn on its side. However, the birds were disturbed before I could see any actual delousing take place. It does seem likely that they might act as "tick birds" for the great inert molas.

Kelp fronds were found in only one stomach, but a couple of birds were watched for some time as they pecked repeatedly and rhythmically at a floating mass of kelp. I am fairly confident that they were feeding upon the kelp and not upon attached animal life.

I have seen shearwaters churn the surface of the sea into spray as they darted about in pursuit of small fish, even swimming some distance completely submerged. No such impulse was ever observed in the albatross and I have come to look upon him as a gleaner of floating material that has ceased to be active. He certainly is not a predator in any sense of the word. Drinking of sea water by albatrosses was several times observed.

Activities.—So much has been written regarding the flight of albatrosses, chiefly that of the larger species, that I would not be justified in an attempt to add much. In fact, in regard to this small species, something might even be subtracted. For example, the larger species are reported to sail for long periods of time in a high wind without a flap of the wings, although constantly making adjustment of the plane angle. I never saw *D. nigripes* sail for as much as sixty seconds even in a smart gale. They behave much like a gigantic shearwater with a retarded wing beat and a longer glide. In quiet weather, the larger albatrosses are reported to sit about on the sea surface, reluctant to make the great effort required to rise and remain on the wing. *D. nigripes*, which is little more than one-third the weight of his greatest congener, is as busy in a flat calm as he is in a stinging gale.

The rise from a calm surface is always accomplished by dint of a brief "taxi" assisted by alternate strides, but they do not hesitate to rise. In a brisk wind the rise is almost straight off the water without a flap, much as a kite will sometimes lift in the wind when perfectly balanced and bridled. Alighting again may be accomplished in a

stiff gale with the appearance of falling-leaf freedom from effort. Quite in contrast is the ponderous way in which they take to the water in calm weather. Launching a freight barge would be almost as graceful.

The generic name of the delicate Storm Petrel (*Hydrobates*) refers to its treading of the sea surface as it seems almost to float between air and water. Its big diomedine cousin was often seen in a gale to do just the same thing. Its extended wings motionless, the breast free of the water surface, with its great expanded foot webs affording the slight additional support needed, the bird appeared to stand momentarily upon the limpid sea water. Again, like an expert ski runner it would slip along the steep side of a great snow-crested blue mountain, the uphill leg sharply bent and the other fully extended.

The close approach of the birds while the ship lay hove to afforded many long but interesting hours of contact with these wanderers which enabled me to observe them sometimes at distances of as little as eight or ten feet. One even nipped playfully at the blade of my resting oar while I was out in the skiff. Sea birds in a nesting colony may be approached equally near, but they have always seemed to me out of their element and a bit awkward on land. Here I was the awkward intruder into what was their real element and their perfect at-homeness was a constant delight to me.

Upon the water our birds were as competent as when above it. A wind-cuffed wave crest might seem about to wreck a swimming bird, but he would ride it as lightly as the foam itself. A slight spread of wing might assist him over it or the spray might rarely spatter him, to run off like drops of quicksilver. Never was he to the slightest degree disconcerted by the most violent and complex pathway that his body described in the three (or was it four) dimensions of space.

Forward strokes of his great paddles would throw him quickly into reverse if a wave brought him too close to the ship or to other source of potential danger. Opposite action of the two paddles would spin him about in the pivot-like whirligig of a phalarope, or their concerted action would send him through the water with a distinct "bow wave." While the ship was towing the plankton nets at a speed of 1.8 knots, a bird easily overhauled us "on foot" after a brief stop in our wake.

Social Relations.—Pure curiosity appeared to be the chief factor that concentrated the birds about our ship from an indeterminate area surrounding each station. Although food which we threw out would attract them close up to the ship's side, it appeared to be a strong social impulse that held them together in a loafing group on the sea surface. These groups were almost invariably up wind from us so that the easiest take-off would be directly away from the ship. This reaction seemed to me to be entirely instinctive, for they were entirely lacking in timidity. Individuals would swim close together, frequently rubbing beaks or "caressing" each other about the head. Often, with the ship underway, we would approach a pair or a trio sitting quietly on the water. There seemed to be no food supply to act as a focus—just pure sociability. When wheeling about over the sea surface, they seem a lonely bird, but when they sit down, they appear to like company. Only once or twice in the course of all my watching did I observe anything in the way of peck dominance, that term so popular with present day students of bird sociology. Frequently there were vocal interchanges where two birds approached with closed beaks raised at an angle above the horizontal and emitted a low, nasal groan, after which they separated. Another approach, when food was present or suspected, seemed to be a begging action. Here the beak was held wide open and a squealing note was emitted which was practically identical with that of young domestic pigeons. The only other sound heard from them was a sharp castanet-like rattling of the mandibles,

the significance of which was not clear to me. Walter K. Fisher (Condor, vol. 6, 1904, p. 78) speaks of the albatross "dance" having been witnessed by Dr. Charles Gilbert while the birds were sitting together on the water. This beak rattling and the nasal groan are perhaps part of such a display, but I saw nothing else that could be so interpreted. On the whole these great birds gave the impression of friendly dignity, getting along peacefully with their own kind and showing a companionable interest in us that was quite apart from any gastronomic urge.

I saw no evidence of their having any competitors or any external enemies in their normal habitat. Once a Pomarine Jaeger far off shore made a half-hearted stoop at a pair of albatrosses sitting on the water, but the birds took no notice and the jaeger did not take himself seriously. The albatross does not often take food that would be of interest to a jaeger. An adult sea lion visited us at one station west of the islands and in his cruising about us, swam right through a small group of Black-foots sitting quietly on the water. The birds paid no attention to him. On the other hand, when our deck boy submerged and started swimming under water in their direction, a pair took wing at once and left in haste.

Although the albatrosses appear to encounter no predator that is a menace to their well being and although they seem so well adapted to their mode of life that only a very sick individual would be buffeted seriously, there are a number of smaller species that serve to dilute their perfect happiness. Flat flies and a variety of smaller arthropods inhabit the feather stratum with more or less disturbing effect, it would seem, for one of the oft-repeated remarks of the crew members watching the birds on the water was, "They seem to have plenty of cooties on them." Part of the seeming "cootie hunt" was doubtless due to the preening of growing feathers, since at the season of my observations most individuals were in the process of molting some of the feathers.

Round worms were taken from several stomachs, but in no instance were they found in great abundance. The identities of these several parasites have not yet been worked out. Dr. Sherwin Wood discovered no blood parasites in smears from the birds freshly collected.

The only albatross that I have ever found cast up on the beach in many years of "beach combing" was picked up on the shore of Monterey Bay. It was a female in molt and had an ovarian cyst six millimeters in diameter—again, the only case of the kind that I have ever met with. Birds taken at sea were all in good condition, although happily for me, they lacked the excessive fat accumulations so often found in non-breeding water birds.

A meticulous toilet is made by preening and bathing of the plumage and by washing the beak after each feeding act. The bill is lowered till the nares are immersed, then the head is shaken from side to side with great vigor. No ill odor was noted in the fresh birds, although after dry skins have been kept in closed cases for a time, the characteristic procellariform muskiness is evident.

All things considered, my distinct impression of the Black-footed Albatross is that of a big, cleanly, well-mannered bird of friendly, even playful disposition, with an abundant and perhaps excusable curiosity as to our presence and our activities within the realm of open ocean over which he presides. His benign expression and his confiding nature with, above all, his supreme ability to take care of himself made my acquaintance with him a great and genuine pleasure. I always look forward with high anticipation to my next meeting with *Diomedea nigripes*.

University of California at Los Angeles, March 21, 1940.