NOTES ON DISTRIBUTION OF NORTH PACIFIC ALBATROSSES

BY DANIEL Q. THOMPSON

THERE is comparatively little detailed information available on the seasonal distribution of North Pacific albatrosses. Miller (1936, 1940, and 1942) contributed observations from cruises in waters offshore from Southern California, Yocom (1947) reported notes on Black-footed Albatross from four oceanic stations in the North Pacific, and Arnold (1948) contributed notes from Aleutian waters. The following refers to a far more extensive area than do those cited above and represents day-to-day observations through 45,000 nautical miles cruised between January 24, 1945, and December 2, 1945. Approximately half of this mileage was cruised between the Pacific Coast of the United States and the Hawaiian Island Chain; the remaining mileage was spread over the Central and Western Pacific, reaching a southwestern limit at the New Hebrides and extending northwest to Okinawa. Of the total, approximately 5,000 miles were logged below the equator and hence were far south of the normal range of all three North Pacific albatrosses.

While under way, an average of four hours was spent on bridge watch during each daylight period; an alert lookout was maintained in all sectors during these periods. Several trips were also made to the stern each day and observations recorded on birds attracted to the ship's wake. Marine binoculars (7 by 50) were used in all observations.

At the end of the war, the ship's logbooks were reviewed; positions, soundings, sea-water temperatures, and local weather data thus became available for comparison with the daily bird notes.

A total of 352 Black-footed Albatrosses, *Diomedea nigripes*, were seen during 1945; of these only ten individuals were seen west of Oahu, T. H. On the same runs ten Laysan Albatrosses, *Diomedea immutabilis*, were observed, four of which were west of Oahu. No Short-tailed Albatrosses, *Diomedea albatrus*, were encountered during the entire year. Thus the greater part of these notes deals with Black-footed Albatrosses observed between the Pacific Coast of the United States and the Hawaiian Chain. This portion of the data is presented in graphic form. The remaining notes are insufficient for graphic presentation.

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BLACK-FOOTED ALBATROSS

Black-footed Albatrosses habitually followed the ship for hours during daylight, evidently foraging for garbage scraps. This scavenging habit was often observed after meal hours when garbage was dumped over the stern. A dozen or so birds then gliding over the wake would quickly settle in the turbulent water and drift astern with the refuse. Meat scraps were the preferred food. It is possible that these albatrosses were also attracted by natural food churned up in the ship's wake. On two occasions they were observed scaling close astern on bright, moonlight nights.

When Black-footed Albatrosses were numerous, it was impossible to keep a count of individual birds; therefore, it was thought best to record the maximum number seen at any time during the day. These counts then are minimum daily figures because no attempt was made to account for stragglers or replacements.

Ten crossings (5 round trips) between the Pacific Coast of the United States and the Hawaiian Chain are graphed in Figure 1. Sea temperatures ranged from 9° to 30° C.; albatross counts varied from zero to 45. For comparison it is thus convenient to plot these separate quantities on a common numerical scale. Note again that the curve for Black-footed Albatrosses does not represent the total number of birds seen each day but rather is the maximum number of birds counted astern at any one time during the day.

From these data it would seem that Black-footed Albatrosses tend to concentrate over the cold waters of the California Current during all seasons of the year. These birds are probably attracted by an abundant natural food supply stemming from the relatively rich biota of these low-temperature waters. The continued presence of numbers of Black-footed Albatrosses along the North American continental shelf during their breeding season (beginning in late October on the northwestern part of the Hawaiian Chain) indicates a substantial non-breeding population.

Using longitudes 155, 145, 135 and 125 West as class midpoints, the seasonal data from the ten crossings or transects graphed above are summarized for each ten degree span of longitude as follows:

Longitude	*155 W.*	*145 W.*	*135 W.*	*125 W.*
Black-footed Albatrosses	1.0	2.7	7.5	13.8
Sea Temperatures	27.7° C.	21.6° C.	18.5° C.	14.4° C.

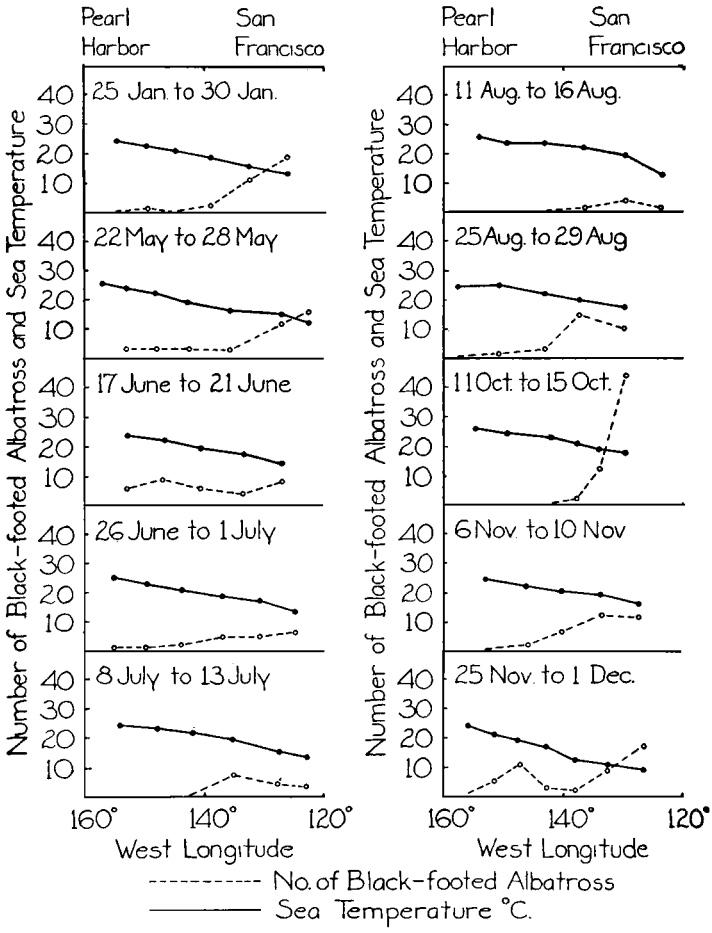

FIGURE 1. Correlation of daily numbers of Black-footed Albatrosses with temperatures of the sea.

The sea temperatures reflect the distinct change in water masses which one encounters between the American West Coast and the Hawaiian Islands. Sverdrup, *et al.* (1942) described an Eastern Central Water Mass which lies to the eastward of the Hawaiian Islands. This mass is in part formed by the boundary between the warmer water to the west and subarctic water to the east in the region of longitude 130 to 150 W. The number of Black-footed Albatrosses encountered diminishes as one passes westward out of the influence of the subarctic waters. The region of the 135th meridian might be considered as the westward limit of moderate albatross abundance.

TABLE 1

AVERAGE BLACK-FOOTED ALBATROSS COUNTS

	155 W.	*145 W.*	*135 W.*	*125 W.*
Eastbound	0.8	2.3	4.8	17.3
Westbound	1.2	3.1	10.2	10.3

AVERAGE SEA WATER TEMPERATURES

	155 W.	*145 W.*	*135 W.*	*125 W.*
Eastbound	24.8° C.	21.4° C.	18.1° C.	13.7° C.
Westbound	24.5° C.	21.8° C.	18.8° C.	15.0° C.

Murphy (1936) pointed out that sight records of Tubinares which habitually follow ships are inclined to be misleading when they are used in determining distribution. He noted that vessels cruising north towards the equator report Wandering Albatrosses, *Diomedea exulans*, from lower latitudes than do vessels southbound from the equator.

The Black-footed Albatross apparently does not have as great an inclination to follow a ship as does the Wandering Albatross. Miller (1942) marked 25 Black-footed Albatrosses in the coastal waters off Southern California. He found that 12 of these birds repeated at 20 miles, seven at 30 miles, three at 40 miles, but only one bird repeated at 50 and 60 miles. Yocom (1947) was of the opinion that a single Black-footed Albatross would not follow his ship for more than four to six hours. My observations of a few distinctively marked individuals indicate a similar behavior; however, one bird was thought to have followed the ship for at least 12 hours.

To examine the possible effects of this behavior on my sampling method, the data are broken down into eastbound and westbound components and presented in Table 1.

The average counts from westbound transects show a tendency to continue westward in greater numbers than do the eastbound counts. With the possible exception of the data from 125 W., comparisons of the temperature of the sea water for the same transects do not reflect this relationship. It seems probable, therefore, that the tendency of the Black-footed Albatross to follow ships actually introduces a limited bias to my method of sampling their distribution and abundance. However, this error is not excessive and lumping the eastbound and westbound samples tends to average out the bias.

As in any animal, the distribution of this species is conditioned by food supply. There was little opportunity to carry out a study of the bird's natural food habits or food sources. However, it was assumed that the abundance of the albatross's food was related to the produc-

tivity of the oceanic waters in which the ship cruised. An indirect method for appraising oceanic productivity was devised as follows.

When eastbound for the Pacific Coast, it was often noticed that the number of large jellyfish passing through the ship's wake increased greatly as we entered the cold waters of the California Current. Assuming that these jellyfish would be a reliable indicator of oceanic productivity, it was decided to keep a daily estimate of the abundance of jellyfishes. This daily count was carried out rather more for my own amusement than as a scientific measurement. However, the correlation between abundance of jellyfishes and albatross abundance was so striking that it is presented here as an item of interest. The daily estimate of numbers of jellyfishes was accomplished by the following method.

Under the impact of the ship's churning wake, jellyfish became luminescent for many seconds as they rolled about in the disturbed waters. At night these bright glows could be easily detected by an observer stationed at the ship's stern. Thus some time during each night, the number of jellyfishes passing through the wake was counted. Four counts, of two minutes' duration, were found to give an accurate expression in a minimum time. The results of the four counts were averaged; this figure was recorded as the "jellyfish index" for the day. This technique was not adopted until November, 1945, when we departed from San Francisco on our last round trip to the Hawaiian Islands.

This trip was irregular in that we returned to Seattle, not to San Francisco; moving northeastward towards Seattle from Oahu, one enters cooler waters in more westerly longitude than on the San Francisco route.

Sea-water temperatures, Black-footed Albatross counts, and jellyfish indices gathered on this last cruise are plotted in Figure 2.

The curve for the Black-footed Albatross shows general agreement with the abundance of jellyfishes; both albatross and jellyfish tend to increase as sea temperatures decrease. Stomach contents of Black-footed Albatrosses examined by Miller (1940) and Martin (1942) included such items as squid beaks, fish bones, fish eggs and seaweed tips. Other observers (Fisher, 1945, and Yocom, 1947) reported this bird catching flying fish. Thus, from data on food habits we would not interpret the correlation evident in Figure 2 as indicating that the albatrosses forage on jellyfish, but rather that concentrations of both of these animals are confined to low temperature waters, rich in nutrients and of a high biotic productivity.

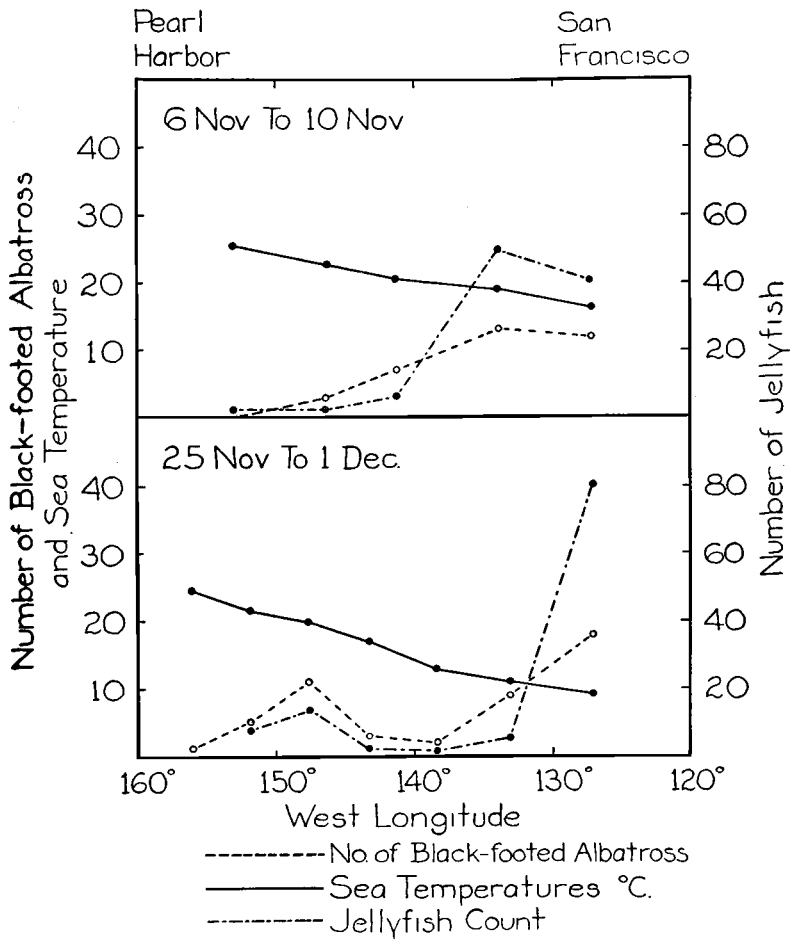

FIGURE 2. Relation of temperature of the sea, number of jellyfishes, and number of Black-footed Albatrosses seen each day.

This general relationship of abundant life with low sea temperature is common knowledge among oceanographers. Murphy (1936) summed up much of this information in his discussion of the nutritional basis of marine life. He pointed out that low temperature waters are favorable to a high gaseous content and are richer in mineral nitrogenous compounds than are temperate or tropical waters.

Miller (1940) made an intensive study of the distribution of Black-footed Albatrosses at 32 hydrographic stations in the coastal waters of Southern California. The ocean area sampled in Miller's study extended 190 miles offshore and was approximately equal to 13 hours of

Photo by Irven O. Buss

BLACK-FOOTED ALBATROSS: North Pacific, March, 1945.

cruising at 15 knots by my vessel. Thus my data for a single daily sample of albatross abundance transects the entire offshore area considered in Miller's study. His observations were also made in a more southerly latitude. These differences make anything more than general comparisons most difficult, but it is interesting to note that Miller found Black-footed Albatrosses concentrated locally over a narrow "cold tongue" of sea water which varied from a few to 25 miles in width. This "cold tongue" was characterized as an area of turbulence, rich in nutrient salts, and supporting a wealth of plankton. This phenomenon of extreme local concentration of albatrosses may in part be characteristic of the lower reaches of the California Current. If similar areas of local concentration occurred offshore from the Golden Gate, they were not noticed in my observations. Yocom's (1947) observations offshore from the Golden Gate were similar to my own; he did not note any narrow zones of concentration of Black-footed Albatrosses but rather observed that the birds were uniformly distributed over the waters cruised by his ship.

The most westward longitude reached in Yocom's four oceanic stations was 136° 32′ W. This is still within the zone of influence of sub-arctic water and hence falls at the westward edge of albatross abundance as determined by my transects.

Only four crossings (two round trips) were made through the Central Pacific. These transects were noteworthy for the extreme scarcity and even complete absence of Black-footed Albatrosses throughout the reaches of this vast, uniform water mass. Daily observations frequently continued for a week and more without a bird of any species being seen. It is pointless to treat these notes in graphical or tabular form. They can best be summarized as follows:

Steaming on a modified great circle track-line from San Francisco to the New Hebrides, the last Black-footed Albatross was observed at Lat. 21° N., Long. 149° W., on January 29.

No Black-footed Albatrosses were recorded on passages during March and April from New Hebrides to the Solomons to the western Carolines, or from the Carolines to Okinawa to Saipan.

En route to Pearl Harbor from Saipan, the first Black-footed Albatross was encountered at Lat. 15° 40′ N., Long. 176° 20′ E., on April 21.

Running a modified great circle course from San Francisco to Eniwetok, the last Black-footed Albatross was seen east of the Hawaiian Chain at Lat. 35° N., Long., 151° W., on August 28. This cruise continued from Eniwetok to the Philippines with no Black-footed Albatrosses recorded. Likewise, no birds of this species were observed on the eastbound return trip from the Philippines which ended at Pearl Harbor in early October.

LAYSAN ALBATROSS

Only ten Laysan Albatrosses were observed during the 45,000 miles cruised in 1945. They were recorded on the following dates:

January 25: 37° 37′ N., 124° 53′ W.; one Laysan Albatross, "remained far astern."

February 1: 8° 30′ N., 163° 35′ W.; one Laysan Albatross, "scaling rapidly downwind—paid no attention to the ship."

April 22: 17° 30′ N., 171° 20′ W.; three Laysan Albatrosses, "followed wake for an hour."

November 29: 39° 40′ N., 139° W.; one Laysan Albatross, "appeared far astern for a few minutes." 40° 32′ N., 138° 17′ W.; one Laysan Albatross, "again far astern, did not remain in vicinity for more than a few minutes" (possibly a repeat).

November 30: 44° 10′ N., 132° W.; two Laysan Albatrosses, "scaling over wake—foraging for refuse with Black-footed Albatrosses."

December 1: 47° 15′ N., 126° 45′ W.; one Laysan Albatross, "foraging in ship's wake with Black-footed Albatrosses."

Laysan Albatrosses showed less inclination to follow the ship than did the black-footed species. However, it was noted on April 22 that three of them (Laysans) scaled along behind the ship for an hour (15 nautical miles). On two occasions they mingled with Black-footed Albatrosses and adopted the latter's scavenging habit.

SUMMARY

Notes on albatrosses were recorded on 45,000 nautical miles of North Pacific cruising during 1945.

Ninety-nine per cent of all albatrosses seen were the Black-footed Albatross; one per cent was the Laysan Albatross; Short-tailed Albatrosses were never encountered.

Approximately half of the total miles cruised were logged between the U. S. Pacific Coast and the Hawaiian Chain. Ninety-nine per cent of all Black-footed Albatrosses observed were seen in this area.

Black-footed Albatrosses tend to concentrate over the cool waters offshore from the Pacific Coast of the United States. This is probably in response to the abundant food present in these low temperature areas. These concentrations probably exist in all seasons of the year and indicate a substantial non-breeding population.

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Wildlife Conservation Building, University of Missouri, Columbia, Missouri, June 8, 1950.

GENERAL NOTES

Raccoon Predation on the Great Blue Heron, *Ardea herodias*.—On June 22, 1950, while I made observations on a heron rookery located in the Crab Orchard Lake Wildlife Refuge in southern Illinois, a raccoon, *Procyon lotor hirtus*, was observed to climb a tree containing heron nests. The raccoon entered a nest which was located 50 feet from the ground; it was seen feeding on remains of Great Blue Herons. It remained in the nest for 30 minutes, after which time it left the tree. About five minutes later the raccoon again climbed the tree, entered the nest, and continued its eating activities. Supporting evidence of predation by raccoons, was several scats containing heron feathers, that were found on logs in the vicinity of the rookery. The total effect of this predation on the heron colony is not known, but it is conceivable that young herons might be eaten by raccoons, both in the nest as well as during their early flight period.—ALVIN C. LOPINOT, *Department of Zoology, Southern Illinois University, Carbondale, Illinois.*

Nest of the Yellow-crowned Night Heron, *Nyctanassa violacea*, in Kansas City, Mo.—The Yellow-crowned Night Heron has been a summer visitor in the Kansas City region with increasing frequency during the past decade. Most of these birds have been in the immature plumage and, with only two exceptions, were reported in late summer.

A nest was discovered in its earliest stages of construction on May 13, 1950, and a number of local bird students made observations until August 10. Three young were reared successfully. This seems to be the northernmost nesting positively known in western Missouri or eastern Kansas.

The nest was on the fork of a horizontal limb up about 70 feet in a walnut tree in a river bottom tract of virgin timber in Swope Park which is within the city limits. On May 13, the pair was discovered courting in the "stick ceremony." The stick was placed across the fork which already supported a half-dozen sticks. Then the herons stood side by side but facing opposite directions and exchanged stroking gestures in which each passed the side of the beak downward against the primaries of the other's folded wing. The nest grew slowly. May 16, one heron was sitting on the nest