hopping from twig to twig in the manner by which so many of the smaller birds as clearly display their anxiety as they do by their notes of distress.

The male bird did not appear at all and, after waiting for him some three-quarters of an hour, we collected the female together with the nest and eggs.

PETRELS OF SOUTHERN CALIFORNIA.

BY A. W. ANTHONY.

FROM the day that I saw my first Petrel dancing over the waves of the Pacific none of the birds of southern California so thoroughly interested me or so completely baffled all attempts at a more intimate acquaintance. Several species were often common off shore and during such times dozens would pass and repass a sailing vessel but always keeping just out of gunshot. All of the coast islands were examined for breeding colonies but owing to my lack of experience and knowledge of their breeding habits, several years passed before any clue was found to their very restricted nesting grounds. In May, 1895, a small colony of Socorro Petrels was found on one of the Coronado Islands, but it was too early for eggs, and I was unable to revisit the island again at the proper season. Armed with the knowledge gained in 1895 I visited the island April 21, 1896, and camped five days, thoroughly exploring the northern and two middle islands of the group. On the first night of my sojourn I had scarcely fallen asleep, curled up on a rocky shelf just above the water, when I was suddenly recalled to my senses by a loud *Tuc-a-roo, tuc-tuc-a-roo* within two feet of my head. The call was repeated from half a dozen directions and as many bat-like forms were seen flitting back and forth in the moonlight along the cliffs and hillside. One or two attempts to shoot them proved utter failures and the black forms soon moved out to sea, returning at intervals of an hour or so all night. The next afternoon I

located one of the birds in a burrow under an immense rock, as I passed on my way to camp. It several times uttered a clicking note which I felt sure was that of a Petrel. During the evening I watched the hillside and discovered several burrows by following the direction of the call notes and watching the birds as they entered the holes, which were all under very large bowlders or in cracks in the ledges where it was impossible to secure eggs had there been any. From the large size of the Petrels I was reasonably sure that they were *Oceanodroma melania*, and marking several of the most likely burrows I returned the following day with a shovel and undermined the bowlders, letting them roll down the hill, hoping to uncover the nests, but all were so far back in the rocks that I secured neither eggs nor birds, nor could I determine whether they were nesting. From what I afterward learned I now know that they were mating and I was much too early for eggs.

On the 24th of April I visited the colony of Socorro Petrels discovered in 1895 and found a number of nearly finished burrows and one bird. I visited the same colony on June 12 and in each burrow found two Petrels, male and female, but no eggs. It was not until July 10 that I had an opportunity to again visit the island when I found both eggs and birds. Most of the eggs were more or less incubated, and two young ones were found not over two or three days old. They were mere little bunches of sooty down of uniform color, winking and blinking when brought to the light like little owls. In the same colony I found two Black Petrels with fresh eggs, confirming my identification of the birds seen on April 12. The eggs of *Oceanodroma socorroensis* were usually freckled with reddish spots in a more or less complete ring about the larger end, but those of *O. melania* were unmarked, as have been all that I have subsequently handled.

From the data I have accumulated I find that both of the preceding species inhabit the burrows for nearly three months before the egg is laid, usually both birds being found in the burrow until incubation begins. After the chick is a day or two old the parent is seldom if ever found in the burrow in the day time. On Guadaloupe Island a colony of *O. macrodactyla* were found breeding among the pines and oaks at about 2500 feet above the sea. Well incubated eggs were taken March 24, and

well grown young the middle of May. The range of variation in breeding in these three species of *Oceanodroma* presents an interesting study. The Guadaloupe Petrel, with a breeding season early in March, leaves the colony altogether by June 10, by which time *O. socorroensis* has not begun to lay, and *O. melania* is still later. I have found the last species incubating as late as September 8. I am quite sure that only one young is raised each year, though each species seems to have a rather long nesting season.

Little attempt is made at nest building by either the Socorro or Black Petrel, though a few sticks are often dragged into the burrow with an evident desire to construct something resembling a nest. The Guadaloupe Petrel, however, nearly always has a few dry oak leaves or pine needles at the end of the burrows I have opened, it making a much better attempt at nest building, owing perhaps to the fact that the burrows are dug among the trees where this class of nesting material is abundant, whereas the other species nest on barren islands and cannot so readily obtain desirable material.

In early June I have found the Least Petrel migrating along the coast of Lower California in company with the Socorro and Black Petrels, and in late July have found them nesting on the small rocky San Benito Island, fifty miles off the coast of the peninsula. So far I have never found the Least Petrel nesting in burrows. They have always been taken from the crevices in rocky ledges or among the loose stones. The pearly white egg is laid on the bare rock. Usually several are found within a few feet if desirable crevices are numerous. Young were taken as late as September 7 or 8 that were but a few days old. They were like the young of the three species of *Oceanodroma* I have mentioned, except for size. All are covered with sooty or slaty black down, through which the feathers appear when the bird is nearly or quite fully grown.

For the past ten years I have at times seen a small white-rumped Petrel at sea as far north as southern California but more common perhaps about Guadaloupe and Cerros Islands. They were quite common in April and May about Socorro Island and a few were seen off Clarion but, like veritable will-o'-the-wisps, they were always just out of reach and all attempts to identify

the species were unsatisfactory. No nesting colonies were found on the southern islands, — Socorro and Clarion, — all the birds seen at sea seeming to be migrants. July 15 found us becalmed in a fog not far from Guadaloupe Island. Black and Socorro Petrels were seen at a short distance from the schooner, passing and repassing, pausing for a moment at times to investigate objects thrown from the vessel. Several of the rare white-rumped form came and went with the rest but none ventured near the schooner. In hopes of getting at least a nearer view a skiff was launched and with my assistant, Mr. H. B. Kaeding, I spent two hours or more in drifting about a quarter of a mile or so from the vessel. In place of frightening the Petrels the smaller craft seemed to excite their curiosity and they often turned aside from their course to examine us. Several of the white-rumped birds were secured which have since formed the basis for a new species[1] named in honor of Mr. Kaeding as a slight recognition of his valuable services.

The breeding grounds of Kaeding's Petrel are at present unknown, but I have reason for supposing that they nest on Guadaloupe, in July. Those which were taken on the 25th of that month showed enlarged ovaries and the nesting season was but little if any passed. The wing of a small Petrel was picked up on Guadaloupe in September, 1896, and direct comparison made with specimens of *O. homochroa*, to which species I assigned the fragment after much hesitation. I am now reasonably sure it belonged to the new species. All of the species mentioned in the present paper depend almost entirely upon the young of the spiny lobster for food while on our coast, both adults and young having their stomachs filled with the larval stage of that crustacean, which is extremely abundant about all of our outlying islands during the spring and summer months.

In August and September Petrels are more abundant off our southwestern coast than during the rest of the year. The birds that have finished nesting congregate in regions where food is abundant, often following vessels for long distances to pick up what scraps of suitable food may be thrown over. I have on

[1] Auk, XV, Jan. 1898, p. 37.

several occasions hooked *O. melania* with a small hook baited with a piece of seal blubber, but as a rule they decline to be taken in by any such means. Both *O. melania* and *O. socorroensis* will at times dive a foot or more below the surface for a piece of meat that is sinking if they are hungry, but diving seems to be out of their usual line of business and is only resorted to when food is scarce. They seem to be unable to get below the surface of the water without first rising two or three feet and plunging or dropping, exactly as I have seen the Black-footed and Short-tailed Albatrosses dive under similar circumstances.

THE ECONOMIC VALUE OF THE WHITE-BELLIED NUTHATCH AND BLACK-CAPPED CHICKADEE.[1]

BY E. DWIGHT SANDERSON.

THE value of our common birds as insect-destroyers has of late years come to be recognized as an important field of investigation for the ornithologist and a large item in rural economy. Much valuable work has been done in determining their economic relations, but there has also been a large amount of assumption by various writers based on insufficient data. It is my purpose in this thesis to determine the character and amount of food and the economic relations of two of our most common residents, the White-bellied Nuthatch (*Sitta carolinensis* Lath.) and the Black-capped Chickadee (*Parus atricapillus* Linn.) from the analysis of the stomachs of 34 specimens of the former, and 28 of the latter, notes taken while collecting them, and incidentally from as much reliable data as could be found elsewhere.

METHOD OF ANALYSIS.

In no instance was any food found in the true stomach, mouth, or gullet, and the only part containing food was that ordinarily

[1] A Thesis submitted to the Faculty of the Michigan Agricultural College.