

parts of the reproductive cycle actually spent in the spatial confines of the territory. The spatial dimensions would have to be in some convenient measure, such as square meters or yards. Thus, we might measure a hypothetical territory and express our results as follows: "The territory of—— species is of the primal type and occupies approximately 500 square meters over a period of nest-building (2 days) plus egg-laying (6 days) plus incubation (28 days) plus 3 days after hatching (precocial); a total of 39 days," or, again: "The territory of —— species is of a merged type and occupies approximately 100 square meters over a period of courtship (6 days) plus nest-building (4 days) plus egg-laying (5 days) plus incubation (15 days) plus nestling period (11 days) plus 5 post-nesting days, a total of 46 days. The male alone occupies the territory for the first 4 days."

The probabilities are that some simpler, better method will be found as the measurements of territories in many birds are attempted; the plan given here is more in the nature of a suggestion than anything else. The main point of this paper is to stress the various combinations of factors (other than food, which is obvious) that have a resulting influence on the size of the territories, and to distinguish between them.

BANDING WILSON'S PETRELS

By SAMUEL A. ELIOT, JR.

To any one becoming interested in the possibilities of bird-banding, the following passage could not but be suggestive. It is from "The Story of a Bird-Lover," by W. E. D. Scott, a prominent ornithologist of the last century, and refers to August, 1881.

"With a fisherman I left Chatham, Massachusetts, very early one morning and by daylight we were far out at sea. A gun and ammunition were part of my equipment, and as occasional birds were seen in the distance I thought it worth while to begin my preparations. I saw an amused look pass over the captain's face as he said to me, 'Better wait till we get where the birds are; it will be easier to get 'em!' After two hours' sail—we were now out of sight of land—he announced that we had arrived on the fishing-banks, and that he would make a try. This seemed to be entirely foreign to the work I had come out to do, but I did not interfere. Without anchoring the boat, simply heaving to, he baited a couple of codfish lines and lower-

ing them soon had two large fish struggling in the bottom of the boat. . . . When some eight or ten were in the boat he said he would show me the birds that frequented the banks. He then took out the livers of several of the codfish and cut them into very minute pieces, grinding these into pulp. This 'chum' was cast overboard to float on the water. A long oily streak on the surface soon indicated the run of the tide . . . and following this oily streak or lane, allured by the bits of liver, the birds I had seen at a very considerable distance began to arrive in the vicinity of the boat. Shortly, birds were about us in countless numbers . . . the stormy [Wilson's] petrel, the greater shearwater, the sooty shearwater, and an occasional parasitic gull [Jaeger]. Before collecting any specimens, it seemed worth while to examine the birds with care, for I feared that with the report of the gun they would be frightened away; so I waited for a time. The captain now took a piece of string some seven or eight feet long, fastened a large piece of cod-liver to it, and allowed this to float out at the stern of the boat. I had thought the birds were quite fearless but was not prepared to see them come to such close quarters. As soon as they detected the large piece of liver tied to the string, they thronged about it like flies about a lump of sugar. Gradually the cord was shortened until the bait was not more than three or four feet from the gunwale. From the cabin the skipper brought an ancient crab-net with a long handle, and presently he was catching the three kinds of petrels much as one catches butterflies, emptying his net as he caught each bird into the cock-pit of the boat. Here they were absolutely helpless, as from such a flat surface it was quite impossible for this kind of bird to rise on the wing, and they walked about much after the fashion of chickens and with about as much commotion as fowls make when intruded upon. Shortly, all appeared to be affected by the motion of the boat and began to disgorge what they had eaten, and the cock-pit was now a scene of filth which can better be imagined than described. Of course it was not necessary to use a gun. . . . At a single sweep of the net, the captain took nine of the little birds. We selected such as seemed of particular value [as specimens] and allowed the rest to go overboard, where on reaching the top of a wave they immediately took flight." Thus wrote Scott.

"Well," I thought to myself, "what could be done in 1881 can be done in 1932. I doubt if any one has ever banded these sea-birds. What fun to be the first!" So I sent to Washington, with a very brief explanation, for bands of the size to fit Shearwaters (a type of bird not even mentioned in the Manual for Bird-banders), and though the official who sends out bands

thought (as he afterwards told me) that I was crazy, he forwarded a string of No. 5's. I already had a lot of No. 2's, the size the Manual recommended for Petrels. A party of bird-students whom I knew were considering a sea-trip out of Chatham to observe, merely, birds of this sort, and on August 16th I joined them. Next morning, through the early fog, eight men¹, all more or less seasoned ornithologists, set out in a fisherman's launch and chugged steadily toward the banks. A trawler and her line of dories came into view on the horizon, and round her we could see a swarm of birds. Wilson's Petrels (*Oceanites oceanicus*) fitted by us more and more commonly, and as the land sank behind us to a mere sandbar, a Cory's Shearwater was seen. Within a few miles of this very spot, on October 11, 1880, the first Cory's Shearwater known to science had been obtained. Several came within our purview, but their usually more numerous cousins, the (smaller) Greater Shearwater, made no appearances, and the Sooty Shearwater only an unsatisfactory one, at a great distance. Eager for cod-livers wherewith to tempt them nearer, most of us started fishing, and by-and-by I was crumbling the oily stuff over the side with mounting excitement: for the little black chipping Petrels found it at once and began flying fearlessly within easy reach of the fisherman's long-handled net. The weather, however, was not the flat calm that must have favored W. E. D. Scott, for our launch was drifting before a breeze up which all the Petrels flew. It was necessary to drop the liver-chum over the lee side, well aft; then, as the boat drifted, the chum passed under her stern, and rapidly away to windward; and only the boldest, hungriest Petrels pounced on it before it was several yards away from us. We did get a constant stream of them flying under our stern, and I began valiantly wielding the net.

It was no butterfly-net. Designed for scraping whelks off the sea-floor for bait, it had a heavy iron hoop, a short, coarse-meshed bag, and a ponderous wooden handle. A dozen lunges at the dodging birds "winded" me entirely. And my skeptical comrades would do nothing but jeer and boo at my panting efforts. For perhaps half an hour I doggedly struggled, crumbling liver over, seizing the great net, and swooping at the elusive flutterers who thronged towards it. At last I caught one, and the tune changed. One friend held the Petrel while I attached a No. 2 band, and discovered that No. 2 was too big. Others asked for turns at the net. One man would bang it down over a Petrel, completely submerging the poor bird.

¹They were Aaron C. Bagg, Ludlow Griscom, Dr. John B. May, Wendell Taber, John H. Conkey, George L. Perry, and Charles E. Clarke.

Others failed to twist the net inboard fast enough, and the prey escaped from the shallow bag. But they began to catch birds faster than I could band them, and I remembered that Scott's captives had been unable to rise from the cockpit. Alas, on this breezy day, Petrels turned loose in the cock-pit had little difficulty in getting a puff of air that wafted them neatly out of our reach. Each one had to be held, and soon some of my companions had a Petrel in either hand. It was hopeless trying to put on my No. 1a bands in sequence: I had only twenty or so of that size, and they were remnants of three different series. As rapidly as possible I wrote down each number, pinched the band on above the little yellow-webbed foot, and watched the released bird fly straight and fast as an arrow down wind away from that boat! They never paused nor swerved, and were indifferent to the hordes of their fellows pressing up wind past them toward the feast of bait.

Twelve I banded, before accident befell. His hands all slippery with cod-liver oil, one of the party grabbed the net for his turn, made a mighty lunge, and away went the greasy pole through his palms, entirely out of reach and promptly dragged to the bottom by its iron hoop. We continued to pull in cod and strew liver, and had the Petrels in jabbering, squeaking hordes almost in hand's reach, but the catching and banding were over. Attracted by the throng of birds, several Parasitic Jaegers investigated us, and just as we turned about for the return trip a splendid Pomarine Jaeger came. So despite the mischance, the trip was voted a complete success, and I had proved my point that Petrels, if not Shearwaters, could be caught wholesale by a properly prepared banding-expedition.

Such an expedition should be equipped with several light-weight, deep-bagged nets at the end of long, light poles, perhaps of bamboo. It should carry some bait along, in order not to be dependent for it on fishermen's luck. Cod-livers are probably purchaseable, and I have heard that cheap, veterinarians' castor-oil is equally alluring to the birds. To prevent too rapid consumption or loss of bait, especially on a breezy day, a cod-liver might be made fast to a shingle or bit of cork, so as to float naturally and yet be tied to the boat. It was amply clear that Petrels would hover in clouds over such a piece of bait as that: one might catch several together. In the cockpit there should be a coop or deep barrel, into which to stow the captives that cannot at once be banded. Hundreds, literally, could be tagged in a few hours by such a trip, and were the practice an annual one, recoveries would pretty certainly be made. Then sooner or later the far-southern islands where Wilson's Petrels breed would be visited, and birds that had

been banded off Massachusetts recovered in their home burrows. What a thrill, to be a party in both enterprises, banding at sea in summer and burrowing for the same birds in winter!

It is hardly probable that any of the twelve who wear my bands will be heard from; but let hundreds or thousands be banded at different points off our coasts, and some returns would seem certain.

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GENERAL NOTES

Mortality of Banded Hawks and Owls.—An analysis of the recoveries expressed in percentages in the table submitted herewith indicates very closely the comparative efficiency of custom and law in the protection of our raptors. Comparison of the protected birds in Group I and the unprotected birds of Group II shows a mortality rate of over two and one half times among the more destructive species. Unfortunately the figures show also a distressing mortality among Group III, raptors which should be but are not generally protected.

Another method of approach is a comparison of mortality rates among different groups of birds as represented by recoveries. The table clearly indicates the fact, which is generally known but not often shown so forcibly, that birds which are exposed to hunting or which lack complete protection have an excessively high mortality. The case of the hawks, which raise small broods in contrast to the ducks, which require a comparatively large territory for breeding purposes, and which have no group of people like sportsmen interested in their propagation, but instead have many avowed enemies, therefore becomes a serious one. The corollary to lower mortality rates of the protected species is more protection of the others if the raptors are to survive. Of course, it is possible to give reasons why these percentages will not be absolutely accurate, but still I believe the trend is clear.

	<i>Number Banded</i>	<i>Recoveries</i>	<i>Rate in Percent</i>
I			
2 Vultures.....	188	2	1.6
Osprey.....	175	11	6.3
Barn Owl.....	679	35	5.2
5 Other Owls			
(except Screech Owl ¹ and Great Horned Owl)	568	16	2.8
Sparrow Hawk.....	391	24	6.1
	2001	88	4.4 average
II			
3 Accipiters.....	247	31	12.6
Great Horned Owl.....	209	20	9.6
	456	51	11.2 average
III			
Marsh Hawk.....	367	52	14.2
4 Buteos.....	473	50	16.6
2 Roughlegs.....	63	9	14.3
3 Falcons (except Sparrow Hawk).....	94	13	13.8
2 Eagles.....	53	3	5.7
	1050	127	12.1 average

¹Screech Owl figures omitted because most of the recoveries were of birds recaptured and released, not of birds shot.