NOTES

OBSERVATIONS ON THE DIVING BEHAVIOR OF THE NORTHERN FULMAR

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Northern Fulmars are relatively light weight, aerial seabirds, and are not anatomically well-adapted for diving or underwater swimming. However, Fisher (1952) stated, "the literature is full of controversy about the diving of fulmars." He listed eight observers reporting diving; presumably their reports represented most of the detailed descriptions of this behavior discovered during an extensive literature search conducted on the species (see Fisher 1952). Subsequent published reports are few if any. Descriptions in more recent references (e.g. Palmer 1962, Cramp 1977) apparently are derived from Fisher's synthesis. Ashmole (1971) listed the fulmar's feeding methods as surface seizing, surface filtering, scavenging and pursuit diving (which is classified as "of minor importance"). Cramp (1977) stated pursuit-plunging is "infrequently" employed. There is disagreement on the depth to which fulmars dive, with estimates of depths ranging from 18" to 2 fathoms (0.5 to 4 m) or more.

On 4 July 1983 I was aboard the *T.V. Oshoro Maru* which was leaving a salmon gill-net sampling station at 55°00'N 147°30'W in the northern Gulf of Alaska. About 25 Northern Fulmars (*Fulmarus glacialis*), 4 Black-footed Albatrosses (*Diomedea nigripes*), 6 Fork-tailed Storm-Petrels (*Oceanodroma furcata*) and 1 Short-tailed Shearwater (*Puffinus tenuirostris*) were gathered at the offal slick which was apparent even on the relatively calm sea surface. This group was typical of the relatively small assemblages noted during my 2-week cruise. As the ship got under way, a dark-phase fulmar flew in and landed within 1 m of another dark-phase fulmar already present. The newcomer lunged aggressively with opened beak and half-opened wings to drive the other bird back 1-2 m, and then abruptly reared-up on the surface and dove almost vertically with wings partially opened. It popped to the surface 6 seconds later, swallowed something, waited perhaps 4 seconds, and dove again for 6 seconds. I then lost track of the bird as the ship moved off station.

After I recovered from the surprise of actually seeing a fulmar dive, questions came to mind. How frequently do fulmars dive? Under what conditions are fulmars likely to dive? I contacted other observers who have watched numbers of fulmars feeding at sea and found two who recall seeing fulmars dive. R.G.B. Brown (pers. comm.) reported seeing fulmars dive on three occasions in the Greenland Sea and Baffin Bay. Single birds on two occasions and two birds on another submerged for 3 to 5 seconds while feeding apparently on planktonic items. In all cases birds dove from the surface. A bird submerged for 3 seconds was feeding where Black-legged Kittiwakes (*Rissa tridactyla*) were plunging and submerging to tails and wingtips—a depth of about 40-50 cm.

In the North Pacific, H. Ogi (pers. comm.) experimented with baits suspended from a floating wooden bar at seven depths, ranging from 20-200 cm. Many fulmars were unwilling to approach the floating bar and birds were frightened away after one became hooked on the line. Some fulmars dove for bait during three "sets," but they did not try for bait at a depth greater than 80 cm.

Fisher (1952) thought that fulmars will dive, "with enough stimulus, e.g. for light-coloured fatty stuff." I have seen frenzied fulmars rush to choice, just-jettisoned fish entrails only to watch the food sink, just out of reach, with no more effort employed by

the birds than submerging head and neck before giving up. The bird I saw dive for 6 seconds was probably well below the surface and could have retrieved large amounts of food other fulmars missed. Is food normally so plentiful that individual fulmars become sufficiently motivated to dive only when desperately hungry? The aggressive feeding behavior displayed by fulmars on many occasions may make it hard to distinguish extremely hungry birds. And of course certain choice food items might "turn-on" any fulmar to diving. This possibility should be investigated. "Natural" foods taken by fulmars (see Fisher 1952) apparently come from the surface layer. The relative importance of nocturnal feeding by fulmars and other seabirds, particularly pelagic species, is almost unknown. Possibly fisheries discards are less important in the fulmar's diet under many circumstances than is often believed. Perhaps enough of this offal is available at the surface so that what sinks is usually unimportant and not worth the effort of underwater retrieval.

Do fulmars dive only when more agile underwater retrievers (e.g. shearwaters) are not present? Fulmars feeding at vessels in areas where aggressive surface-feeders like gulls and underwater feeders like shearwaters are present can be seen to be at an obvious competitive disadvantage because they neither feed by "dipping" from flight nor fly as adeptly in close quarters as gulls, nor do they (normally) catch or retrieve items underwater like shearwaters. Fulmars often appear to compensate for this disadvantage by crowding closer than other species and aggressively contending for whatever comes within reach. Even where there was no subsurface avian competition for sinking food, however, I have seen thousands of fulmars feeding at pelagic sources of discards and have witnessed just this one incident of diving. And when this incident took place there was much less competition for discards than on many other occasions. Several times I have observed adult Glaucous-winged Gulls (*Larus glaucescens*) diving from about 1 m above the surface and (barely) submerge while attempting to retrieve sinking food. However, I observed this behavior only when very few other birds were competing for the food. To gulls and fulmars, diving is likely only marginally worthwhile energetically. Are these birds more inclined to dive when competition is minimal or lacking?

Have fulmars learned to dive only recently, with the advent of "industrial fishing?" While this presumably could have been the case in the Atlantic (see Fisher 1952), observations by Anthony (1895) and Linton (1908) would seem to predate intense, large scale effort in the Pacific. It is clear that this aggressive, successful species, with its long-documented association with man, has long included at least some individuals that could and did dive. Fulmars have been known to dive for many generations, and diving is not restricted to one population or another.

Have only certain individuals adopted the diving technique? Due to the apparent infrequency of encounters with diving fulmars, this question is likely unanswerable. The value of diving behavior may be marginal enough for fulmars so as not to reflect in its spread throughout a population.

The reports given here indicate fulmars may dive at natural feeds and also for fishing discards, and to relatively shallow depths. Further experiments would be of great interest. Descriptions of prey taken during diving are needed to document the type of "pursuit diving" employed. Do fulmars actually "pursue" or do they simply extend their reach toward relatively inactive plankton? In the case of discards, perhaps "retrieval diving" is what fulmars actually perform.

Perhaps, though it seems unlikely, other observers are seeing lots of fulmars diving. Response to this note may document and explain the extent of this "controversial" behavior in a species otherwise well-known.

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LITERATURE CITED

Anthony, A.W. 1895. The fulmars of southern California. Auk 12:100.

Ashmole, N.P. 1971. Seabird ecology and the marine environment. Pp. 223-286 *in* D.S. Farner, J.R. King & K.C. Parkes, eds., Avian biology, Vol. 1. Academic Press, New York.

Cramp, S., ed. 1977. Handbook of the birds of Europe, the Middle East and North Africa. The birds of the western Palearctic, Vol. 1. Oxford Univ. Press, New York.

Fisher, J. 1952. The fulmar. Collins, London.

Linton, C.B. 1908. Pacific fulmars and Pacific kittiwakes at Long Beach. Condor 10:238.

Palmer, R.S., ed. 1962. Handbook of North American birds, Vol. 1. Yale Univ. Press, New Haven, CT.

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Northern Fulmar

Sketch by Tim Manolis