

Seabird-Tuna Relationships

Like fishermen, fishery scientists can learn much about tuna by studying seabirds. Since 1976 biologists of the Pelagic Division, Southwest Fisheries Center, National Marine Fisheries Service, have been recording seabird observations in the eastern and central tropical Pacific. This work, begun on the 1976-1980 dolphin surveys, implicitly recognizes the biological entity of seabird-tuna-dolphin associations.

The studies have revealed a large-scale dichotomy in the apex, pelagic community that appears to involve feeding tactics: multispecies flocks that feed with yellowfin tuna, mainly in tropical waters north of the equator, are apparently sharply separated from virtually single-species flocks that occur largely south of the equator and that feed with skipjack or other small tunas. Boobies (*Sula* spp.) are the most abundant of the birds in the multispecies flocks, and, like most other species in the flocks, are facultative commensals with the tuna they follow. Overall, about 50% of these tuna schools were found to be with dolphins, primarily the spotted dolphin (*Stenella attenuata*) but also to a lesser extent spinner and common dolphins (*S. longirostris* and *Delphinus delphis*). Most other cetaceans in the eastern Pacific (some 20 kinds) were found to seldom associate with either tuna or birds. In the single-species flocks to the south, the sooty tern (*Sterna fuscata*), essentially an obligate commensal on tuna, predominates. Those flocks, and associated tuna, are seldom with dolphins. This dichotomy in community organization is a conspicuous biological feature of the eastern tropical Pacific, and indicates the existence of different, large-scale feeding regimes.

One implication from these species relationships is that ecologically successful species of sparsely productive, tropical seas will be those species capable of following or feeding with tunas—which by their annual fishery yields are evidently very successful in that habitat. Boobies, especially the red-footed and masked species (*S. sula* and *dactylatra*) are the most abundant of birds in tropical waters north of the equator, and are characteristic of flocks that feed with yellowfin tuna. The spotted dolphin is the most abundant cetacean in the eastern Pacific, and it too is closely associated with yellowfin. Sooty terns are the most abundant bird

species south of the equator (and also in the central Pacific), and have a strong, commensal feeding relationship with skipjack or other small tunas there.

Differences in availability of tunas appear related to differences in productivity, and how tunas accordingly feed, as indicated by bird behavior. South of the equator, food is not apparently in large patches; the tuna there are fast moving, and their feeding bouts are brief. Only sooty terns seem to be very successful in following these tuna. In contrast, tuna on the purse seine grounds north of the equator feed on relatively long-lasting aggregations of surface prey, in association with several other, similarly feeding species of seabirds and dolphins. And where both "schoolfish" and longline tuna fishing are important (and "porpoise fishing" is not), as in some areas west of Panama and Costa Rica, the bird-tuna association is very variable, suggesting that the tuna there feed variously between surface and subsurface layers (presumably, birds do not build up flocks over schools not feeding long at the surface). Finally, the summer immigration of southern hemisphere Juan Fernandez and white-necked petrels (*Pterodroma externa* subsp.) onto the extensive yellowfin fishing grounds west of Clipperton Island indicates a reliable seasonal increase of production—and of surface-feeding tuna over which these birds flock. This is also indicated by the seasonal increase of fishing effort and catches there. The feeding of these petrels with tuna was not expected, as they are of a family of birds that are typically surface gleaners.

Future research will include analyses of areal changes in flock species diversity, in the degree to which flocks associate with tunas (as an indicator of tuna behavior and availability), studies of seasonal movements of flocks and flock behavior, and of the relationship of flock size to tuna-school tonnage.

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