

THE ASSOCIATION OF SEA TURTLES AND OTHER PELAGIC FAUNA WITH FLOATING OBJECTS IN THE EASTERN TROPICAL PACIFIC OCEAN

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Yellowfin tuna, *Thunnus albacares*, are the target of one of the most important fisheries of the eastern tropical Pacific (ETP); they are caught by purse seiners, longline vessels, and bait boats from Baja California to Ecuador and from the coast to almost 150 W. They are frequently associated with dolphins, and also with a wide variety of floating objects. Both these associations include a variety of pelagic species. The tuna-dolphin association usually involves yellowfin tuna, several species of dolphins and seabirds, sharks, billfishes, and other fauna. Sea turtles also associate with dolphins, but are more frequently found near tunas associated with flotsam.

In 1987 the Inter-American Tropical Tuna Commission (IATTC) started a study of the communities associated with floating objects in the ETP, among whose objectives are to study the association of young yellowfin tunas and other species with floating objects in relation to possible migration cycles and drift patterns in the ETP, and to investigate the pelagic ecology of sea turtles in the ETP, about which very little is known. Observers aboard tuna vessels record data on the shape, size, and nature of the flotsam, and estimate the abundance (in numbers, biomass, or catch) of target and non-target species.

In this study, the nature of the floating objects and the species composition of flotsam-associated fauna from 1987 to 1989 were analyzed. The data source is limited to presence/absence data, one type of purse-seining, the range of the tuna fishery, and seasonal spatial components within that range. First the data were tabulated to determine the percentage composition of the fauna by species and the frequency, by type and characteristics, of the floating objects. In a second stage, the data were classified into two sets by the presence or absence of sea turtles in the observations. The species compositions and type of floating objects for each data set were computed and compared. Results indicate that the community associated with flotsam is diverse, and includes most of the epipelagic fauna of the ETP. Sea turtles, mostly (75%) olive ridleys, *Lepidochelys olivacea*, are present in 15% of observations. The species most frequently found are sharks, mostly Fam. Carcharhinidae, (in 65% of observations), triggerfish (Fam. Balistidae) and small baitfish (60%), dorado, *Coryphaena* spp., (55%), and yellowfin and skipjack, *Katsuwonus pelamis*, tunas (45%). Most floating objects are trees or parts of trees; the number of objects classified as man-made (which includes trees bearing marks of human intervention) is about the same as that of objects of natural origin.

In Table 1 the characteristics of floating objects in both data sets are compared. Observations of sea turtles associated with man-made objects are significantly more frequent than those of turtles associated with natural objects: this may be because of the greater proportion of man-made objects along shipping lanes or in fishing areas, but may also be related to the turtles' affinity for three-dimensional objects. Turtles show a preference for objects floating horizontally and nearly submerged, and are strongly attracted to brightly colored objects. Table 2 compares the proportions of fauna found associated with floating objects in both data sets. Sea turtles are found most frequently associated with some shark species, marlin, and frigate birds, and slightly less frequently with triggerfish. Some of these associations

may result from geographic correlations of the distribution of species with similar habitat requirements, while others are probably the product of trophic interactions.

The analysis also revealed that observations of sea turtles are most frequent between 11 am and 1 pm, which may indicate a basking behavior around noon; that aggregations of sea turtles, sometimes numbering more than a hundred animals, were observed as far offshore as 120° W; that turtles start to aggregate near the nesting beaches two months before the beginning of the nesting season; and that turtles were observed mating in the open ocean, hundreds of kilometers from the coast.

The association of sea turtles with floating objects may be dependent on the age and size of the turtle and the type of floating object. This behavior should be viewed on two scales: on the small scale, turtles and other fauna, as well as kelp patties and assorted flotsam, may aggregate, actively or passively, in oceanographic discontinuities such as fronts and driftlines. Young sea turtles may find food and/or protection in these areas. On the large scale, the association may benefit turtles of all sizes; floating objects may act as indicators of habitat quality: they enter the ocean at the mouths of tropical rivers, drift mostly along the coastal zones, and eventually converge in frontal areas of the region, all of which are areas of high productivity. Adult turtles may also use flotsam as clues by which to orient themselves during migrations over featureless expanses of the ocean.

These results are preliminary, but they show that floating objects may play an important role in the pelagic ecology of sea turtles. We propose to continue the research to establish the relationships and interactions of sea turtles of various ages and sizes with floating objects and with other fauna in the ETP. A quantitative analysis of the data over time and space, including seasonal variation in flotsam production and turtle abundance, would help to determine patterns of behavior for migration and breeding.

TABLE 1. FLOATING OBJECTS (% counts) AND SEA TURTLES

TYPE	SEA TURTLES		
	PRESENT	ABSENT	
Natural	53.3	60.7	● ●
Wooden	70.4	74.5	
Logs	48.8	56.6	
Man-made wooden	21.6	17.9	
Fishing gear	2.9	1.3	●
Other plastics	16.4	15.4	
Dead animals	1.8	2.6	
FADs	4.7	2.7	●
Other	1.1	1.0	
SHAPE			
Cylindrical	38.7	46.1	● ●
Polygonal	18.7	15.8	
Irregular	22.9	20.7	
DIMENSIONS			
Size ≥4 m	34.3	33.7	
Angle of inclination ≥45°	10.4	20.0	●
COLOR			
Yellow	55.8	15.9	● ●
Brown	16.7	46.3	● ●
AGE			
Long time in water	29.0	37.0	●
Epibiota present	50.4	45.3	
Epibiota coverage >10%	56.0	56.9	
≥75% underwater	57.1	47.2	●
Depth >2m	14.7	15.4	
FISHING			
Previously fished	7.9	21.7	●
Aggregated shape (FAD-like)	14.9	9.5	● ●
PHYSICAL ENVIRONMENT			
Temperature: ≤83°F	70.5	54.5	● ●
Cloud cover: none	36.2	39.2	
Beaufort: 1-3	84.9	87.9	
Time: 0900-1500	60.0	47.6	

● ●: significant at $\alpha = 0.01$
 ●: significant at $\alpha = 0.05$

TABLE 2. SPECIES AGGREGATIONS (% counts) AND SEA TURTLES

	SEA TURTLES		
	PRESENT	ABSENT	
TUNA			
Yellowfin	32.9	33.4	
Skipjack	33.6	33.9	
Bigeye	2.9	1.7	
Bluefin	0.3	0.2	
Black skipjack	15.3	15.7	
Bullets	14.5	14.1	
Bonito	0.5	0.9	
OTHER FISH			
Blacktip shark	1.7	1.8	
Whitetip shark	1.8	0.8	● ●
Hammerhead shark	0.5	0.4	
Other shark	3.4	2.8	
Unidentified shark	16.3	16.1	
Manta ray	1.2	0.6	●
Stingray	0.5	0.3	
Other billfish	1.31	0.7	● ●
Unidentified Marlin	5.4	3.5	● ●
Sailfish	0.6	0.5	
Swordfish	0.4	0.3	
Other large fish	2.5	2.4	
Dorado/Mahi mahi	25.2	23.4	
Wahoo	6.1	5.9	
Rainbow runners	2.1	2.3	
Yellowtail	2.8	2.7	
Other small fish	4.4	5.6	
Triggerfish	10.0	13.9	● ●
Small baitfish	12.7	14.1	
BIRDS			
Boobies	39.9	46.6	
Shearwaters	5.7	5.2	
Terns	8.2	5.8	
Frigate	27.6	11.1	● ●
Petrels	1.6	2.3	
Unidentified/Other	13.8	26.9	●
EPIBIOTA			
	1.6	2.3	
INVERTEBRATES			
	0.7	0.7	
Unidentified fish	0.4	0.4	
Other fauna	0.1	0.1	
None (no fauna)	0	0.6	

note: ● ● sig. at $\alpha = 0.01$; ● sig. at $\alpha = 0.05$

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