OCCURRENCE OF THE WHALE SHARK, *RHINCODON TYPUS* SMITH 1828, IN CALIFORNIA WATERS

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The whale shark, *Rhincodon typus* Smith 1828, is the world's largest living fish, reportedly growing to a total length (TL) of about 17 or 18 m (Compagno 2001). It can be distinguished from other large shark species by its slightly flattened head, terminal mouth, long straight gill openings, prominent lateral ridges on its flanks, and a prominent pattern of white spots between vertical and horizontal stripes, reminiscent of a checkerboard pattern. This unique color pattern is offset by a dorsal background color ranging from dark gray to bluish or brown (Compagno 2001).

Whale sharks have a global distribution, occurring in most tropical to warm temperate waters (Compagno 2001). They are common in the eastern Pacific from southern Baja California to northern Chile and the Galapagos Islands, with a few scattered reports extending their range into southern California (Miller and Lea 1972). Although they are abundant seasonally in the Gulf of California (Clark and Nelson 1997; Eckert and Stewart 2001), whale sharks are considered rare along the northern Baja and California coast. Fitch (1951) reported a whale shark 30 mi south of the United States–Mexico border near the South Island of Los Coronados in January 1951. It was estimated to be about 6.1 m TL and appeared to be feeding on sardines. The only reported California record is of a single individual sighted several times between San Diego and Torrey Pines near La Jolla, San Diego County (Miller and Lea 1972).

Increased knowledge on whale shark population structure can be gained from tracking studies and from observations on their occurrence. Tracking studies conducted off of southern Baja have revealed adult whale sharks to be wide ranging in the North Pacific (Eckert and Stewart 2001). However, despite the high profile of the whale shark as the largest living fish and increasing concern over its conservation status, virtually nothing is known about its distribution in the eastern North Pacific. Here we report on at least 10 previously unpublished records of the whale shark occurring along the California coast (Fig. 1). These records, which span a time period of over 70 y, were compiled from personal observations, recorded notes by observant biologists, and from records kept during marine mammal surveys.

While reviewing notes written by the late JB Phillips, a biologist with the California Department of Fish and Game (CDFG), on the basking shark (*Cetorhinus maximus*) fishery in Monterey Bay, we came across several entries that document the occurrence of whale sharks in Monterey Bay (36°45'N, 121°58'W). These handwritten notes that were used to prepare a publication on the basking shark fishery (Phillips 1948) mention that on ≥3 occasions between 1928 and 1944 whale sharks were sighted in Monterey Bay. Phillips' notes on whale sharks were never published and are now archived at the Monterey Maritime Museum. This prompted us to further investigate the Monterey Bay sightings and look for other unreported observations of whale sharks elsewhere in California waters.

The following 3 observations are taken from handwritten notes made by Phillips between 10 February and 6 May 1947. In August or September 1929, Herman Korf, local basking shark fisherman, observed at least 2 whale sharks mixing with a school of basking sharks. He distinguished the whale sharks by their larger size, distinct light-colored spots, and somewhat more rounded snout as compared with the basking sharks. Between 1828 and 1930, Henry J Leppert, a local basking shark fisherman and blacksmith, observed 3 whale sharks that he identified by their light colored spots and extremely large size. Phil-

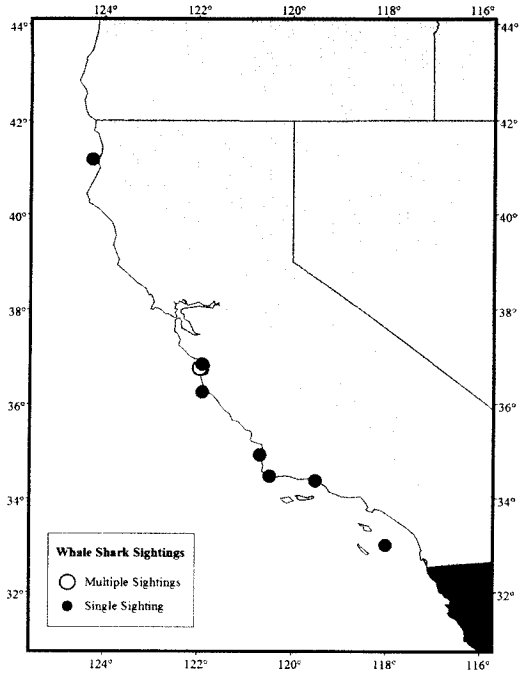

FIGURE 1. Location of whale shark (*Rhincodon typus*) sightings along the California coast.

lips wrote that Leppert was with an experienced former Navy seaman (anonymous) who had seen them before while conducting seal and basking shark surveys up and down the California coast. In the fall of 1944, Korf once again observed several whale sharks mixing together with basking sharks in Monterey Bay. To our knowledge these are the 1st observations of whale and basking sharks co-mingling. Known faunal associates of whale sharks include anchovies (Engraulidae), sardines (Clupeidae), scombrid fishes, manta rays (*Manta birostris*), tiger sharks (*Galeocerdo cuvier*), and hammerhead sharks (*Sphyrna lewini*) (Colman 1997).

Phillips wrote in his notes that Monterey Bay is several hundred miles north of the reported range of the whale shark. However, Phillips further commented that autumn is when the water is warmest in Monterey Bay and the warm Davidson Current is closest to shore. He wrote that other warm-water species such as albacore (*Thunnus alalunga*) were close to shore during this time of year. Phillips' notes commenting on the occurrence of albacore near the California coast are significant as Iwasaki (1970) found that whale sharks would gather with skipjack tuna (*Katsuwonus pelamis*) as they follow the warm Kuroshio Current as far north as the main Japanese island of Honshu (36°N, 141°W). Iwasaki (1970) observed a relationship between the abundance of skipjack tuna and whale sharks.

In 1943, during the height of the soupfin shark fishery, 1 of us (WER, retired CDFG biologist) observed a whale shark about 1 km off Carpinteria, Santa Barbara County (34°22'N, 119°30'W). WER recalled that he approached it close enough to touch, observed the large distinctive spots, and estimated the shark to be about 20 m TL.

Tom Dohl, former leader of the Mineral Management Service (MMS) flight surveys for marine mammals along the California coast between 1972 and 1984, observed whale sharks off the coast on ≥4 occasions. The 4 sightings, starting with the southernmost record, were from off San Clemente Island (33°00'N, 118°00'W), just south of Point Conception (34°28'N, 120°28'W), just north of Vandenberg Air Force Base off Santa Maria, Santa Barbara County (34°55'N, 120°40'W), and most surprisingly off Patrick's Point, Humboldt County, in northern California (41°10'N, 124°15'W). All 4 sightings by Dohl occurred on the continental shelf and not offshore in deepwater. These sharks are often seen in areas close to the continental shelf break where cool, nutrient-rich, upwelled waters mix with warmer surface waters (Iwasaki 1970; Beckley and others 1997). Cool subsurface waters do not appear to restrict their behavior or movements, as whale sharks in the Gulf of California will spend significant time at temperatures as low as 10°C (Eckert and Stewart 2001). These mixing areas of high biological productivity are optimal for nektonic organisms such as copepods that are a primary prey item for whale sharks in the Gulf of California (Clark and Nelson 1997). Large whale sharks, >6 m TL, often feed subsurface which may preclude their being observed more frequently (Compagno 2001).

The most recently reported sighting of whale sharks off California was made during marine mammal surveys conducted along the central California coast, Monterey County, in 1989. While flying in a fixed-wing aircraft at about 213 m altitude on 6 September 1989, 1 of us (KAF) observed a single whale shark off the Big Sur coast (36°15'N, 121°55'W). The shark was about 9 to 10 m TL with a broad, squared head, bluish-gray coloration, and many distinct light spots on the dorsal surface. This initial sighting was fol-

lowed moments later by a 2nd whale shark, seen by biologist Doyle Hanan (CDFG). Two days later (8 September), during continued aerial surveys, 1 or 2 whale sharks were seen off Santa Cruz (36°50'N, 121°55'W). It is possible that the animals moved northward and these sightings represented the same individuals seen on 6 September.

Interestingly, all whale shark sightings reported here, where the season and year were recorded, were found to occur during the late summer or autumn, and during La Niña years. This finding is consistent with Wilson and others (2001), whose analysis of whale shark abundance in Western Australia found that their numbers increased during La Niña years.

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Literature Cited

Beckley LE, Cliff G, Smale MJ, Compagno LJV. 1997. Recent strandings and sightings of whale sharks in South Africa. Environmental Biology of Fishes 50:343–348.

Clark E, Nelson DR. 1997. Young whale sharks, *Rhincodon typus*, feeding on a copepod bloom near La Paz, Mexico. Environmental Biology of Fishes 50:63–73.

Colman JG. 1997. A review of the biology and ecology of the whale shark. Journal of Fish Biology 51: 1219–1234.

Compagno LJV. 2001. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Vol 2. Bullhead, mackerel, and carpet sharks (Heterodontiformes, Lamniformes, and Orectolobiformes). Rome, Italy: FAO Species Catalogue for Fishery Purposes. No. 1, Vol 2. 2001. 269 p.

Eckert SA, Stewart, BS. 2001. Telemetry and satellite tracking of whale sharks, *Rhincodon typus*, in the Sea of Cortez, Mexico. In: Tricas TC, Gruber SH, editors. The behavior and sensory biology of elasmobranch fishes: an anthology in memory of Donald Richard Nelson. Environmental Biology of Fishes, 60:299–308.

Fitch JE. 1951. The whale shark, *Rhineodon typus*, off northern Baja California. California Fish and Game 37:351.

Iwasaki Y. 1970. On the distribution and environment of the whale shark, *Rhincodon typus*, in skipjack fishing grounds in the western Pacific Ocean. Journal of the College of Marine Science and Technology, Tokai University, 4:37–51.

Miller DJ, Lea RN. 1972. Guide to the coastal marine fishes of California. Sacramento, CA: California Department of Fish Game, Fish Bulletin 157. 235 p.

Phillips JB. 1948. Basking shark fishery revived in California. California Fish and Game 34:11–23.

Wilson SG, Taylor JG, Pearce AF. 2001. The seasonal aggregation of whale sharks at Ningaloo Reef, Western Australia: currents, migrations and the El Niño/southern oscillation. Environmental Biology of Fishes 61:1–11.

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