

FISHES NEW TO THE EASTERN BERING SEA

A joint Japan-United States groundfish survey was conducted during the summer of 1979 on the continental shelf and slope in the eastern Bering Sea. Of the more than 100 species of fishes taken during the survey, 1 has not been previously reported from the Bering Sea—*Kali indica* Lloyd 1909 (Chiasmodontidae)—and 3 others have been recorded, but no specific localities in the eastern portion have been attributed as capture sites: *Percis japonicus* (Pallas 1772) (Agonidae); *Laemonema longipes* Schmidt 1938 (Moridae); and *Macropinna microstoma* Chapman 1939 (Opisthoproctidae). In this paper we document the capture of the four species from the eastern Bering Sea.

Collection Information (Table 1)

Specimens of the four species were captured with a 53.4 m (headrope length) commercial bottom trawl fished by a 350-ton land-based trawler, the *Yakushi Maru No. 21*, chartered by the Fisheries Agency of Japan. As no closing devices were used, capture depths are unknown. Presumably, the specimens of *Kali*, *Laemonema*, and *Macropinna* species were captured in midwater as the trawl was lowered or raised, for the species have been collected previously almost exclusively by midwater trawls. Specimens are deposited in the Laboratory of Marine Zoology, Hokkaido University, Hakodate (HUMZ), and the U.S. National Museum of Natural History, Washington, D.C. (USNM). Other specimens of *Percis japonicus* and *Laemonema longipes* were examined from the collections of the Northwest and Alaska Fisheries Center Kodiak Laboratory, National Marine Fisheries Service, NOAA, Kodiak, Alaska, and

TABLE 1.—Collection data for the eastern Bering Sea fish specimens (summer 1979).

Station no.	Date (GMT)	Position (middle of tow)	Bottom depth (m)	Water temp. (°C)	
				Surface	Bottom
22	27 June	59°47.9' N 178°47.3' W	930	7.5	3.0
28	27 June	59°53.0' N 178°54.3' W	580	7.2	3.7
43	27 June	59°28.6' N 178°12.5' W	280	6.5	—
124	23 June	58°22.1' N 175°01.8' W	740	6.3	—
225	7 July	57°00.6' N 170°16.2' W	510-440	8.1	3.2
251	18 June	56°00.9' N 169°16.5' W	610	6.8	—

the College of Fisheries, University of Washington, Seattle, Wash. (UW), respectively.

Kali indica Lloyd 1909

Figure 1 (upper)

One specimen, HUMZ 81941, taken at station 124. This bathypelagic chiasmodontid is widely distributed in tropical seas and has been taken in the temperate South Atlantic and North Pacific as well (Johnson 1969; Johnson and Cohen 1974). Hubbs et al. (1979) have recently reported it from off California based on two specimens (lat. 32°37.7' N, just north of the United States-Mexican border; and about lat. 33° N, long. 119°20' W; locality information from L. J. Dempster¹). The Bering Sea specimen is the most northern record of the species, the first from boreal waters, and an addition to the fish fauna of Alaska.

Counts: D. XIII+24; A. I,25; P. 11; V. I,5; branchiostegal rays 6. Teeth: in lower jaw 5 (outer row) and 3 (inner row); in upper jaw 6 (outer) and 3 (inner); on palatine 4. Measurements in millimeters: standard length 175.3; predorsal 48.5; preanal 95.8; greatest body depth 30.1; least depth caudal peduncle 7.6; length caudal peduncle 20.6; pectoral fin length 30.9; head length 41.6; snout 14.5; eye diameter 6.2; postorbital length of head 22.8; width bony interorbital 11.6; length upper jaw 34.2; length lower jaw 37.2; largest teeth on upper jaw 8.9.

Percis japonicus (Pallas 1772)

Figure 1 (lower)

One specimen, HUMZ 84945, taken at station 43; another deposited in the Northwest and Alaska Fisheries Center Kodiak Laboratory, NMFS, from lat. 57°16.3' N, long. 172°56.5' W (RV *Oregon* cruise 794, haul 90, 23 July 1979). Other specimens have been taken from the eastern Bering Sea northwest of Unalaska.² This agonid is common in Japanese waters and is also known from the Okhotsk Sea and the Asiatic coast of the

¹Lillian J. Dempster, Associate Curator, Department of Ichthyology, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, pers. commun. January 1980.

²Doyle Kessler, Fishery Biologist, Northwest and Alaska Fisheries Center Kodiak Laboratory, National Marine Fisheries Service, NOAA, P.O. Box 1638, Kodiak, AK 99615, in litt., 5 August 1980, and James Long, student, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331, pers. commun. 9 September 1980.

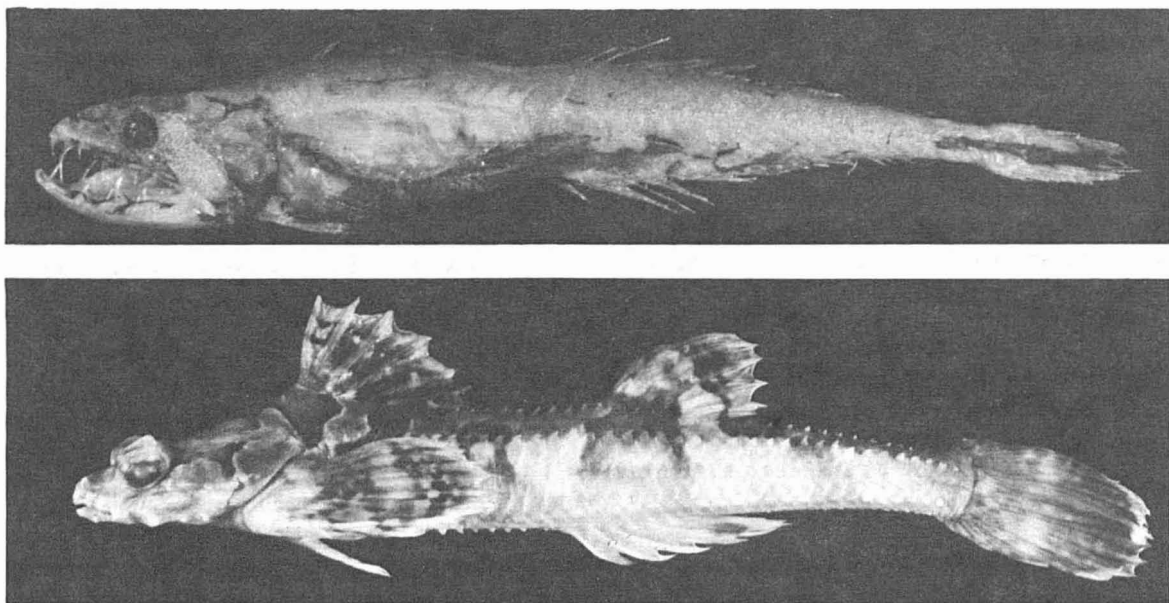


FIGURE 1.—Specimens of *Kali indica*, HUMZ 81941 (top) and *Percis japonicus*, HUMZ 84945 (bottom) taken in the eastern Bering Sea.

Bering Sea (Jordan and Gilbert 1899; Andriashev 1937; Schmidt 1950). Schultz (1967) quoted a letter from Teodor Nalbant which mentions a capture in the south-central Bering Sea, but without an exact locality. The present specimens are the first certain records of the species from the eastern Bering Sea and an addition to the fauna of North America.

Counts (HUMZ 84945 first): D. VI+7, VI+7; A. 8, 8; P. 12, 12; V. I,2, I,2; lateral line plates 30, 37; vertebrae (excluding ural centrum) 40, —. Measurements in millimeters (HUMZ 84945 first): standard length 241, 215; predorsal 66.0, 60.3; preanal 131.0, 122.6; preventral 61.2, 61.8; greatest body depth 40.5, 35.9; least depth caudal peduncle 16.8, 17.5; pectoral fin length 56.0, 50.2; ventral fin length 31.5, 29.2; first dorsal fin base 48.2, 39.8; second dorsal fin base 33.1, 32.2; anal fin base 69.1, 40.3; head length 60.8, 55.4; snout length 15.4, 15.7; eye diameter 12.2, 8.9; interorbital width 16.2, 16.1; upper jaw length 15.3, 13.0.

Laemonema longipes Schmidt 1938

Two specimens, HUMZ 82892 and USNM 220877, were collected at station 251; a third example, UW 20772, eastern Bering Sea, summer 1978, was also examined. This elongate morid is locally abundant in the western North Pacific, ranging from off Owase, Mie Prefecture (speci-

mens in the collections of the University of Kyoto, Maizuru), to the Okhotsk and Bering Seas. Large trawl catches from Suruga Bay have been noted by Matsubara (1955), and >1,000 individuals were found in the stomach of a whale in the Kurile-Kamchatka Trench (Rass 1954). Although Fedorov (1973) listed the species from the Bering Sea, apparently no specimens or precise localities documenting the record have been published. These specimens are new additions to the fauna of North America.

Counts (HUMZ 82892 first, followed by USNM 220877 and UW 20772): D. 6+52, 6+52, 6+50; A. 49, 50, 50; P. 17, 17, 18; V. 2, 2, 2; caudal rays 23, 25, 22; gill rakers 7+18, 8+21, 8+22; branchiostegal rays 7, 7, —; vertebrae (not including ural centrum) 52, 53, 50. Measurements in millimeters: standard length 178, 219, 205; predorsal 46.9, 57.1, 54.7; preanal 68.7, 78.1, 77.1; preventral 34.8, 40.1, 38.1; greatest body depth 39.9, 34.0, —; pectoral fin length 39.8, 46.2, 43.9; ventral fin length 71.0, 78.4, 64.5; head length 42.9, 49.6, 46.3; snout 13.0, 15.8, 14.2; eye diameter 7.4, 9.3, 8.6; width interorbital 9.4, 15.2, 12.8; length upper jaw 20.0, 23.3, 22.1.

Macropinna microstoma Chapman 1939

Three specimens were taken: HUMZ 81966 (stn. 22), HUMZ 81975 (stn. 28), and USNM 220876

(stn. 225). This bizarre, tube-eyed opisthoproctid fish is a characteristic member of the mesopelagic fauna in the temperate eastern North Pacific, where it has been caught between the Gulf of Alaska and northern Baja California (Berry and Perkins 1966; Quast and Hall 1972). It also has been taken in the southeastern Pacific west of the Juan Fernández Islands (Craddock and Mead 1970). Although no localities have been presented, western Pacific captures are mentioned from the Kurile-Kamchatka Trench (as Macropinnidae; Rass 1955) and listed from the northwestern Pacific (Parin 1961). Fedorov (1973) listed the species from the Bering Sea without documentation. The three specimens reported upon here are the first verified records of the species from the Bering Sea.

Counts and measurements of HUMZ 81966 (eyes, distal portion of ventral fin, and skin lost), HUMZ 81975 (eyes, dorsal fin, and skin lost), USNM 220876 (eyes lost). Counts: D. 11, —, 12; A. 14, 14, 14; P. 17, 17, 17; V. 10, 10, 10; branchiostegals 3, 3, 3. Measurements in millimeters: standard length 96.4, 112.8, 56.7; predorsal 68.6, —, 42.7; preanal 76.7, 82.5, 41.9; preventral 53.3, 61.7, 33.1; vent to anal origin 22.1, 18.0, 6.1; greatest body depth 36.6, 36.8, 20.3; least depth caudal peduncle 13.2, 14.3, 7.3; pectoral fin length 21.6, 17.8, 16.5; ventral fin length —, 48.9, 28.0; dorsal fin base 15.8, —, 8.8; anal fin base 14.3, 18.4, 9.6; head length 38.0, 47.8, 26.6.

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MAMORU YABE

*Laboratory of Marine Zoology
Faculty of Fisheries
Hokkaido University
Hakodate 041, Japan*

DANIEL M. COHEN

*Systematics Laboratory
National Marine Fisheries Service, NOAA
National Museum of Natural History
Washington, DC 20560*

Fisheries Agency of Japan
 Far Seas Fisheries Research Laboratory
 1,000 Orido, Shimizu 424, Japan

TOMIO IWAMOTO

California Academy of Sciences
 Golden Gate Park
 San Francisco, CA 94118

SCHOOLING OF THE SCALLOPED HAMMERHEAD SHARK, *SPHYRNA LEWINI*, IN THE GULF OF CALIFORNIA

Groups of sharks have been witnessed occasionally by airborne or shipboard observers (Bass et al. 1975; Clark 1963; Springer 1967; Kenney 1968). Such remote observations, augmented with inferences from fishery records (Ford 1921; Olsen 1954; Jensen 1965), have provided fragmentary descriptions of these groups and speculations on their function. We have studied polarized schools of the scalloped hammerhead shark, *Sphyrna lewini*, by free diving among them at several offshore sites in the Gulf of California. Here we report preliminary observations on the sizes, depths, movements, and compositional dynamics of these schools, and the sizes, sexes, and behavior of the school members. Based upon these observations, we discuss the possible function of such schools.

Previous sightings by others indicated that schools of *S. lewini* might be encountered during the summer at three locations near La Paz, Baja California Sur, Mexico: Las Arenitas Rocks (Isla Cerralvo), El Bajo Espiritu Santo, and Isla Las Animas (Figure 1). These locations were visited between 26 July and 6 August 1979 aboard either our 7 m fiber glass skiff or the 23 m ferrocement research vessel, the *Juan de Dios Batiz*. At these locations and others, four search techniques were employed: 1) Free diving and surface swimming; 2) scuba; 3) baiting with ground Pacific mackerel, *Scomber japonicus*; and 4) playback of pulsed, low-frequency sounds (for description, see Myrberg 1978). Scalloped hammerheads were most easily discovered and approached by free diving, and data were recorded on small plastic slates. Relatively few scalloped hammerheads were observed by divers with scuba, even in areas where this species was abundant. This was probably due to their avoidance of the divers' sounds

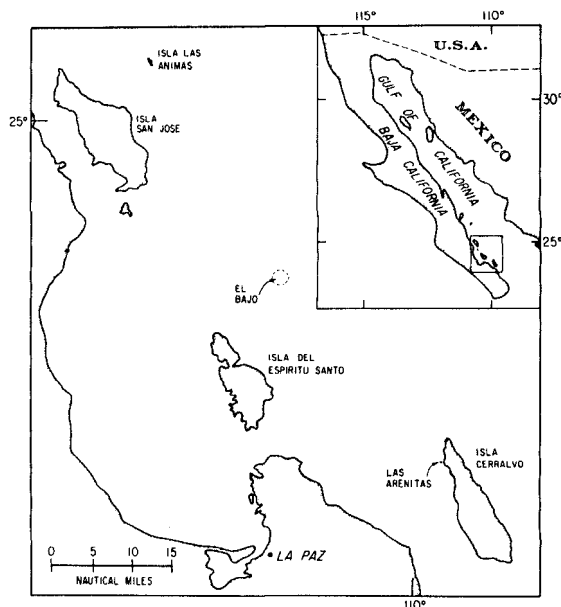


FIGURE 1.—The La Paz study area in the Gulf of California. Grouped scalloped hammerhead sharks were encountered at three sites: 1) Las Arenitas, a cluster of rocks 100 m from Isla Cerralvo; 2) El Bajo Espiritu Santo, a seamount rising to within 14 m of the sea surface; and 3) Isla Las Animas.

and visually conspicuous bubbles. Only three scalloped hammerheads were attracted in 11.5 h of baiting and none during 40 min of sound playback, indicating a lack of interest in these feeding stimuli.

Both individuals and schools of *Sphyrna lewini* were seen. Generally the sharks within schools swam in a polarized manner, remaining relatively equidistant from each other and swimming forward and changing direction together (Figure 2A, B). For the purposes of data sampling, sharks were counted during discrete "observation dives," which usually consisted of free dives, but included some observations from the surface. Scalloped hammerheads were encountered on 91% of the free dives at El Bajo, 58% at Isla Las Animas, and 34% at Las Arenitas Rocks. These percentages are a rough index of relative abundance because they are probably affected by differences in search success and water clarity. School sizes at El Bajo were larger than those at Las Arenitas Rocks and Isla Las Animas, but no large difference existed between group sizes at Las Arenitas Rocks and Isla Las Animas.

The number of scalloped hammerhead sharks in the vicinity of El Bajo was estimated by using the