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First Documentation of the Roper Inshore Squid, *Loligo roperi* (Cohen 1976), in the Gulf of Mexico

Jennifer L. DeBose
University of California, Davis

Michael Vecchione
Smithsonian Institution

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where none existed only a few decades earlier has clearly influenced antipatharian population dynamics within the Gulf of Mexico. Both the platforms and the Flower Garden Banks represent habitats with exceptional water quality and other conditions that allow settlement and growth of *P. pennacea*.

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- GREGORY S. BOLAND AND PAUL W. SAMMARCO, (GSB) U.S. Department of the Interior, Minerals Management Service, MS 5432, Gulf of Mexico OCS Region, 1201 Elmwood Park Boulevard, New Orleans, Louisiana 70123; and (PWS) Louisiana Universities Marine Research Consortium (LUMCON), 8124 Highway 56, Houma, Louisiana 70344. Send reprint requests to GSB. Date accepted: June 17, 2005.

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FIRST DOCUMENTATION OF THE ROPER INSHORE SQUID, *LOLIGO ROPERI* (COHEN 1976), IN THE GULF OF MEXICO.—Roper's inshore squid, *Loligo roperi*, is a small squid (dorsal mantle length [DML] to 72 mm) that becomes mature at around 43 mm DML (Cohen, 1976). Past collections suggest that this species is associated with islands in the western Atlantic, ranging from the Caribbean shelf off Panama and Colombia, through the Greater and Lesser Antilles within the Caribbean Sea, and north to the Bahama Islands (Fig. 1; from Cohen, 1976). There have been no previous reports of this species from the Gulf of Mexico, although two other *Loligo* spp., the longfin inshore squid (*Loligo pealeii*) and the slender inshore squid (*Loligo plei*), are known to occur in this area (Hixon et al., 1980; Roper et al.,

1984). In general, very little is known about the distribution and movement patterns of cephalopods within the Gulf of Mexico, and even less is known about which habitat types are important for spawning and juvenile development of squid in this region.

Here we document the first collection of *Loligo roperi* within the Gulf of Mexico. Specimens were collected within the boundaries of the Flower Garden Banks National Marine Sanctuary, where several other cephalopod species including *Loligo pealeii* (Bright and Pequegnat, 1974), *Illex coindetii* (DeBose), and an unidentified *Octopus* sp. (Bright and Pequegnat, 1974) have been previously reported. We also describe general observations on school size and behavior of *L. roperi* because almost nothing is known about the behaviors of this species.

Methods.—The East and West Flower Garden Banks are located approximately 177 km off the coast of Texas and Louisiana. The Flower Garden Banks are continental shelf-edge banks that rise from the surrounding sea floor (with an average depth of 130 m) to approximately 18.2 m depth. The shallowest regions of these banks are topped by 140 hectares of coral reef that provide habitat for more than 475 species of fish and invertebrates (see Rezak et al., 1985; E. Hickerson, FGBNMS, pers. comm.).

Specimens were collected in the evening between 2030 and 2150 hr on four separate SCUBA dives conducted during 9–10 Sep. 2001 and 28–29 Aug. 2002. All dives occurred over the East and West Flower Garden Banks (located at 27°55'N 93°36'W and 27°52'N 93°49'W, respectively). Squid were collected by open-circuit SCUBA divers with hand nets at depths ranging from 20 to 30 m. Specimens were identified on the basis of morphological characteristics (Cohen, 1976; Roper et al., 1984) and are currently housed at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). All collected squid were assessed for sexual maturity as defined by the presence of mature ovaries or testes. Observations of squid behavior in the wild were recorded by six divers over a total dive time of 5.2 hr.

Results.—Collections: 9–10 Sep. 2001. One specimen was collected over the West Flower Garden Bank, at 27°52'N 93°48'W (cat. no. USNM # 1074405): mature female *Loligo roperi* (45 mm DML; Fig. 2). Two additional specimens were collected over the East Flower Garden Bank, at 27°54'N 93°35'W (USNM # 1074406): one mature male (41 mm DML)

and one mature female *L. roperi* (37 mm DML). Spermatangia (packets containing sperm) were attached to the buccal membranes of both mature *L. roperi* females.

28–29 Aug. 2002. Four specimens were collected over the East Flower Garden Bank, at 27°54'N 93°35'W: three mature females *L. roperi* (37–42 mm DML, USNM # 1074407) and one mature male *L. roperi* (44 mm DML, USNM # 1074408). Again, spermatangia were attached to the buccal membranes of all mature *L. roperi* females.

Behavioral observations: The largest squid (37–44 mm DML) were observed in small groups of two to four individuals located approximately 1–3 m above the reef crest. Smaller squid (10–30 mm DML) were found in slightly larger groups of 6–10 individuals. These smaller squid were generally located over sand flats or higher in the water column approximately 5 m above the reef crest.

Large numbers of squid were observed on both 9 Sep. 2001 and 28 Aug. 2002. These dates coincide with the beginning of the week long annual coral spawning event on the Flower Garden Banks. During 2030–2250 hr, larger squid were observed in groups of three to four individuals only 1 m above the reef, and smaller squid were seen aggregating in large groups of several hundred individuals higher in the water column. By around 2400 hr, these large groups of smaller squid appeared to have broken up into approximately 20 groups of 30 individuals. These smaller squid avoided dive lights and moved upward into the water column when dive lights were directed toward the school.

Discussion.—Between the years 1990 and 2000, loliginid catches in North America totaled 600,728 tons (FAO, 2004), of which 646 tons were harvested by U.S. fishermen in the Gulf of Mexico (FIN DATABASE, 2004). However, most squids (75%) captured in North America fisheries are not identified to species level (FAO, 2004), so there is little information about the distribution of individual *Loligo* species. Cohen's (1976) catch data showed *L. roperi* occurs near islands in the western Atlantic and Caribbean Sea (e.g., Bahamas and Antilles), but the present record extends the known distribution of *L. roperi* into the Gulf of Mexico. It remains unclear whether this species recruits into the Gulf from the Caribbean (possibly via the Loop Current) (see Lugo-Fernandez, 1998) or permanently resides in the Gulf of Mexico.



Fig. 1. *Loligo roperi* capture sites: records of confirmed identifications in the Gulf of Mexico and Caribbean Sea. Type locality, Bahama Islands (*); literature records (■); new locality from this study (▲).

Seamounts and shallow banks (<100 m) are "islands" used by diverse species of fishes and invertebrates as unique foraging and spawning habitat. Nesis (1993) highlighted the particular use of seamounts as spawning habitat for several genera of cephalopods, including *Loligo*, in the Indian and southeastern Pacific oceans. The presence of spermatangia attached to the buccal membranes of females suggests that mating may have occurred above the Flower Garden Banks. This report of mated *L. roperi* specimens is further corroboration of the importance of shallow banks in the reproductive ecology of *Loligo* squid.

These observations of *Loligo roperi* in the northwestern Gulf of Mexico are significant for a number of reasons. Only three cephalopod species have previously been documented within the Flower Garden Banks National Marine Sanctuary, making this report novel and significant to understanding the diversity of cephalopods that occupy the Sanctuary. This collection is also the first record of *L. roperi* in the northwestern Gulf of Mexico. These observations further provide the first description of this squid's behavior in the wild and raise a number of questions about how this species selects and uses habitats. If *L. roperi* recruits to coral reefs in the Gulf of Mexico, how do the squid locate the shallow banks? Are shallow coral areas the only suitable habitat for this species within the Gulf of Mexico, or does *L. roperi* use deeper habitats as well? A consider-

able increase in the density of *L. roperi* was observed on 9 Sep. 2001 and 28 Aug. 2002, suggesting that the abundance of squid may surge regularly during annual coral spawning events. These repeated increases in squid density, combined with the absence of such large numbers of squid during other times throughout 2001 and 2002 (J. L. DeBose, unpubl. data), suggests that these may be transient aggregations (see Domeier and Colin, 1997). What stimulated the aggregation behaviors of *L. roperi* during the weeks of coral spawning is not known; however, the corresponding timing suggests that there may be an association between these two events.

The documentation of *Loligo roperi* within the Gulf of Mexico indicates that identifications of previously collected *Loligo* specimens in this region could be inaccurate. *Loligo plei* is a common squid species in this region that shares a number of morphological characteristics with *L. roperi*. These similarities, including the shape of the mantle and fins as well as the morphology of the hectocotylyzed arm and tentacles, led Cohen (1976) to suggest that these may be closely related species that diverged through an evolutionary shift in growth rate or timing of sexual maturation. Caution should therefore be exercised when interpreting earlier surveys of squid composition and abundance in this area because misidentification between adult *L. roperi* and juveniles of other *Loligo* species in the Gulf of Mexico (i.e., *L.*

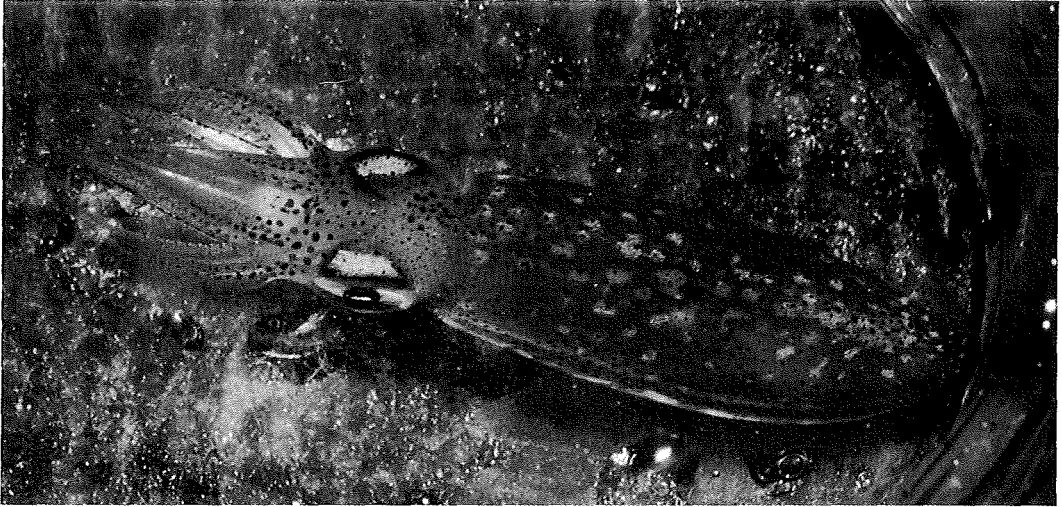


Fig. 2. *Loligo roperi*: live female (45 mm DML) showing chromatophore patterns. The animal was captured approximately 0.2 m above a coral head on 10 Sep. 2001; photographed shipboard in a glass specimen dish. Photo courtesy of G. Merritt.

pealeii and *L. plei*) may have previously occurred.

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- JENNIFER L. DEBOSE AND MICHAEL VECCHIONE. (JLD) *Center for Animal Behavior and the Section of Neurobiology, Physiology & Behavior, University of California, Davis, California 95616. (MV) NMFS Systematics Laboratory, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560.* Send reprint requests to JLD. Date accepted: May 20, 2005.