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SPINY LOBSTER

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The spiny lobsters are marine crustacea belonging to the family Palinuridae, a group which has numerous representatives throughout tropical and sub-tropical seas. The genus *Panulirus* is represented by species of economic importance on both the Atlantic and Pacific coasts of America, in the Hawaiian Islands, Japan and South Africa. The spiny lobster of Florida, *Panulirus argus*, known also as sea crawfish, is found in waters as far northward as Beaufort, N. C., where small specimens are caught occasionally by shrimp fishermen. Apparently the southern limit of its range is Rio de Janeiro, Brazil. This species is common on the Florida Reef from Miami to the Dry Tortugas and is also abundant along the coast of the Yucatan Peninsula in Mexico. The best fishing grounds are along the southern shores of the reefs and keys, where the greater part of the catch is made in water from one to 10 feet deep. The spiny lobster of the western coast of the United States, *Panulirus interruptus*, is abundant along the Lower California coast of Mexico, and in Southern California, occurring as far north as Oregon. It inhabits rocky ledges and kelp beds, living in deeper water during the winter than during the summer.

The spiny lobsters are not closely related to the true lobster, *Homarus americanus*, of New England. The spiny lobster has very long legs, long whip-like antennae studded with spines, numerous spines on the cephalothorax or body, two horn-like spines protruding over the eyes, and lacks the great claws characteristic of *Homarus americanus*. None of the long, delicate walking legs of the spiny lobster is equipped with claws.

The spiny lobster is fished intensively as its flesh has a delicate flavor. It is also the favorite food of many fishes and has been used as bait by hand-line fishermen, especially in southern Florida. The following table shows the landings in the United States. It will be noted that California draws heavily upon the waters off the west coast of Mexico. It is reported that over 1,000,000 pounds are taken annually along the western shore of Baja California, Mexico, much of which is shipped into California. The Florida catch is also supplemented by importations from the West Indies, especially Cuba and the Bahamas. Large importations of spiny lobster tails also come from South Africa.

Landings of spiny lobsters in United States ports

Year	California 2/		Total
	Florida 1/		
	From State waters	From South of California	
	Pounds	Pounds	Pounds
1943	1,911,000	298,000	2,896,000
1944	1,176,000	512,000	2,095,000

1/ From Florida State Board of Conservation.

2/ From California Bureau of Marine Fisheries.

The average market size of the Florida spiny lobster is 9 to 10 inches long, exclusive of the antennae. A 9-inch lobster weighs about a pound. The largest Florida specimen of which the Fish and Wildlife Service has authentic record weighed over 8 pounds when caught and measured 17 inches. It is now in the U. S. National Museum collection. The spiny lobster of the California coast is said to attain a weight of 17 pounds, while animals four, five, and six pounds in weight are fairly common.

The spiny lobster is nocturnal in its habits, crawling about at night to feed. Most of those caught by fishermen are taken at night. During the day they remain hidden under rock ledges or among sponges and other marine growths, where they may be detected in the clear water by their protruding antennae. They are gregarious creatures, and have been observed crawling about in single file, the antennae of one in contact with the body of the one in front. There is no evidence that the spiny lobster burrows in muddy banks or inhabits muddy bottoms. Apparently it prefers coral reefs, rocky bottoms, or other grounds where plenty of cover is available.

The spiny lobster moves about slowly but nimbly over the bottom, supported on the tips of the long walking legs. Short rapid movements can be made to either side or backward. Swimming is resorted to chiefly as a means of escape from enemies. In spite of the rather sluggish movements of this animal, there is no reason to believe that its range is restricted to a small area. Large numbers of darkly colored individuals of the type not usually found near shore come into shallow waters at times, apparently to feed, and later disappear, presumably to return to deep water. There is no evidence of migrations parallel to the coast.

Worms, small mollusks, and probably smaller crustaceans compose the natural food of the spiny lobster. It is often a scavenger, including in its diet a great variety of such food as bits of fish, pieces of clams, and garbage. Fishermen may bait their traps with beef ribs or fish but often use no bait.

In Florida the mating season is thought to extend from August to November. The exact method of insemination of the female is not well understood. Apparently the spermatophore is deposited on the thoracic sternum of the female, where it hardens into a mass of dark gray or black matter which has the consistency of whalebone. The spermatophore is probably carried over the winter by the female.

During the act of extruding the eggs the female remains in a normal resting position. The abdomen is flexed, with the swimmerets forming a sort of pocket. The spermatophore is scraped repeatedly by the legs, an action which apparently ruptures it and frees the sperm. The eggs, after emerging from the oviducts at the bases of the third pair of legs, must pass over the spermatophore and thus be fertilized in order to reach the swimmerets, where they are attached later. All the eggs are laid during a period of about six hours. They are carried by the female in small bunches of various sizes attached to the fine hairlike setae of the swimmerets.

The hatching season extends from the latter part of February until the latter part of June or July, the time varying from year to year. Females have been observed with eggs as late as August. The smallest egg bearing female which was observed at Key West measured 5 inches in length of carapace, and about 8 inches in total length excluding the antennae. The number of eggs carried by a female depends upon its size. Several estimates have been made, and it is apparent that the number varies from 500,000 to 700,000. Recently laid eggs are of a bright orange-red color, but as the embryo develops the color changes to a clear light brown. Just before hatching the eggs are colorless. The change in color is due to the absorption of yolk material.

Cleavage appears to be holoblastic. The time required for development probably varies. According to the account of Crawford and Desmidt, the 8-cell stage may be reached within 12 hours after the eggs are laid; the 16-cell stage within 24 hours; the morula within 30 hours; and the blastula within 48 hours. The eyes of the embryo may be seen after 7 days, at which time at least 5 pairs of appendages are developed. All eggs are hatched within about 18 days.

This comparatively short embryonic period is followed by a long larval period, during which gradual changes take place from the curiously shaped first larva or phyllosome, to the adult form. This long larval period has been the principal barrier to success in the artificial propagation and rearing of the spiny lobster.

The transparent newly hatched larvae are entirely unlike the adults. They live at or near the surface of the water for a considerable period of time undergoing changes in size and complexity until they reach the puerulus stage, which resembles the adult. According to the work of Tague on the European spiny lobster, Palinurus vulgaris, the larvae of this species sink to the bottom before their transformation to the puerulus stage. The complete process of development has never been described for either the European or American species.

The smallest spiny lobsters of adult form taken at Key West were not less than 1-1/2 inches total length, excluding the antennae. These small forms live among sponges and other marine growths. Molting occurs when the old shell has become too small and the act thus depends upon factors which affect the rate of growth. The shell forward of the jointed portion splits along the sides and becomes loose at the rear margin. The position of the spiny lobster during molting is upright, with the legs extended

forward and the tips of the legs, or dactyls, gripping the ground. The carapace rises upward and forward, and the fore part of the body is slowly withdrawn from the old shell. The antennae and legs are quickly withdrawn and the shell is cast from the tail with a few movements. The spiny lobster is now very soft, and great injury may result from handling it at this time. It is able to crawl slowly about, and is capable of swimming if disturbed. The shell usually hardens in 3 weeks, although individuals have been observed in which the shell hardened in 18 days. It is probable that there is no sharply defined molting season. The young are known to molt more frequently than adults. Females that have been carrying eggs molt 3 or 4 days after the eggs hatch, while males may molt at any time during the year. Because they attain a larger size, males are thought to molt more frequently than females.

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