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Short Communication

PRELIMINARY STUDIES OF THE MARICULTURE POTENTIAL OF THE SLIPPER LOBSTER, *SCYLLARIDES NODIFER*

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ABSTRACT

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The gregarious, non-aggressive slipper lobster, *Scyllarides nodifer*, which commonly reaches weights of 250—300 grams, was examined for its mariculture potential.

Two groups of lobsters, one predominently adult and one predominently juvenile, were held between December 1980 and February 1982. Observations were made on food preference and consumption, growth increments and behavior. Size frequency data on field populations were also gathered.

Live bivalves were the preferred food. Growth from post-larvae to a 300-g animal is hypothesized to require nine to ten molts and approximately 18 months. No problems of diseases, malnutrition or water quality were encountered.

INTRODUCTION

The slipper or Spanish lobster, *Scyllarides nodifer* (family Scyllaridae), occurs from the Gulf of Mexico to North Carolina at depths of 20—150 m. Reaching 250—300 g, it has been proposed as a candidate for lobster mariculture (Van Olst et al., 1980). It is believed to spend 9 to 11 months in the oceanic plankton (Lyons, 1980), and attempts to rear it from the egg have been unsuccessful (P.B. Robertson, personal communication, 1980; Cline et al., 1978). However, observations reported here indicate that if captured at the post-larval or puerulus stage as it moves inshore and settles to the bottom, it can be maintained and reared in captivity.

The species is largely unexploited at this time although some animals are brought in as bi-catch from the shrimp fleet in North Florida and from the spiny lobster fishery in the Florida Keys. No landings statistics are available for this species. Consumer acceptability is good when the lobster is available.

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MATERIALS AND METHODS

Animals were maintained in a 3000 gallon (11 355 l), 4.2 m diameter circular tank supplied with natural sea water. Water was continuously filtered through sub-gravel filters after being pumped from an adjacent estuary. Depth was approximately 1 m.

Two groups of animals were held during the study. For the first group of mostly adult lobsters held from December 1980 to May 1981, water temperature varied from 20° to 26°C, while salinity varied between 30 and 35‰. The second group of mostly juvenile lobsters was held at water temperatures ranging from 26° to 12°C from August 1981 to February 1982. Shelters of limerock slabs and cinderblocks were provided. Sponges, sea whips and other marine invertebrates were added to approximate a semi-natural setting. The lobsters were provided live bivalves of various species upon which they fed at will.

Animals were non-injuriously tagged. Upon molting, the cast shell and the lobster were isolated for 24 h within the tank, after which carapace lengths of the cast shell and the lobster were recorded. The animal was then retagged and returned to the tank. The lobsters' behavior was observed two times per week between 21.00 h and 03.00 h under two red 60 watt electric bulbs approximately 1 m above the water.

In addition to the aquarium studies, three samples of lobsters were collected from shrimp trawlers in February, August and December 1981 for size frequency analysis. The samples, of 130, 68, and 59 animals respectively, were taken prior to sorting so that small animals were not excluded.

RESULTS

Growth rates

The first sample of 50 mostly adult lobsters ranged in carapace length from 2.9 to 10.1 cm (mean 7.3 cm). During the 5-months period from December 1980 to May 1981, 35 of these animals molted, two of them twice and the rest once. The second sample of 68 animals, mostly juveniles, varied in carapace length from 2.3 to 6.9 cm with a mean of 4.5 cm. Of these animals, all molted once and eleven molted twice.

Of the 126 molts, 30 were discarded due to uncertainty in matching the animal to its cast exoskeleton or to tag loss. Of the remaining 96, mean growth increments per molt in centimeters of carapace length were 20% (S.D. 4%) for juvenile lobsters of 2 to 4 cm in carapace length (N = 26); 12% (S.D. 2.5%) for animals of 4 to 6 cm in carapace length (N = 37); 9% (S.D. 6.2%) for animals of 6 to 8 cm in carapace length (N = 18); and 3% (S.D. 2.4%) per molt for animals of 8 to 10 cm in carapace length (N = 15). Intermolt intervals ranged from 3 weeks to 3 months.

Comparison of the molted exoskeletons of the variously sized animals permitted determination of the number of instars required to reach full size (Table I). Approximately 9 to 10 molts are involved, with sexual maturity at the sixth instar. The smallest trawl-collected animal at 2.3 cm carapace length was probably two molts past the post-larva, which is 1 cm in carapace length.

TABLE I

Molt sequence of slipper lobsters reconstructed from molts of various lobsters

Instar	Mean carapace length (cm)	Mean total length (cm)
1	2.34	6.5
2	2.95	8.5
3	3.66	10.8
4	4.61	13.4
5	4.85	16.7
6	7.14	20.2
7	8.18	23.8
8	9.05	26.5
9	9.37	29.0

The size frequency distribution of the various field collections (Table II) suggests two post-larval settlement peaks, one in early spring and one in late summer. That is, the 2 cm animals of the August collection were hypothesized to be recently settled in August and the earlier spring settlement class had grown to 6 cm by late summer. The winter collection also shows two age classes at 6 and 9 cm respectively. With early rapid growth (approx. 1 molt per month) and slower growth in the later instars (approx. 1 molt per 3 months) and with growth increments as seen in the captive populations, it is hypothesized that the 6 cm age class in the winter collection is the same group that had reached that size by late summer, while the 9 cm age class is 6—9 months older and probably of the preceding year's post-larval settlement.

Thus, based on the field size frequency data, the number of molts reconstructed from various animals molting in captivity and the growth in-

TABLE II

Seasonal size frequency patterns of *S. nodifer* collected from the field

Carapace length (cm)	August 1981		December 1981		February 1981	
	# Animals	% of Sample	# Animals	% of Sample	# Animals	% of Sample
0—1.99	0	0	0	0	0	0
2—3.99	25	37	0	—	4	3
4—5.99	35	51	10	17	12	9
6—7.99	8	12	18	31	43	34
8—9.99	—	—	26	44	68	52
10—	—	—	5	8	3	2
Total	68		59		130	

crements measured in captivity, it is hypothesized that an animal will grow from a post-larva to full size (approximately 30 cm total length) in 16—18 months.

Diet

The slipper lobsters readily ate any bivalve species presented which was small enough to be pried open. The lobsters also consumed other bivalves if the shells were cracked prior their being placed in the tank. No other species of invertebrate or fish tested was readily accepted as food, although frozen fish and crab were eaten when no bivalves were available.

The mussel, *Modiolus americanus*, and the brackish water clam, *Rangia cuneata*, were used as primary food sources due to ease of collection. Consumption for these species was 1.26 mussels per lobster per day or 1 clam per lobster per day. Flavor of the meat was not affected by this diet. Tanks were cleaned of discarded shells approximately once a month.

Behavior

Individual slipper lobsters established a residence in a given area of the tank within either a cinder block or rock pile shelter. They generally remained inactive throughout the day until late afternoon when they began to forage around the tank. Animals foraged by walking around the tank slowly, often with long pauses during which they sat motionless. Not all animals were active every night. By midnight they generally re-entered their home shelters. Molting occurred at night, with newly molted animals generally remaining in the shelter nearest to where the exoskeleton was cast until they re-hardened. Observed social interactions were limited to larger animals occasionally displacing smaller ones on a clump of mussels or a resting site.

DISCUSSION

The results to date indicate that this species will be easily maintained in captivity and will grow to a harvestable size relatively quickly. Using a semi-closed sub-gravel filter tank system and live food, we have encountered no water quality or disease problems at the densities considered.

While natural foods have proved effective on a small scale, their use on a commercial scale for slipper lobsters has yet to be addressed. In general live food has been considered cost ineffective in mariculture efforts in the U.S. However, our experience to date suggests that if the operation is located in a sufficiently productive estuarine area, the biota of which is well known, it may be practical for this species. The kuruma shrimp, *Penaeus japonicus*, is successfully cultured in Japan using live bivalve and other natural foods, as are the seabream, *Chrysophrys major*, and the yellowtail, *Seriola quinqueradiata* (Korringa, 1976).

Research is now underway on post-larval collecting techniques, seasonality and availability as well as on optimal population densities for a commercial mariculture system.

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