Recruitment of Postlarval Spiny Lobster (*Panulirus argus*) in Southwestern Puerto Rico

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Report: Final

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Abstract

A survey of the spiny lobster, *Panulirus argus*, postlarvae recruitment was conducted off the West Coast of Puerto Rico using Whitman collectors. Sampled areas included different types of habitat substrate, in order to assess preferences in habitat by puerulus. A total of 188 post larvae were collected, 54% of the pueruli being collected from August to October. The relative abundance of postlarvae was approximately 1.1 postlarvae/collector/sample. Data collected were not enough to determine recruitment seasonality pattern.

Executive Summary

One of the primary problems for managers is a lack of biological and ecological information on many of the resources. Landing for spiny lobster has declined markedly in recent years, and adequate information on stock status needed for management is not available. The purpose of this study was to provide spiny lobster larval recruitment information. The objective of this study was to collect and analyze fishery-independent data on the spiny lobster post-larval recruitment and their environment encompasses in the marine waters within the territorial sea and Exclusive Economic Zone (EEZ) contiguous to Puerto Rico.

The spiny lobster puerulus were surveyed using modified Witham collectors. Sampled stations were selected in a randomized manner. Areal emphasis for the survey was the southwest insular shelf of Puerto Rico.

Purpose

One of the primary problems for managers are a lack of biological and ecological information on many of the resources. Landing for many species, such as the spiny lobster, have declined markedly in recent years, and adequate information on stock status needed for management is not available. Managers have a continuing need for current data, and long time series of data are necessary for describe population trends, explain responses to environmental factors and regulatory programs, and predict stock abundance, recruitment, and yield. The purpose of this survey was to provide spiny lobster recruitment assessment information needed to identify fishery management needs and to implement plans to protect and restore the fishery stocks to support viable productive recreational and commercial fisheries. The only previous survey of the spiny lobster recruitment (Monterrosa, 1991) was conducted over 14 years ago and limited to a small area on the insular shelf off La Parguera. Information obtained from the current study will enable Puerto Rico to identify, implement and measure the effectiveness of fishery management measures.

The objective of this study was to collect and analyze data on the spiny lobster postlarval recruitment and their environment encompassed in the marine waters within the territorial sea and Exclusive Economic Zone (EEZ) contiguous to Puerto Rico.

Approach

Stations

Each station consisted of two Witham collectors (Fig. 1).

Station 1 – Punta Guanajibo FRL facilities 18°09.615'N 67°11.026'W. Punta Guanajibo is south of the Guanajibo River, being the river south mouth margin. Therefore, fresh water influence to the stations close to this river is high. Water turbidity is high during the raining season. When the prevailing current shift due south water transparency becomes very low. Bottom substrate consists of fine sediment with fairly well developed turtlegrass mats (*Thalassia testudinum*).

Station 2 – Punta Guanajibo FRL facilities 18°09.312'N 67°11.264'W. This station is located due west of the previous one in direction to shore moving into Bahía (Bay) Bramadero. Distance between these two stations is more or less 200 m.

Station 3 – Bahía Bramadero north 18°08.834'N 67°11.162'W. This station is located near a hard bottom, consisting of rocks near shore more or less located at the center of the bay. The coastline used to be a mangrove-lined, at the present time only a small portion of mangrove remains north of the station site. Water turbidity tends to be less, than the two previous stations, although the distance between them is less than one (1) nm. Bottom substrate consists of highly developed turtlegrass bed and very fine sediment.

Station 4 – Bahía Bramadero south 18°08.411N 67°11.423'W. This station is located near shore about 500 m south of the previous one. Fresh water runoff is higher in this station due to the fact that drainage from inland is located exactly in front of it. Bottom substrate is highly muddy, with sparse turtlegrass mats.

Station 5 – Bahía Bramadero south 18°08.531,N 67°11.003'W. Fresh water runoff is higher in this station due to the fact that drainage from inland is located exactly in front of it. Bottom substrate is highly muddy, with sparse turtlegrass mats.

Station 6 – Escollo Negro 18°08.617'N 67°14.713'W, this is an emerging fringing reef located 4-nm southwest from Punta Guanajibo.

Station 7 – Escollo Negro 18°08.628'N 67°15.020'W, this is an emerging fringing reef located 4-nm southwest from Punta Guanajibo.

Station 8 – Cayo El Ron 18°06.361'N 67°15.791'W. The name of this station comes from an emerging fringing reef located about 4½ nm from shoreline, in front of Punta Ostiones. Bottom substrate consists of fine sediment covered with turtlegrass, and softcoral.

Station 9 - Cayo El Ron 18°06.231'N 67°15.496'W. The name of this station comes from an emerging fringing reef located about 4½ nm from shoreline, in front of Punta Ostiones

Station 10 – Cayo El Ron 18°06.036'N 67°15.564'W. The name of this station comes from an emerging fringing reef located about 4½ nm from shoreline, in front of Punta Ostiones. This station is located west of the two previous ones.

Artificial Habitats

Twenty modified Witham collectors were deployed at ten stations (two collectors/station). As per Bannerot *et al.* (1992), Butler and Herrnkind (1992) and Quinn and Kojis (1997), this collector consisted of a PVC float and substrate, each one holding 6 pages of nylon-webbed unbacked carpet matting (Nomad ™, 3M Co. Inc) 61 x 4.5 x 0.5 cm. The collector was anchored with polypropylene line tied to concrete blocks. A Styrofoam buoy was tied to each corner of the PVC float.

Biological growth over the artificial habitats (fouling) was consistent with local flora and fauna. Fouling was permitted to provide a settlement surface similar to surrounding natural environment. Fouling was partially removed when overgrown became to heavy and affect floatation of the artificial habitats.

Each collector was set in, or adjacent to, Bramadero Bay, El Negro Reef, and El Ron Reef. The collectors were placed no deeper than 3 meters. A station will consist of two collectors placed approximately 50 feet apart from one another. Collectors were sampled at least once every 2 weeks. Collectors were lifted from the water in a mesh bag to catch pueruli that washed out of the filter material. All collectors were thoroughly searched on board the boat and pueruli and juvenile counted. Pueruli were staged as follows: stage 1 - transparent, stage 2 - semi-pigmented, and stage 3 - pigmented. First stage juveniles will be distinguished from pueruli by their rounded carapace and erect supra orbital spines. This stage was considered as a stage 4 in our samples.

For each trip the following data was recorded:

1. Date, time;
2. Latitude and longitude using a GPS (station number);
3. Habitats type under the collector;
4. Weather conditions;
5. Pueruli numbers and stage and/or juvenile numbers and stages;
6. Salinity, and temperature at each station.

Personnel from the Lab. were trained for data collection during postlarval settlement of the spiny lobster survey.

The study areas were distributed from 18° 09.615'N; 67° 11.026'W to 18° 06.036' N; 67° 15.564' W (Fig. 1). Distance from shore varied from approximately 0.5 to 5 nautical miles. The insular platform in this area is from 12-16 km wide, with an average depth of 25 m. Southeast trade winds prevail, resulting in a complex surface water flow dominated by island topography rather than by prevailing wind. In general terms water flow is along the coast from north to south. Emergent coral reefs are more common to the northwest of the study area. They do not comprise more than 10% of the shelf area. The coastline consists of well develop mangrove (*Rhizophora mangle*) forest at discreet locations, entwine with sandy beaches, and rocky coasts.

Sampling Schedule:

Artificial habitats were deployed during January 2003. Sampling started in February 2003, two weeks after deployment. It was decided that two weeks sampling as carried out in our previous study undertaken in 1998 (Rosario and Figuerola, 1998) was the best strategy in order to maintain a standard method between the USVI and PR. Collectors were sampled at least twice every month from February 2003 to February 2004, with the exception of November 2003 and January 2004 when only one sampling trip was done. Lost collectors were replaced as soon as possible. At the end of the sampling period, of the 60 collectors

originally built, only four were still operating in the water. In our opinion, most collectors were lost due to vandalism and bad weather, while some were probably affected by boat traffic. All stations were sampled sequentially using a 19' in-out board motorboat. Habitats were lifted inside a dip net with 0.5-mm mosquito mesh to prevent lost of pueruli. Each page was thoroughly inspected individually. Afterward habitat was shaken inside the net to dislodge any pueruli clinging to the substrate. All pueruli were counted and removed from the habitat. All pueruli were classified as one of four of the following stages:

1. Stage 1. Transparent, exhibiting no-pigment with dorsoventrally flattened carapace.

2. Stage 2. Puerulus with slight pigmentation at base of antennae and sometimes-faint pigment along sides of carapace.

3. Stage 3. Pigmented areas darkened and expanded dorsally, distinct pigmentation of uropods and telson.

4. Stage 4. Juvenile - First post-puerulus molt, carapace more cylindrical, light dorsal stripe disappearing, tail section elongated, uropods enlarged.

Lunar days were defined as n + x; where n=day of new moon and x=days after new moon.

Findings

A summary of the data collected from February 2003 to February 2004 is presented in Table 1. A total of 188 post larvae (stages 1 to 3) and 43 juveniles (stage 4) were collected. Aproximately 48% of pueruli were obtained from three collectors. These collectors were located in Bramadero Bay, at less than 0.5 m from the shore. Fifty four percent of the pueruli were collected from August to October. Our relative abundance estimate is 1.1 pueruli/collector per sampling event. That figure is the same reported during the 1998 study. The highest number of pueruli collected in a single collector was 16. As reported by other investigators, more pueruli are collected during the first part of the lunar cycle (104 vs. 84). Sixty three percent of pueruli were collected in the stations closer to shore (118 vs. 70). Stage 2 pueruli comprised 81% of all lobster collected (N=124), excluding juveniles. Similar results were reported by Monterrosa (1991).

According to the data collectors set near rocky shores compiled a greater number of pueruli than other habitats. Sandy beach was the second habitat with the greatest number of pueruli sampled. On the other hand the most productive collectors were set in areas with a combination of bottom type that have mud sediment with hard-ground and *Thalassia*. Separating the juveniles (stage 4) pueruli from the other three stages we obtained that the collector set with the above combination of habitat and bottom type representing 94% of total sampled juveniles. A single station (collectors 9 and 10) caught 28% of total sampled juveniles. Water surface temperature during the sampling period ranged from 25.5 to 29.5 °C, and salinity from 35.5 to 39.10‰.

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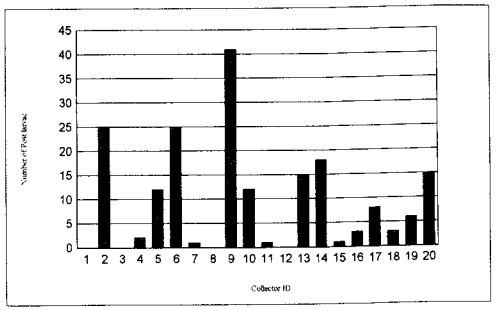
Table 1. Summary of lobster recruits data collected from February 2003 to February 2004.

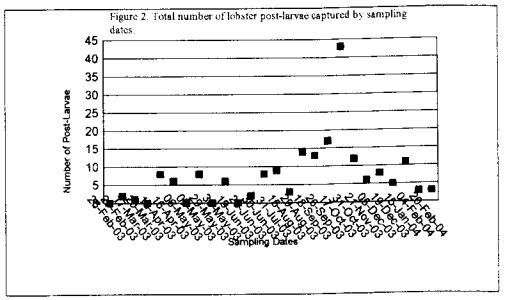
Trip #	Date	Juliana Date	Collector # 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Number of postlarvae/sampling	Lunar day (n+x); n=day of new moon x=days after new moon	
1	26-Feb-03	57	0	0	0	0		0		0		0											0	25	0.00%
2	27-Feb-03	58													0	1	1						2	26	1.06%
3	17-Mar-03	76			0	0		1		0		0											1	14	0.53%
4	20-Mar-03	79													0						0		0	17	0.00%
5	15-Apr-03	105											0	0	3	0	0	0	2	1	1	1	8	14	4.26%
6	16-Apr-03	106	0	0	0	1	0	1	1	0	0	3											6	15	3.19%
7	06-May-03	126	0	0	0		0	0		0	0	0											0	4	0.00%
8	07-May-03	127											1	0	1	3		3	0	0		0	8	5	4.26%
9	29-May-03	149	0	0	0		0			0	0	0											0	28	0.00%
10	30-May-03	150												0	1	0			3	2		0	6	29	3.19%
11	19-Jun-03	170	0	0	0		0	0			0	0											0	19	0.00%
12	20-Jun-03	171												0	0	0			2			0	2	20	1.06%
13	30-Jun-03	181	0	0		1	0	0			0	0		0	3	2			1			1	8	1	4.26%
14	31-Jul-03	212		1			1	0			1	3				3						0	9	2	4.79%
15	15-Aug-03	227		0			0	0			1	1				0						1	3	17	1.60%
16	29-Aug-03	241		0			0	1			8	5				0						0	14	2	7.45%
17	18-Sep-03	261		6			4				0					2						1	13	8	6.91%
18	26-Sep-03	269		8			2	5			2					0						0	17	0	9.04%
19	17-Oct-03	290		8			3	16			10					1						5	43	21	22.87%
20	31-Oct-03	304		0			2	1			8				0	0					1	0	12	6	6.38%
21	21-Nov-03	325		1							3				1	0					0	1	6	27	3.19%
22	05-Dec-03	339		0							2				0	0					1	5	8	12	4.26%
23	19-Dec-03	353		0							2				2	0					1	0	5	26	2.66%
24	15-Jan-04	15		1							4				2	3					1		11	23	5.85%
25	04-Feb-04	35									0				1	1					1		3	14	1.60%
26	20-Feb-04	51									0				1	2					0		3	0	
			0	25	0	2	12	25	1	0	41	12	1	0	15	18	1	3	8	3	6	15	188		
																							7.23		
Number postlarvae/collector			0	25	0	2	12	25	1	0	41	12	1	0	15	18	1	3	8	3	6	15	188		
Number samplings/station			6	17	6	4	12	12	1	5	18	10	2	5	14	19	2	2	5	3	9	15	167		
Avg. # postlar/col/station			0	1.5	0	0.5	1	2.1	1	0	2.3	1.2	0.5	0	1.1	0.9	0.5	1.5	1.6	1	0.7	1	1.1		

postlarvae/lunar cycle
Days 0-14 = 104
Days 15-28 = 84

 # Recruits/stage

Stage 1	15	Transparent
Stage 2	124	Semi-Pigmented
Stage 3	49	Pigmented
Stage 4	43	Juveniles
Total	**231**	





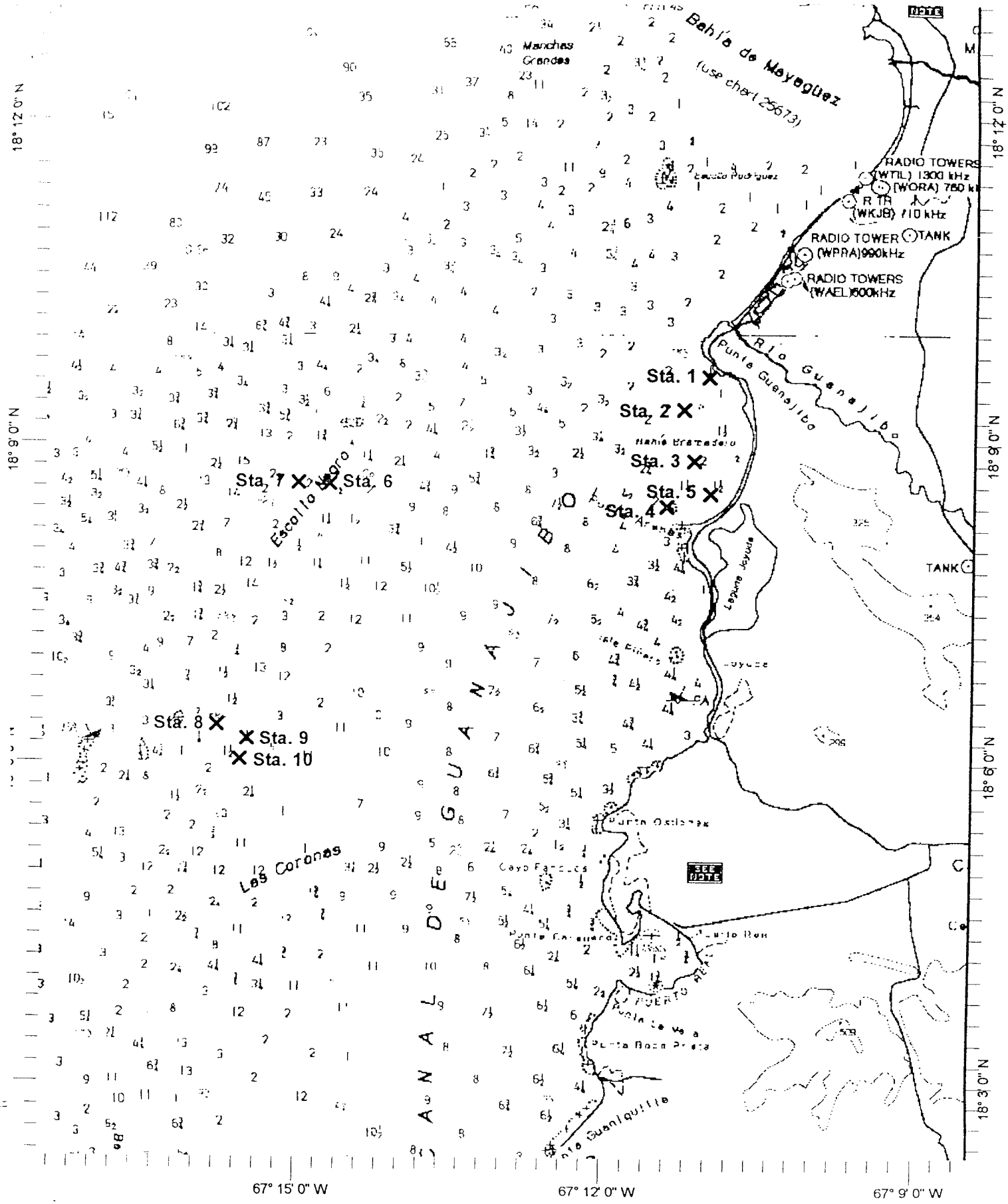


Chart Name: WEST COAST OF PUERTO RICO
Chart ID: 25671_1
Top Left: 18° 13' 1" N 67° 17' 28" W
Bottom Right: 18° 2' 18" N 67° 8' 27" W

Recl. Langosta
2003 - 2004

Localizacion colectores

STA. #	Lat. N	Long. W
1	18° 09.615'	067° 11.026'
2	18° 09.312'	067° 11.264'
3	18° 08.834'	067° 11.162'
4	18° 08.411'	067° 11.423'
5	18° 08.531'	067° 11.003'
6	18° 08.617'	067° 14.713'
7	18° 08.628'	067° 15.020'
8	18° 06.361'	067° 15.791'
9	18° 06.231'	067° 15.496'
10	18° 06.036'	067° 15.564'