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FINAL REPORT: YEAR 2

Monitoring Spiny Lobsters in Biscayne National Park

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Summary of Work

In this second year of funding, we sampled spiny lobsters at nine sites in Biscayne National Park (BNP) that were established as study sites in 2001, and at Pacific Reef which had been sampled twice yearly since 1997. We also added one new forereef site and two patch reefs, bringing the total number of sites to thirteen, to achieve better spatial coverage. Building on the baseline data acquired in the first year of the study, our aim was to monitor trends in lobster population size and structure. By sampling before and after the lobster sport season, we hope to determine the effect of the Two-Day Special Sport Lobster Season on lobsters residing in BNP. At each site, teams of divers searched for lobsters for a combined total of sixty minutes; the total number of lobsters sighted during the 60 minutes of searching represents lobster abundance for that site. Data collected from captured lobsters included den number and depth, sex, size, molt phase, reproductive phase of females, and presence of late stage HLV-PA infection. Lobsters that escaped capture were included in abundance estimates; whenever possible, their sex was recorded and size was estimated. Sampling occurred during the end of June (closed to fishing) and again during the end of July, immediately following the close of the Two-Day Special Sport Lobster Season, for all sites open to fishing. The remaining hardbottom sites were completed in September. We spent approximately 280 staff hours in 8 days of sampling to complete the field survey portion of this study alone. Open season sampling was completed on July 30, 2002 and the hardbottom sites were completed on September 27, 2002. Summary statistics are included in this report. Data analysis will continue as we gather additional data through 2003.

Introduction

The Florida Fish and Wildlife Conservation Commission's (FWC) spiny lobster research team monitored spiny lobsters, *Panulirus argus*, at 13 marine protected areas (MPAs) and paired reference areas in Florida Keys National Marine Sanctuary (FKNMS) on a semiannual basis from 1997-2001 (Cox et al. 2001). One of our reference sites, Pacific Reef, is in Biscayne National Park (BNP). In 2001, we began a project to obtain baseline data on spiny lobster size, sex, and abundance in BNP, and to monitor lobster population trends in the future. To this end, we extended our sampling to include six additional reefs in BNP and three hardbottom sites in the Biscayne Bay Lobster Sanctuary (Table 1, Fig. 1). In 2002, we added one new forereef site and two patch reefs, bringing the total number of sites in BNP to 13, to achieve better spatial coverage. We also changed the sampling schedule at Pacific Reef to coincide with the other BNP sites. With the exception of the three hardbottom sites, all sites were sampled in June (closed season) and immediately following the Two-Day Special Sport Lobster Season (hereafter termed sport season). It was our intent to drop the hardbottom sites in Biscayne Bay from the our sampling schedule in 2002 because they are within the Biscayne Bay Lobster Sanctuary, and therefore, population size should not be affected by harvest. At the request of the Park, however, we sampled the sites in September 2002 during an additional sampling trip.

In 2003, we will continue using semi-annual sampling to monitor lobster population trends. These data will be available to BNP managers for use in the development of the BNP Fisheries Management Plan. Once the Fisheries Management Plan has been implemented, these data will be invaluable in determining the efficacy of the Plan in sustaining BNP spiny lobster stocks.

Sampling Methods

Divers performed 60-minute timed-searches to sample spiny lobsters. Two teams of divers (consisting of one searcher and one catcher) searched for lobsters for 30 minutes each, resulting in the total number of lobsters observed in a 60-minute search (abundance). Lobsters observed by the catcher but not by the searcher were neither counted nor captured. Time was kept by the searcher using a stopwatch that was turned off while lobsters were captured or if the team traveled over a large expanse of unsuitable habitat (seagrass).

At the time of capture, each lobster was numbered, and sex and den depth were recorded. All captured lobsters were brought to the boat where size, molt stage, and reproductive status of females (e.g. presence or absence and condition of spermatophores and eggs) were recorded. Additionally, all lobster brought on board were visually inspected for signs of late stage herpes-like lobster virus, HLV-PA (Sheilds and Behringer, in press). Lobsters that eluded capture were always included in abundance estimates, and when possible, their sex and estimated-size were recorded. Lobsters were returned alive to the area of capture. Sampling of forereef and patch reefs was conducted in June (closed fishing season) and late July (open fishing season) immediately following the sport season. Hardbottom sampling was conducted once, during September.

Results

All forereef and patch reef sites were successfully surveyed during both closed and open

fishing seasons in 2002 (Table 2). The three hardbottom sites were sampled only during the open season. We counted a total of 347 lobsters during 2002, with estimated total N equaling 430 (Table 3). None of the captured lobsters had obvious signs of the lobster virus, HLV-PA. Lobster abundance declined following the sport season at most sites (Fig. 2). However, there were so many lobsters at Brewster Patch during the open season that we had to cut our search short and extrapolate abundance from the data collected. Overall, we found more lobsters during the open fishing season than during the closed fishing season, with more than half of open season lobsters found at Brewster Patch. Interestingly, abundance of legal-sized lobsters (≥ 76 mm carapace length (CL)) was higher after the sport dive season than during the closed season at all but one site (Table 4).

The three habitat types supported different size assemblages of spiny lobsters (Figure 3). With one exception, all lobsters found at harbottom sites were juveniles (Table 5). The one adult found was 79 mm CL, just over the minimum legal size of 76.2 mm CL (Table 5). Interestingly, the smallest lobsters observed each season (23 mm CL closed season and 25 mm CL open season) were found on an offshore patch reef. The mean size of lobsters observed at offshore patch reefs was 53 mm CL in the closed season and 73 mm CL in the open season, reflecting the large percentage of sub-legal lobsters (Table 6). The exception to this pattern was Brewster Patch where legal sized lobsters were so abundant that the search time was cut short and abundance was extrapolated from the data collected. The largest lobsters observed each season (102 mm CL closed season and 96 mm CL open season) were found at forereef sites, and no lobsters smaller than 52 mm CL were found on the forereef (Table 6).

All habitats showed an increase in mean lobster size overall, and for each size class

between the closed and open fishing seasons (Table 6, Fig. 3).

Discussion

Spiny lobsters were more abundant on forereef habitat than on patch reef or hardbottom habitats, with the notable exception of Brewster Patch Reef. Between the closed and open fishing seasons, the average size of both sub-legal and legal lobsters increased by 2 mm CL. The number of legal lobsters sighted stayed the same, but the number of sub-legals decreased by 60% (Table 6). It is likely that many of the sub-legal lobsters molted into legal-sized animals between surveys and that the number of animals lost to harvest or emigration was approximately equal to the number of animals molting to legal size.

Spiny lobster abundance on patch reefs was highly variable between seasons and among sites. Most notable was the large aggregation of lobsters found on Brewster Patch during the open fishing season, estimated at 194 individuals per 60-minute search. It is likely that animals were migrating adults (mean size 78 mm CL) passing through the area on the way to the forereef for reproduction. The large abundance of adults present on Brewster Patch during the open season strongly influenced the data. This is most apparent when looking at the mean size of all lobsters observed on all patch reefs during the closed season (58 mm CL) compared to the same statistic in the open season (73 mm CL). Interestingly, average size of legal lobsters increased by only 2 mm (83-85 mm CL) while that of sub-legals increased by 9 mm CL (53-62 mm CL) suggesting that many of the juveniles molted between surveys.

The three hardbottom sites were dropped from the sampling schedule following the completion of the 2001 field season. At the request of BNP, they were re-established at the end

of the 2002 season. All three sites were sampled in September of 2002, when FWC staff were sampling hardbottom sites for a separate project. As Biscayne Bay is never open to fishing and primarily houses juvenile (sub-legal) lobster, it is unlikely that fishing season would have much effect on lobster abundance or size structure. Consistent with our 2001 data, the overwhelming majority of animals found at hardbottom sites were juveniles (Mean size 44 mm CL). Only one legal-sized individual was found at hardbottom sites 2002. Measuring 79 mm CL, it is likely that the animal had recently molted to legal size and had yet to move out of the Bay into the ocean.

Visual inspection of all captured lobster for signs of late stage HLV-PA infection continued this year. However, no infections were detected. Visual inspection to detect the virus is very crude; animals were considered diseased only when displaying outward signs of infection such as discolored hemolymph and shell. In the lab, electron microscopy is used to document the presence of the virus in fixed histological samples (Behringer et al. 2002, Sheilds and Behringer in Press). It is possible that animals in early stages of infection, showing no visible signs, were scored as healthy. To date, there has been no systematic or random sampling of apparently healthy individuals to detect early stages of infection of lobsters residing in BNP. Therefore, the prevalence and geographic range of the disease is not known.

In 2003, we will sample the same thirteen sites that were sampled this year. Additionally, the hardbottom sites will be sampled on the same schedule as all other sites. Combined with the creel studies conducted by BNP staff, these data may aid in determining the presence of a relationship between fishing effort and observed lobster abundance. This information would be of particular interest to the Park Service for evaluating the Biscayne National Park Fisheries

Management Plan.

References

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Table 1. Lobster sampling sites in Biscayne National Park.

Site	Site Name Code	Habitat
Ajax Reef	AJAX	forereef
Brewster Reef	BREW	forereef
Long Reef	LONG	forereef
Pacific Reef	PAC	forereef
Triumph Reef	TRIUM	forereef
Alina's Patch Reef	ALINA	patch reef
Bache Shoal	BACHE	patch reef
Ball Buoy	BBUOY	patch reef
Brewster Patch	BREWPCH	patch reef
Triumph Patch	TRIPCH	patch reef
Caesar's Creek Hardbottom	CAESR	hard bottom
North Elliot Hardbottom	NELL	hard bottom
South Elliot Hardbottom	SELL	hard bottom

Table 2. Sample sites, location, and date sampled during 2002.

Date	Site	Habitat	Latitude(min)	Longitude(min)
26-JUN-2002	Ajax	forereef	--	--
24-JUN-2002	Brewster	forereef	25 33.971	80 05.965
25-JUN-2002	Long	forereef	25 25.663	80 07.177
26-JUN-2002	Pacific	forereef	25 22.200	80 08.341
25-JUN-2002	Triumph	forereef	25 29.537	80 06.526
26-JUN-2002	Alina's	patch reef	--	--
25-JUN-2002	Bache	patch reef	25 27.798	80 10.080
26-JUN-2002	Ball Buoy	patch reef	25 18.963	80 11.279
24-JUN-2002	Brewster Patch	patch reef	25 32.490	80 08.050
24-JUN-2002	Triumph Patch	patch reef	25 30.256	80 07.960
29-JUL-2002	Ajax	forereef	25 23.798	80 07.935
29-JUL-2002	Brewster	forereef	25 33.951	80 06.025
29-JUL-2002	Long	forereef	25 26.645	80 07.185
29-JUL-2002	Pacific	forereef	25 22.058	80 08.525
29-JUL-2002	Triumph	forereef	25 29.474	80 06.502
30-JUL-2002	Alina's	patch reef	25 22.928	80 09.899
30-JUL-2002	Bache	patch reef	25 29.098	80 08.947
29-JUL-2002	Ball Buoy	patch reef	25 19.104	80 11.064
29-JUL-2002	Brewster Patch	patch reef	25 32.573	80 08.154
29-JUL-2002	Triumph Patch	patch reef	25 29.813	80 08.109
26-SEP-2002	Caesar's Creek	hard bottom	25 24.387	80 14.827
27-SEP-2002	North Elliot	hard bottom	25 29.802	80 11.855
26-SEP-2002	South Elliot	hard bottom	25 25.171	80 13.914

Table 3. Size and abundance of all spiny lobster observed in Biscayne National Park during 2002 by fishing season. N = total number of lobsters counted. Abundance = (N/search time* 60 minutes).

Site	Closed Season				Open Season			
	N	Abund (N/60 min)	Mean Size (mm CL)	Median Size (mm CL)	N	Abund (N/60 min)	Mean Size (mm CL)	Median Size (mm CL)
AJAX	16	16	81	80	16	16	80	81
ALINA	3	3	78	81	9	9	71	80
BACHE	13	13	41	40	9	9	52	48
BBUOY	27	27	63	66	10	10	74	76
BREW	19	19	75	76	5	5	74	73
BREWPCH	7	7	59	56	109	192	78	79
CAESR	--	--	--	--	1	1	30	30
LONG	14	14	74	73	17	17	77	76
NELL	--	--	--	--	6	6	43	45
PAC	16	16	77	75	7	7	87	88
SELL	--	--	--	--	4	4	48	41
TRIPCH	1	1	60	60	12	12	66	68
TRUIM	16	16	77	76	10	10	87	88
Total	132	132	69	73	215	298	74	77

Table 4. Size of all legal-sized spiny lobster (≥ 76 mm CL) observed in Biscayne National Park during 2002.

Site	Closed Season			Open Season		
	N Lobster	Mean Size (mm CL)	Median Size (mm CL)	N Lobster	Mean Size mm CL)	Median Size (mm CL)
AJAX	12	84	83	13	83	83
ALINA	2	85	85	5	86	85
BACHE	0	--	--	0	--	--
BBUOY	3	81	80	5	86	85
BREW	9	80	81	2	81	81
BREWPOCH	2	83	83	60	83	83
CAESR	---	--	--	0	--	--
LONG	5	86	87	8	83	82
NELL	--	--	--	0	--	--
PAC	7	84	83	7	87	88
SELL	--	--	--	1	79	79
TRIPCH	0	--	--	2	85	85
TRUIM	8	84	85	10	87	88

Table 5. Spiny Lobster Size by Habitat during closed and open fishing seasons in Biscayne National Park, 2002.

		Minimum (mm CL)	Maximum (mm CL)	Mean (mm CL)	N lobsters
forereef	closed season	52	102	77	81
	open season	65	96	81	55
offshore patch	closed season	23	89	58	51
	open season	25	96	73	149
hardbottom	open season	30	79	44	11

Table 6. Spiny lobster size by size-category and habitat in Biscayne National Park during 2002.

			Minimum (mm CL)	Maximum (mm CL)	Mean (mm CL)	N lobsters
sub-legal	forereef	closed season	52	75	69	36
		open season	65	75	71	14
	offshore patch	closed season	23	75	53	41
		open season	25	75	62	47
	hardbottom	open season	30	52	40	10
legal	forereef	closed season	76	102	83	41
		open season	76	96	85	40
	offshore patch	closed season	78	89	83	7
		open season	76	96	84	46
	hardbottom	open season	79	79	79	1

Figure 1. Chart of lobster sampling sites in Biscayne National Park, 2002

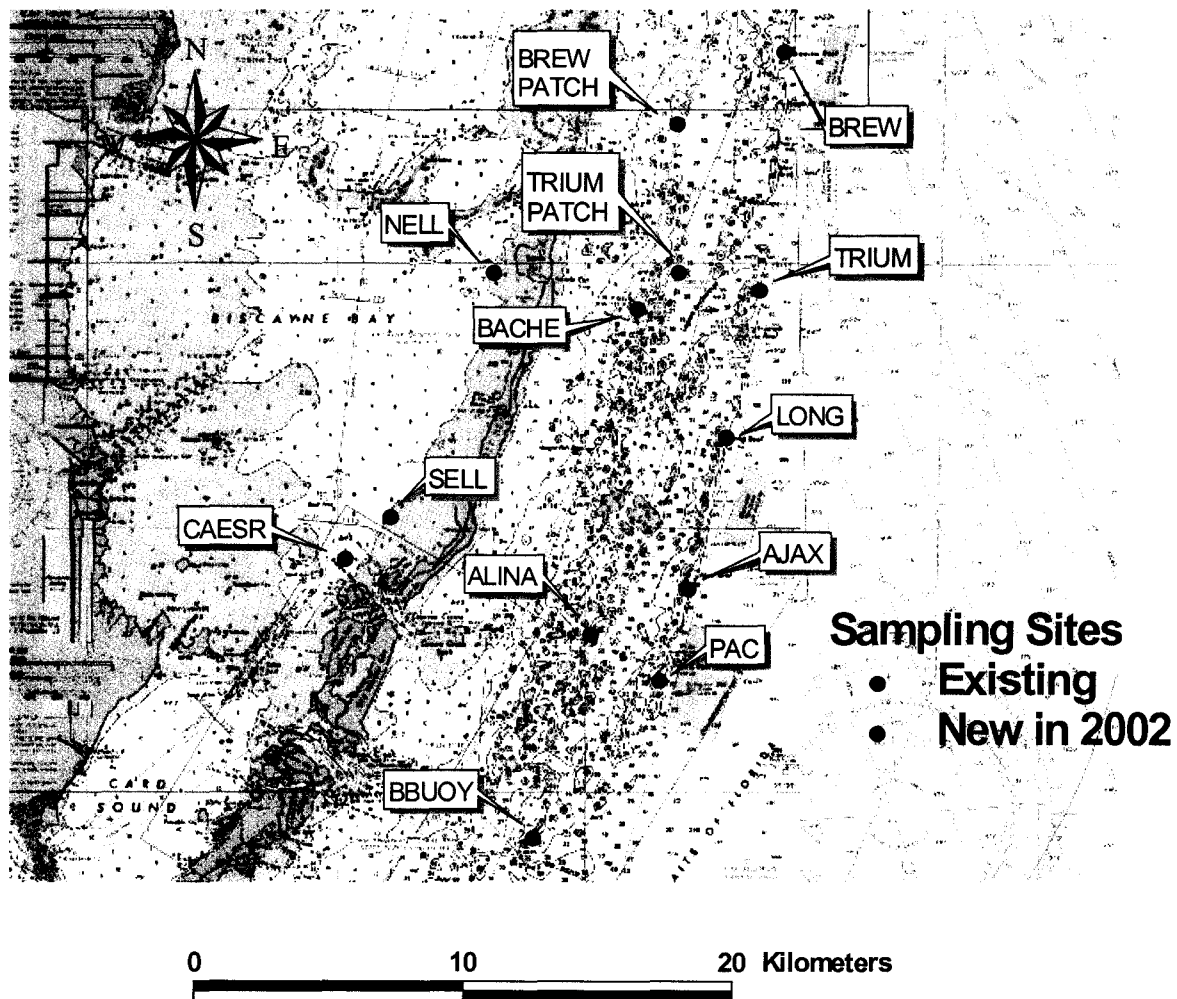


Figure 2. Abundance of spiny lobster at 13 sites in Biscayne National Park before and after lobster sport season during 2002.

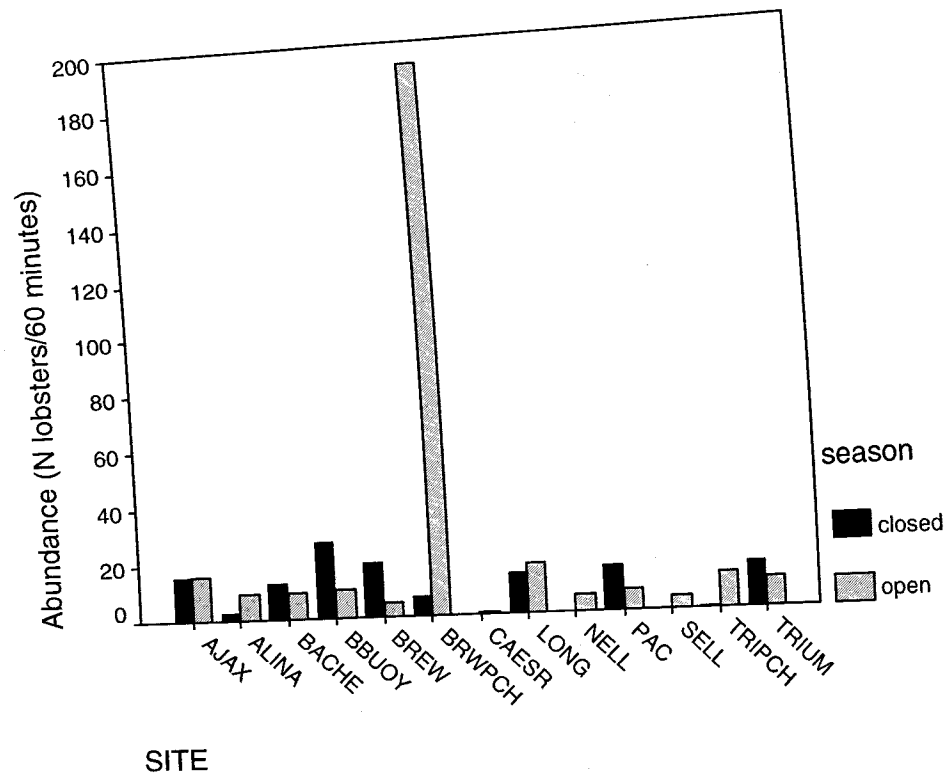


Figure 3. Size of all lobsters sampled in Biscayne National Park during 2002. N is the number of lobsters measured. Bar is the Median size

