

Overview of the assessment history and the current management for the fishery of Spiny Lobster, *Panulirus argus* in the US Caribbean

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1. Management Overview for Caribbean Spiny Lobster

1.1 Management Unit Definition

In the U.S. Caribbean, *Panulirus argus* is limited to the shelves off Puerto Rico and the U.S. Virgin Islands, that covers a total area of 2,115 nm². The entire shelf area of Puerto Rico comprises 1,540 nm², while the entire shelf of the Virgin Islands comprises 575 nm². Federal waters extend from 3 to 200 nm off the coast of the Virgin Islands, while federal waters off the coast of Puerto Rico extend 9 to 200 nm. These waters are managed under various Fishery Management Plans that were developed by the Caribbean Fishery Management Council and approved by the Secretary of Commerce (CFMC 1982, 1990, 2001). The inshore fisheries are managed by the Commonwealth of Puerto Rico (Commonwealth) and the Territorial Governments of the U.S. Virgin Islands (Territorial Governments) (CFMC, 1981).

1.2 Regulatory History

Historically, the Commonwealth and the Territorial Governments managed their fisheries independently within their own territorial areas. Before the Caribbean Council's Spiny Lobster Federal Management Plan (FMP) was implemented in January 1985, Puerto Rico and the Virgin Islands had their own regulations limiting lobster fishing. For Puerto Rico, the Fisheries Act of 1936 (CFMC, 1981) provided the basis for regulating their fisheries before the Spiny Lobster FMP. This act prohibited the harvest of egg-bearing females, required traps with self-destruct panels, and prohibited explosives. In 1974, U.S. Virgin Islands Legislative Act 3330 (DFW, 1994) established a mandatory reporting system for fisheries data, with provisions to protect egg-bearing females, set a minimum carapace length of 3 inches and prohibit the use of spears, explosives and chemicals. In 1998, the Essential Fish Habitat (EFH) Generic Amendment (1998) modified the Spiny Lobster FMP to comply with the Magnuson-Stevens Act requirements regarding habitat protection (CFMC, 1990).

1.2.1 Federal Fisheries Management Regulations

The Caribbean Council's Spiny Lobster FMP was implemented in January 1985. This FMP defined the management objectives and benchmarks for *Panulirus argus* as (CFMC, 1982) to be:

- Maximum Sustainable Yield (MSY) as 830,000 pounds per year.
- Optimum Yield (OY) as "all the non-egg bearing spiny lobsters in the management area having a carapace length of 3.5 inches or greater that can be harvested on an annual basis."
- Lobsters must be landed whole.
- Prohibition of the retention of egg-bearing (berried) female lobsters aboard a vessel. Berried female lobsters may be kept in pots or traps until the eggs are shed.
- Pots and traps must have a self-destructing panel and/or self-destructing door fastening.
- Prohibition to use poisons, drugs, or other chemicals, and the use of spears, hooks, explosives or similar devices to harvest lobsters.
- Entry into the fisheries is limited to permit holding fishermen.

1.2.2 Federal Fisheries Management Amendments

The Spiny Lobster FMP was amended twice. The first amendment, 1990 Amendment 1, defined overfishing as stock levels that are below 20% Spawning Potential Ratio (SPR), the ratio of eggs produced between a fished and unfished population. It was based on the total mean fecundity, which is defined as the total number of eggs potentially produced divided by the total number of females. It recommended management measures that the council could implement when overfishing occurs, such as seasonal closures, increasing minimum carapace length, requiring escape traps, reducing the number of traps, and creating marine reserves. Further, this amendment described the habitat of the spiny lobster and measures needed in order to conserve mangrove, sea grass, and coral reef habitats (CFMC, 1990).

The 2001 Amendment 2 (CFMC, 2001) to the FMP for the spiny lobster fishery, recommended that the MSY for Spiny Lobster be changed from 830,000 lbs. to 251,000 lbs. It reviewed the biological and economic impacts that this change would have and found that it would help to minimize overfishing. This preferred alternative MSY is equal to the average reported harvest from 1989-1999 and should easily support the status

quo of the fishery. Such “status quo” harvest levels should lead to fewer disruptions in the fishery. A preferred OY was derived from catch data resulting in an OY equaling 75% of MSY or 188,000 lbs. This change in OY should allow managers a criterion to judge the effectiveness of the FMP. This new OY focused on protection and sustainability of spiny lobsters and was not meant to optimize the economic value of the fishery. Maximum Fishing Mortality Threshold (MFMT) and Minimum Stock Size Threshold (MSST) were also defined more clearly (CFMC, 2001).

2. Assessment History

The spiny lobster fisheries of the U.S. Caribbean have been assessed six times since 1990. Through these assessments, the status of the spiny lobster was determined, and this information was used to amend the FMP.

In 1990, Bohnsack et al. conducted a stock assessment based on landings and catch per unit of effort for the lobster fishery of the U.S. Caribbean. Their analysis showed that Puerto Rico’s lobster landings over the past 23 years had fluctuated but averaged approximately 317,451 lbs., while the Virgin Islands lobster landings appeared relatively stable since the 1980’s. The difference between island landings, such as that found between St. Thomas and St. Croix, was assumed to be due to differences in the abundance of lobsters. St. Thomas was shown to support a larger resident lobster population than St. Croix, and thus supported more fishermen. The assessment also showed that the Virgin Islands had complied with the minimum size regulations more stringently than Puerto Rico. Between 1985 and 1989, undersized lobsters that were caught in the Virgin Islands represented roughly 2.9% of the total catch, while in Puerto Rico undersized lobsters accounted for 40% of the total catch. With the available data, the review team was unable to determine why this was occurring, but recommended that more effort be used to enforce and increase compliance with the minimum size restrictions, especially in Puerto Rico. The panel also recommended that the lobster stock continue to be defined as overfished while SPR remained below 20% and total landings remained above the level where the fishery was first considered to be overfished (Bohnsack et al., 1991).

Matos-Caraballo (1999) looked at the status of Puerto Rico’s spiny lobster fishery from 1992 to 1998 and found significant signs of overfishing. In 1951, a total of 446,000 pounds of spiny lobster were harvested by 466 fishermen. By 1991, only 211,941 pounds

of lobster were harvested by 576 fishermen, thus showing an overall decrease in the lobster abundance. Matos-Caraballo also saw a decrease in the mean carapace length of harvested lobster over that period, from 117 mm in 1951 to 91 mm in 1991. During his study, he found that the mean carapace length remained relatively close to the 1991 measured size. Between 1989 and 1991, approximately 59% of spiny lobster caught were below the legal size restriction. Matos-Caraballo linked that to poor enforcement efforts by the Department of Natural and Environmental Resources (DNER). Between 1991 and 1998, an increase in enforcement efforts by DNER did lead to an apparent decline the catch of undersized lobsters. By 1998, only 24% of the total lobster catch was below sub-legal size. Matos-Caraballo concluded that increased DNER enforcement would lead to a further decrease in overfishing; helping local fishermen become more educated about the threats of overfishing would help increase support for, and compliance with the spiny lobster FMP.

An assessment of the St. Croix lobster fishery by Mateo and Tobias (2000) found that there had been a steady increase in spiny lobster landings from 1978 to 1998, with landings increasing from 3,400 kg to 17,700 kg. Using the Schaeffer and Fox models to calculate the maximum sustainable yield (15,500 kg per year), these authors found that St. Croix landings had exceeded MSY in the 1990-1991, 1993-1994, 1997-1998, and 1998-1999 fishing seasons. The exploitation ratios ranged from 0.73-0.82 for males and 0.58-0.76 for females; above the optimum exploitation rate ratio of 0.5. Though landings data were incomplete, Mateo and Tobias were still able to conclude that the St. Croix spiny lobster fishery was fully exploited. They recommended that fishing pressure be decreased considerably through implementation of catch quotas, seasonal closures or limitations on the numbers of traps or fishermen. They believed that the spiny lobster population would benefit most from seasonal closures, given that current enforcement of size and sex regulations have had little impact on fishing pressure. They further concluded that increased biological research of spiny lobster and more complete data compiling would lead to better stock assessments and improved management decisions (Mateo and Tobias, 2000).

In 2001, Bolden assessed the status of spiny lobster in the U.S Caribbean from 1980 to 1999. Her conclusions were based upon data gathered from commercial landings reports provided by fishermen and data from the NOAA Fisheries Trip Interview Program (TIP), which includes the collection of biostatistical data on spiny lobsters. Bolden found that

the annual landings of spiny lobster in Puerto Rico had decreased steadily between 1984 and 1988 and had fluctuated since then. In the U.S. Virgin Islands there was an increase in the total pounds of spiny lobster landed between 1986 and 1988, but began to decline in 1996. Though there had been a steady decline in the spiny lobster fisheries of both Puerto Rico and the Virgin Islands, the commercial value for spiny lobster had increased. The commercial value of the total catch increased by nearly 60% between 1994 and 1995; from \$802,959 to \$1,373,497. Mean annual carapace length in the U.S. Virgin Island fishery had declined since 1992, while the mean annual carapace length for Puerto Rican spiny lobster remained relatively stable over the same period. Bolden (2001) did find the spiny lobster landed in Puerto Rico to be significantly smaller in size compared with those landed in the U.S Virgin Islands, and the TIP data revealed that 20% of spiny lobsters landed in Puerto Rico and 0.5% landed in the Virgin Islands were below legal regulation size. Sub-legal sized lobster comprised close to 40% of landed lobster in Puerto Rico and only 4.4% in the U.S Virgin Islands. Bolden concluded that minimum size enforcement needed to be increased in Puerto Rico and should become a priority throughout the U.S. Caribbean. This report concluded that a negative mean annual change in carapace length, sex ratios and trap Catch Per Unit Effort (the predominant gear used in the U.S Virgin Islands) indicates a declining fishery. Bolden recommended that validating and converting all U.S. Caribbean TIP and Landings data should become a priority, recommending that all data be compiled into a single datafile, allowing for more direct comparison between fisheries in future studies. Further, she recommended that authorities monitor landings more carefully since the fishery showed signs of decline (Bolden, 2001).

A current assessment (Mateo and Die, 2004) found that lobster landings in Puerto Rico increased throughout the 1990s and have remained stable since 1995, averaging roughly 285,000 pounds. Mateo and Die found that a current stock status could not be accurately assessed with a dynamic production model due to fact that the data analysed corresponded to a period without large differences in relative abundance. These authors recommended that there be a continued improvement in data collection focusing on extending the historic catch per unit effort data (CPUE) and obtaining landings data from recreational fishermen. They recommend that a “single trip” database be developed in order to facilitate CPUE analysis and that size and relative abundance data be used together in future assessment modeling. Lastly, Mateo and Die recommended the development of a more accurate definition of overfishing in spiny lobster, to be used in

lieu of the current SPR definition (Mateo and Die, 2004).

The final and most recent assessment, Mateo (2004), estimated current exploitation rates of spiny lobster by analyzing TIP data for the period 1999 to 2000 and using a yield per recruit analysis. Exploitation rates were estimated to be 0.66 for males and between 0.68 and 0.71 for females; above the optimum exploitation rate of 0.5. Mateo concluded that spiny lobster in the U.S. Caribbean is fully exploited. He believes that overfishing is due to three factors: management failure to enforce size regulations, a lack of basic biological and ecological knowledge of spiny lobster and a lack of management oriented research. Mateo recommends the need for fully coordinated spiny lobster research involving government, fishermen and industry research, which in turn can be used to develop a sound management plan (Mateo, 2004).

In general, each assessment conducted over the past 14 years has yielded results indicating that the spiny lobster fishery in the U.S. Caribbean have shown signs of overfishing, and that landings, catch rates and relative abundance has declined significantly since the beginning of the fishery. The general consensus is that increased enforcement of the current spiny lobster FMP should lead to a healthier fishery, while the standardization of available fishery data and the collection of data more applicable to the assessment process should allow for a more accurate determination of its status. Further, management of spiny lobster by means other than by relying on minimum carapace length regulations may prove more effective at maintaining a sustainable and profitable fishery.

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Literature

Bohnsack, J., S. Meyers, R. Appeldoorn, J. Beets, D. Matos-Caraballo, and Y. Sadovy. 1991. Stock Assessment of Spiny Lobster, *Panulirus argus*, in the U.S. Caribbean. NMFS SEFSC-Miami Laboratory Contribution No. MIA-9C/91-49.

Bolden, S. 2001. Status of the U.S. Caribbean Spiny Lobster Fishery 1980-1999.

- NMFS SEFSC – Miami Laboratory Contribution No. PRD-99/00-17.
- CFMC. 1981. Draft Environmental Impact Statement/ Fishery Management Plan and Regulatory Analysis for the Spiny Lobster Fishery of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council. 7-15p.
- CFMC. 1982. Environmental Impact Statement, Fishery Management Plan and Regulatory Impact Review for the Spiny Lobster Fishery of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council. 1-9p.
- CFMC. 1990. Amendment Number 1 to the Environmental Impact Statement, Fishery Management Plan and Regulatory Impact Review for the Spiny Lobster fishery of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council. 1-24p.
- CFMC. 2001. Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and Other Required Provisions of the Magnuson-Stevens Act in the Fishery Management Plans (FMPs) of the U.S. Caribbean: Amendment 2 to the FMP for the Spiny Lobster Fishery. Caribbean Fishery Management Council. 8-13, 36-43p.
- DFW. (Meyers, S.) 1994. Cooperative Fishery Statistics Program. Annual Summary Report 1993-1994. Department of Planning and Natural Resources. Division of Fish and Wildlife, U.S. Virgin Islands. Report to the National Marine Fisheries Service.
- Mateo, I and W.J. Tobais. 2000. Preliminary Estimations of Growth, Mortality and Yield Per Recruit for the Spiny Lobster *Panulirus argus* in St. Croix, USVI. Proceeding of the Gulf and Caribbean Fisheries Institute. 53:55-75
- Mateo, I. 2004. Population Dynamics for Spiny Lobster *Panulirus argus* in Puerto Rico: A Progress Report. Proceeding of the Gulf and Caribbean Fisheries Institute. 55:506-520
- Mateo, I. and D. Die. 2004. The Status of Spiny Lobster *Panulirus argus* in Puerto Rico Based on Commercial Landings Data. CIMAS/RSMAS Rosenstiel School of Marine Sciences and Atmospheric Science. p. 1-7.
- Matos-Caraballo, D. 1999. Overview of the Spiny Lobster, *Panulirus argus*, Commercial Fishery in Puerto Rico During 1992-1998. Proceeding of the Gulf and Caribbean Fisheries Institute. 52:194-203