

# Recent Status of Puerto Rican Fish Trap Fisheries

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## ABSTRACT

As a result of a mesh-size selectivity study comparing the effect of three wire mesh sizes (3.8 cm<sup>2</sup>, 3.8 cm hexagonal, 5.1 cm<sup>2</sup>) on the catch characteristics of Antillean fish traps at the southwestern shelf of Puerto Rico, the recent status of the Puerto Rican reef fish fisheries was assessed. There was a clear size-selection effect on mesh size. Number of individuals declined with increasing mesh size, while average size of individuals increased with mesh size, however, these results were not showed or discussed in the present paper. Catch rate for hexagonal mesh observed in the mesh size selectivity study was compared with those from Puerto Rico in the 1970s and from under and overfished areas elsewhere in the Caribbean. The comparison indicated that the Puerto Rico resource is heavily exploited.

**KEY WORDS:** Fish traps, mesh-size selectivity, catch rates, Puerto Rico.

## RESUMEN

Como resultado de un estudio de selectividad de pesca, comparando el efecto de tres tamaños de malla (3.8 cm<sup>2</sup>, 3.8 cm hexagonales y 5.1 cm<sup>2</sup>) en la composición de las capturas de la nasa antillana, realizado en la plataforma insular al suroeste de Puerto Rico, se estableció el estado actual de la pesquería de peces arrecifales en esa zona. Se observó una clara selectividad por efecto del tamaño de malla. El número de individuos disminuye con el aumento en el tamaño de malla, mientras que el promedio de talla de los individuos aumenta proporcionalmente con el tamaño de la misma, sin embargo estos resultados no serán mostrados ni discutidos en el presente artículo. La tasa de captura para la malla hexagonal, estimada en el estudio de selectividad de pesca, fue comparada con aquellas obtenidas en Puerto Rico en los años 70 y con otras áreas del Caribe sometidas a diferentes intensidades de pesca. Esta comparación refleja que los recursos en Puerto Rico esta severamente explotados.

## INTRODUCTION

Wire mesh fish traps are one of the principal artisanal fishing gears used on coral reef areas in the Caribbean (Munro, 1974; Stevenson, 1978; Hartsuijker and Nicholson, 1981). They capture a wide variety of species and sizes of fishes and invertebrates, some of which are not taken by other gear types (Parrish, 1982; Luckhurst and Ward, 1987). Fish traps provide a significant portion of the total fishery landings throughout the Caribbean region. However, in Puerto Rico, the proportion of the catch derived from fish traps dropped from 72% in

1974 (Rolón, 1975) to 67% by the early 1980s (Weiler and Suárez-Caabro, 1980; García-Moliner and Kimmel, 1986; Collazo and Calderon, 1988) and 34% by 1988 (Matos and Sadovy, 1988). This decline in the use of traps follows a similar decline in overall landings. Recent assessments of the spiny lobster and shallow-water reef fish fisheries of Puerto Rico and the U.S. Virgin Islands have concluded that the shelf resources are overexploited (Bohnsack *et al.*, 1991; Acosta and Appeldoorn, 1992; Appeldoorn *et al.*, 1992; Dennis, 1988, 1991).

This study reports on the recent status of the Puerto Rican reef fish resource as assessed by a fishery-independent trap survey. The purpose of the paper is to compare the catch rate for hexagonal mesh observed in this study with those from Puerto Rico and from under and overfished areas elsewhere in the Caribbean.

### METHODS

All traps used were of the standard arrow-head design, with the frame of 0.95 cm steel rod. Trap dimensions were 125 x 120 x 30 cm. Three different mesh types were used: 3.8 cm hexagonal, 3.8 x 3.8 cm square and 5.1 x 5.1 cm square; for the purpose of this paper, only the catch rate for hexagonal mesh was considered. All mesh was vinyl-coated. Traps used a horseneck funnel built around a standard frame to ensure that all traps had the same funnel characteristics (28.5 cm diameter), regardless of mesh type. A total of nine traps of each mesh type were constructed, of which seven were used and two kept as replacement for damage or lost traps. During the study traps were deployed unbaited for a standard soak period of one week.

The study area was the southwestern shelf of Puerto Rico off the village of La Parguera. In order to account for across-shelf differences in the distribution and abundance of fishes, three general sites were fished (Figure 1). Site selection was determined through consultation with local fishermen.

Experimental fishing was conducted from 3 September to 5 November, 1992. A total of 189 trap hauls were made. Each fish caught was identified to species and weighed to the nearest gram (whole wet weight).

### RESULTS

Table 1 compares the catch rate observed in this study with those of other relevant studies. For comparative purposes the results of the 3.8h-traps are used, since these showed the highest catch rate (Appeldoorn and Posada, 1992). Although there are differences in methods and mesh size between studies, consistencies are apparent. Catch rates in the two Puerto Rican studies from the 1970's are quite similar. Likewise, the two recent studies from the same areas show similar catch rates (assuming that the shelf-edge habitat off La Parguera best approximates the selected productive areas on the outer shelf off the west

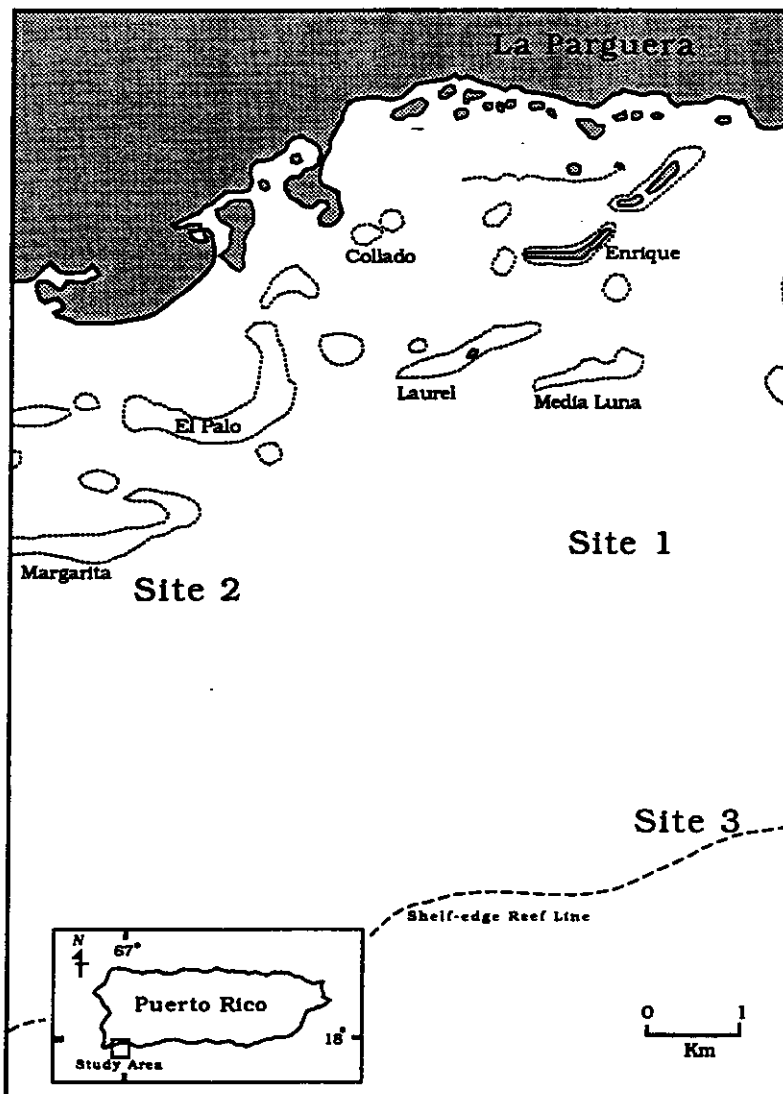


Figure 1. Location of sampling sites off southwest Puerto Rico.

**Table 1.** Comparison of catch rates for fish traps with hexagonal mesh. Weights are in grams. Weight and number are per haul per trap haul. Individual weight is the average weight per individual in the catch.

Year	Weight	Number	Ind. Weight	Mesh (cm)	Location & Comments	Ref.
1970	2,180			2.5	La Parquerria, PR	1
1973-74	2,210	9.2	242	5.1	Cabo Rojo, PR	2
1990	1,716	6.6	260	3.2	Ave. catch = 4 kg/3.4 cm mesh	
1992	748	3.4	255	3.8	West Coast, PR; Productive areas	3
	1,666	6.5	257		La Parquerria, PR - Total	4
1969-73	867	6		3.2	- Shelf Edge	
1986	588	3.5		3.2	Port Royal, Jamaica; z-trap	5
1969-73	2,885	19.2		3.2	Port Royal, Jamaica; z-trap	5
1986	514	4.6		3.2	Southeast Pedro Bank; z-trap	5
1969-73	5,092	23.5		3.2	Southeast Pedro Bank; z-trap	5
1986	5,022	25.4		3.2	Southeast Pedro Bank; z-trap	5
1986-88	4,590	12.8	360	3.2	Southeast Pedro Bank; z-trap	6
1985	10.9	3.8		3.8	Florida Keys	7
					Bermuda	

coast). Catch rates in Puerto Rico have dropped since the early 1970s by at least 25% and perhaps as much as 65%.

#### DISCUSSION

Results from Appeldoorn and Posada (1992) study conform quite closely to other studies on the effects of mesh size, in particular those of Bohnsack *et al.* (1989) and Rosario and Sadovy (1991): number of individuals declined with increasing mesh size, while average size of individuals increased with mesh size.

All catches rates from Puerto Rico are substantially below those reported from lightly fished areas (Florida and Pedro Bank)(Table 1). Based on numbers, the Puerto Rico catch rates are now substantially below that reported for Bermuda (which based on their data decided to ban trap fishing) and based on weight the total average catch rate (748 g/haul) is approaching the levels observed in the overexploited areas of Jamaica. Given these consistencies, it is clear that the Puerto Rico resource is heavily exploited.

Regulation of mesh size is a often used management tool. It can be expected that most larger, commercially important species will recruit to the fishery at or prior to maturity using a larger mesh size (*i.e.*, 5.1 cm<sup>2</sup>). Considering the high rates of exploitation reported for the fishery, the reduction in fishing mortality offered by adoption of a larger mesh may be important for both enhancing yield and ensuring an adequate spawning stock for these species. However, this strategy would need to be weighed against the large decline in catch rates and subsequent economic loss incurred by the fishermen over the short to medium term until stock recovery.

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#### LITERATURE CITED

- Acosta, A. and R.S. Appeldoorn. 1992. Estimation of growth, mortality and yield per recruit for *Lutjanus synagris* (Linnaeus) in Puerto Rico. *Bull. Mar. Sci.* 50: 282-291.
- Appeldoorn, R.S. and J.M. Posada. 1992. The effects of mesh size in Antillean fish traps on the catch of coral reef fish. Final report submitted to the Caribbean Fishery Management Council. 39 pp.

- Appeldoorn, R.S., J. Beets, J. Bohnsack, D. Matos, S. Meyers, A. Rosario, Y. Sadovy, and W. Tobias. 1992. Shallow water reef fish stock assessment for the U.S. Caribbean. NOAA Tech. Mem. NMFS-SEFSC-304. 70 pp.
- Bohnsack, J.A., D.L. Sutherland, D.E. Harper, and D.B. McClelland, Lt. M.W. Hulsbeck, and C.M. Holt. 1989. The effects of fish trap mesh size on reef fish catch off southeastern Florida. *Mar. Fish. Rev.* 51(2): 36-46.
- Bohnsack, J., S. Meyers, R.S. Appeldoorn, J. Beets, D. Matos, and Y. Sadovy. 1991. Stock assessment of spiny lobster, *Panulirus argus*, in the U.S. Caribbean. NOAA, NMFS, SEFC, Miami Lab. Contr. MIA-90/91-49. 29 pp.
- Collazo, J. and J.A. Calderón. 1988. Status of fisheries in Puerto Rico 1979-1982. CODREMAR. Tech. Rep. 1(2): 1-30.
- Dennis, G.D. 1988. Commercial catch length-frequency data as a tool for fisheries management with an application to the Puerto Rico trap fishery. *Mem. Soc. Cien. Nat. La Salle* 48(3): 289-310.
- Dennis, G.D. 1992. The validity of length-frequency derived growth parameters from commercial catch data and their application for stock assessment of the yellowtail snapper (*Ocyurus chrysurus*). *Proc. Gulf Carib. Fish. Inst.* 40: 126-138.
- García-Moliner, G.E. and J.J. Kimmel. 1986. CODREMAR/NMFS Cooperative Statistics Program. Unpublished report, CODREMAR Fish. Res. Lab., Mayagüez, Puerto Rico. Unpubl. MS.
- Hartsuijker, L. and W.E. Nicholson. 1981. Results of a pot fishing survey on Pedro Bank (Jamaica). The relations between catch rates, catch composition, the size of fish and their recruitment to the fishery. Fish. Div., Minist. Agric., Jamaica, Tech. Rep. 4, FAO/TCO/JAM 8902: Potfishing survey of Pedro Bank, 44 pp.
- Juhl, R. and J.A. Suárez-Caabro. 1973. Fish pot fisheries in Puerto Rico. *Cont. Agrop. Pesq.*, Dept. Agric. Puerto Rico 5(40): 18 pp.
- Koslow, J.A., F. Hanley, and R. Wicklund. 1988. Effects of fishing on reef fish communities at Pedro Bank and Port Royal Cays, Jamaica. *Mar. Ecol. Prog. Ser.* 43: 201-212.
- Luckhurst, B. and J. Ward. 1987. Behavioral dynamics of coral reef fishes in Antillian fish traps at Bermuda. *Proc. Gulf Carib. Fish. Inst.* 38: 528-546.
- Matos, D. and Y. Sadovy. 1990. Overview of Puerto Rico' small-scale fisheries statistics 1988-1989. CODREMAR. Tech. Rep. 1(4): 1-17.
- Munro, J.L. 1974. The mode of operation of Antillean fish traps and the relationships between ingress, escapement, catch, and soak. *J. Cons. Int. Explor. Mer.* 35(3): 337-350.
- Munro, J.L. 1983. Coral reef fish and fisheries of the Caribbean Sea. *ICLARM Stud. Rev.* 7: 1-9.

- Parrish J.D. 1982. Fishes at a Puerto Rican coral reef: Distribution, behavior, and response to passive fishing gear. *Carib. J. Sci.* 18(1-4): 9-20.
- Rolón, M.A. 1975. La pesca en Puerto Rico, 1974. Cont. Serv. Aux. Oper. Cent., Contr. Agropec. y Pesq. 7(1): 44 pp.
- Rosario, A. and Y. Sadovy. 1991. Trap mesh selectivity off the west coast of Puerto Rico. Completion Rep. Fisheries Research Laboratory/DNR, Mayaguez, Puerto Rico. 60 pp.
- Stevenson, D.K. 1978. Management of a tropical fish pot fishery for maximum sustainable yield. *Proc. Gulf Carib. Fish. Inst.* 30: 386-397.
- Stevenson, D.K. and P. Stuart-Sharkey. 1980. Performance of wire fish traps on the western coast of Puerto Rico. *Proc. Gulf Carib. Fish. Inst.* 32: 173-193.
- Ward, J. 1988. Mesh size selection in Antillean arrowhead fish traps. *FAO Fish Rep.* 389: 455-467.
- Weiler, D. and J.A. Suárez-Caabro. 1980. Overview of Puerto Rico's small-scale fisheries statistics 1972-78. CODREMAR Tec. Rep., 1(1): 27 pp.