

# Threats to the Grouper Population Due to Fishing During Reproductive Seasons in the San Andres and Providencia Archipelago, Colombia

MARTHA PRADA<sup>1</sup>, ERICK CASTRO<sup>1</sup>, ESTELMAN PUELLO<sup>1</sup>, MILTON POMARE<sup>1</sup>, GIOVANNA PENALOZA<sup>2</sup>, LARRY JAMES<sup>2</sup>, and HARVEY ROBINSON<sup>3</sup>

<sup>1</sup> San Andres Archipelago  
Fishing and Agriculture Department

<sup>2</sup> CORALINA

Av. San Luis

San Andres, Colombia

<sup>3</sup> Fish and Farm Cooperative

San Andres, Colombia

## ABSTRACT

The remote reefs of the San Andres archipelago are of great regional importance because they are productive systems with high biodiversity, which depend on self-recruitment and serve as stepping stones for population exchange; therefore system function will depend on efficient management. Marine resources within the archipelago have subjected to high fishing pressures supplying primarily U.S. markets with more than 90% of the spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*) and several reef fish species.

Although fish catch data is only partially available, it is estimated that at least 520 metric-tons ( $\pm$  S.D.= 103) of reef fish are annually removed from the system due to fishing mortality. Progressive reductions in lobster and conch landings combined with new regulations have shifted fishing effort towards reef fish. New fishers entering the fishery are using multiple fishing gears targeting several species of snappers and groupers. It has been estimated that during 2004-2005 approximately 60% of the fish landings are deep water snappers and 10% groupers. Unfortunately, the longstanding artisanal and industrial reef fish fishery remains unregulated, with few and isolated statistics, which limits the application of effective fisheries management.

Catch and effort data helped to identify that most groupers and snappers are caught in monthly peaks, associated with spawning aggregations –SPAGs. Information acquired from January-May, 2005, indicated for three common groupers that fishing is capturing large individuals, of which 30% were gravid. Thus, there is a potential to impact traditionally high fish abundances due to lack of fisheries management. Fishing at SPAG sites can easily deplete local populations from different insular shelves, generating an overall reduction in natural populations.

This paper analyzes threats of reef fish fisheries, particularly for groupers captured at SPAG sites during their reproductive season and the lack of management, while presenting alternatives. New management models need to be based on higher community participation, more inter-institutional and international approaches and greater integration of conservation measures from the recently established multiple use Seaflower MPA.

KEY WORDS: Spiny lobster distribution, lobster abundance, San Andres archipelago

## Amenazas en la Población de Chernas Debido a la Pesca Durante su Periodo Reproductivo en el Archipiélago San Andrés

Los arrecifes remotos del archipiélago de San Andrés son de gran importancia regional porque son sistemas productivos con alta biodiversidad que dependen del auto-reclutamiento, sirven para el intercambio de poblaciones, y por lo tanto el funcionamiento del sistema dependerá de un manejo eficiente. Los recursos marinos del archipiélago han soportado altas presiones de pesca, sufriendo los mercados estadounidenses con más del 90% de la langosta espinosa (*Panulirus argus*), el caracol reina (*Strombus gigas*) y varias especies de peces arrecifales.

A pesar de tener solo datos parciales de capturas de peces, se ha estimado que al menos 520 toneladas-métricas ( $\pm$  S.D. = 103) de peces arrecifales son anualmente removidas del sistema debido a la mortalidad por pesca. Una reducción progresiva en los desembarcos de langosta y caracol combinado con nuevas reglamentaciones pesqueras han resultado en aumentos significativos del esfuerzo pesquero hacia peces arrecifales. Nuevos usuarios usando múltiples artes de pesca están pescando varias especies de pargos y chernas. Se ha estimado que durante 2004-2005 aproximadamente el 60% de los desembarcos de pescado fueron pargos y que un 10% fueron chernas. Desafortunadamente, las pesquerías artesanales e industriales de peces arrecifales han permanecido sin regulación, y las pocas y aisladas estadísticas han limitado la aplicación de medidas efectivas de manejo pesquero.

Los datos de capturas y esfuerzo han ayudado a identificar que la mayoría de las chernas y los pargos están siendo capturados en picos mensuales, asociados con las agregaciones reproductivas –SPAG-. La información adquirida durante Enero-Mayo, 2005 indicó que para tres chernas comunes la pesca está extrayendo aun individuos grandes, con un 30% de

hembras ovadas. Entonces, hay un potencial de perder las tradicionales altas abundancias de peces por la falta de manejo pesquero. La pesca en los SPAG puede fácilmente desaparecer poblaciones locales de varias plataformas insulares, generando una disminución general en las poblaciones naturales.

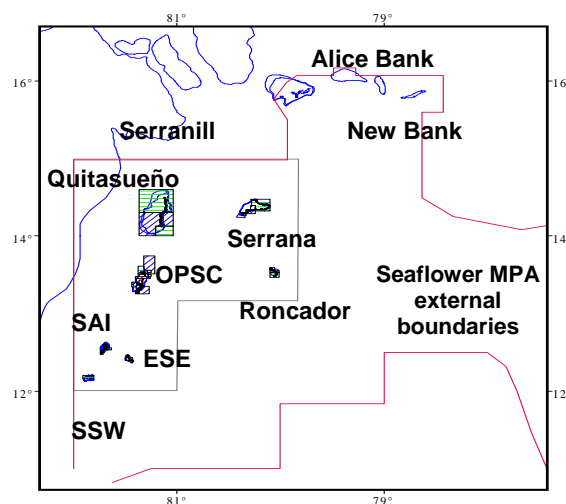
Este artículo analiza las amenazas sobre los peces arrecifales, especialmente para las chernas siendo capturadas en los sitios de SPAG a lo largo de su periodo reproductivo y careciendo de medidas de manejo, a la vez que presenta alternativas. Los nuevos modelos de manejo pesquero necesitan estar basados en una mayor participación de la comunidad, mayor participación inter-institucional e internacional y una mayor integración de las medidas de conservación dadas en el recién establecido sistema de uso múltiple dentro de la AMP Seaflower.

**PALABRAS CLAVES:** Distribución langosta espinosa, abundancia de langosta, archipiélago de San Andrés

## INTRODUCTION

Remote and isolated in the Western Caribbean, the atolls of the San Andres archipelago are experiencing significant changes because the conservation and sustainable use are driving forces for a new model of development in Colombia. Just recently, a large marine protected area (MPA), that includes large sections of the archipelago was declared the first multiple-use MPA in Colombia by the Minister of Environment under the name of Seaflower MPA (SFMPA) protecting 65,000 square kilometers (Figure 1). Having insular shelves dominated by well-developed coral reefs, marine resources within the SFMPA have supported high fishing pressures, supplying international markets, particularly the U.S. with more than 90% of the spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*) and several groupers and snappers locally fished.

Until reef fish have been unregulated stocks because there are not fishing regulations limiting extraction such as quotas (if established, they are extremely high achieving up to 600 m-ton/boat/year), size limits, permanent or temporal close seasons or gear restriction with the exception of the use of gill nets, which are not common in the Archipelago anyways. The use of spear guns, scuba tanks and hookahs are banned, but unfortunately, this lack of enforcement and identification of fishing alternative gears for divers at artisan level have resulted in poor implementation. The new development model imposed by the establishment of the SFMPA as well as new fishing regulations including restriction to industrial divers, establishment of a reef fish global quota and better access to artisan fishermen are expected to revert present diminishing trends in reef fish landings. However, it is necessary to incorporate stronger fishing regulation to protect spawning grouper stocks in accordance with the international protection that these species are receiving and be able to manage valuable reef fish stocks on a regional context.



**Figure 1.** Location of most important fishing grounds across the San Andres Archipelago. Seaflower MPA external boundaries are delimited in black and Colombia frontiers are shown in red. Green areas inside the different atolls are the no-take areas.

## PRESENT SITUATION OF THE CORAL REEF FISHERY CHARACTERIZATION REEF FISH FISHING EFFORT

At industrial levels, reef fish fishing effort is conducted basically on the northern atolls including Quitasueño, Serrana, Roncador, Serranilla, New Bank, Alice Bank and the Colombian section of the Nicaraguan rise or green moon (Figure 1). The fishing effort of the fleet is widely variable because it includes activities targeting multi-specific stocks as well as activities capturing fishes as secondary products or bycatch. Among the first group there are approximately 11 boats that use between 4 to 8 reels to capture the deep water groupers and snappers, plus additional four boats which use 1 or 2 long-lines. Each reel extends over approximately 7 km while the long-lines cover approximately 14 km each. There are also three fish boats using fish traps. Second group include those boats targeting lobsters, but extracting fishes as secondary products. Among them there are additional

31 boat using lobster pots, six lobster diver and 8 conch divers whose fish using illegal spear guns, in some cases using also illegal hookahs (air compressors). Each diver boat takes on average eight canoes and a total of approximately 24 divers. In general, trap boats have trips of 60 days long, while diver boats trips range from 8 to 25 days, both fishing the year round.

The use of fish traps at industrial level significantly increased in the Archipelago in 2005, with the operation of 3 boats which deployed approximately 250 traps each. They fished around Quitasueño as well as Green Moon in trips which last on average 19 days (SD=10) and mostly during the spiny lobster close season (April through June).

At artisan level, reef fish fishing is conducted around the inhabited islands San Andres (SAI), Old Providence and Santa Catalina (OPSC) as well as the most southern reefs East-South-East (ESE) and South-South-West (SSW). Artisan fishing takes place also in close by and deeper fishing banks locally named as Julio Bank, Martinez Bank and Far Bank (Figure 1). These fishers utilize hand lines, reels, fish traps and both skin and illegal scuba diving to capture several reef fishes. There are around 24 small boats and 5 canoes fishing around the OPSC in daily trips using lines and 22 carrying divers or fish traps (Medina, 2004). By the other hand, Castro (2005) reported that in the southern banks there are approximately 61 boats using lines and reels plus another 27 boats fishing with lines and divers in daily trips or at most 4 days when fishing at distant southern reefs. Depending on the author, number of traditional artisan fishers range from 150 to 350 per island (Connolly 2005).

### REEF FISH LANDINGS

Lack of fishing regulations have resulted also in a poor landing monitoring at the species level, thus the only available information is total fish landings and approximation of groupers and snappers captures. It is known that most common industrial captures are coral reef fish species such as snappers and groupers, including *L. vivannus*, *Apsilus dentatus*, *Etelis oculatus*, *Lutjanus buccanella*, *Ocyurus chrysurus*, *Pristipomoides macrophthalmus*, *Mycteroperca venenosa*, *M. interstitialis*, *M. mystacinus*, *M. bonaci*, *M. tigris*, *Epinephelus guttatus* and *E. adcnisionis* (Caldas 2005).

From the reels and long-line industrial fleet has been estimated in around 300 m-tons each year, plus another 107 m-tons from boats having fishes as secondary products. From these, groupers accounted for 6-36 m-tons in the first case and 2.4 m-tons in the second case. In comparison, snappers accounted for 100 to 200 m-tons in the first case and 21.4 m-tons in the second case.

A total of 37.2 m-tons were extracted by boats using fish traps at industrial level, with groupers accounting from 4-18%. Observers reported that in one occasion grouper captures increased from 3% to 18% during three consecu-

tive days, and in another occasion 286 groupers of three species were caught in a single day at sites located at the shelf edge. Both observations happened near the full moon during the reproductive season, thus most probably fished at the spawning aggregation sites.

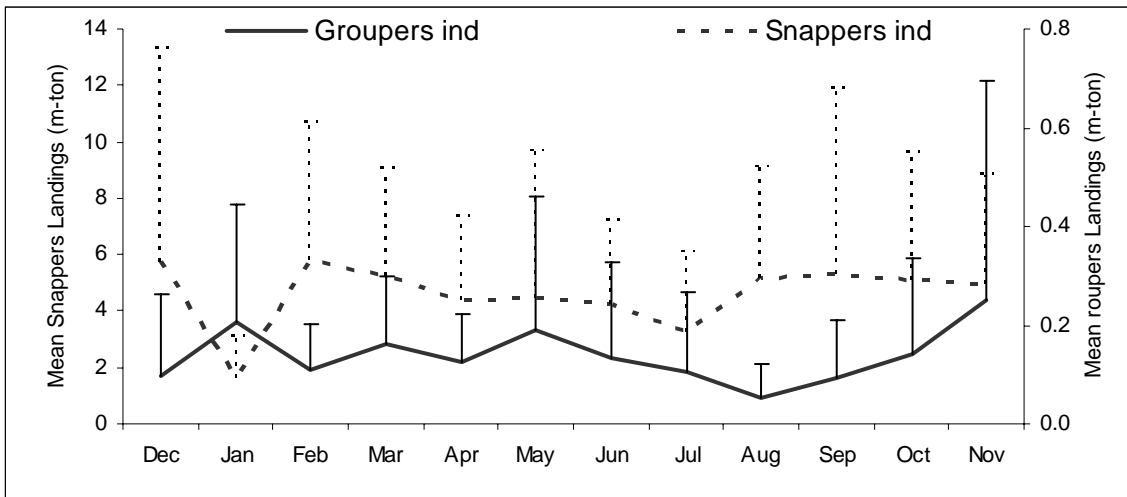
Total annual fish landing from industrial divers are approximately 15 m-tons, with groupers ranging from 3 to 18% and snappers accounting for 10 to 30%. In February 2005, another observer reported that from 76 specimens of two grouper species, only 12 individuals were caught in a single day and around the new moon. Fishing occurred along the 20 m depth contour, with sites concentrating at the south, north and eastern Quitasueño tip, where potential SPAG sites had been previously identified. There were species identification limitations which avoided the incorporation of the full set of data at the species level.

Summarizing, grouper fishing mortality from industrial boats presented monthly peaks in January, March and May with a similar pattern observed for snappers with peaks in February, June and August (Figure 2). The peaks might be one month displaced because data is taking during landings and the fishing trips for most boats last approximately one month.

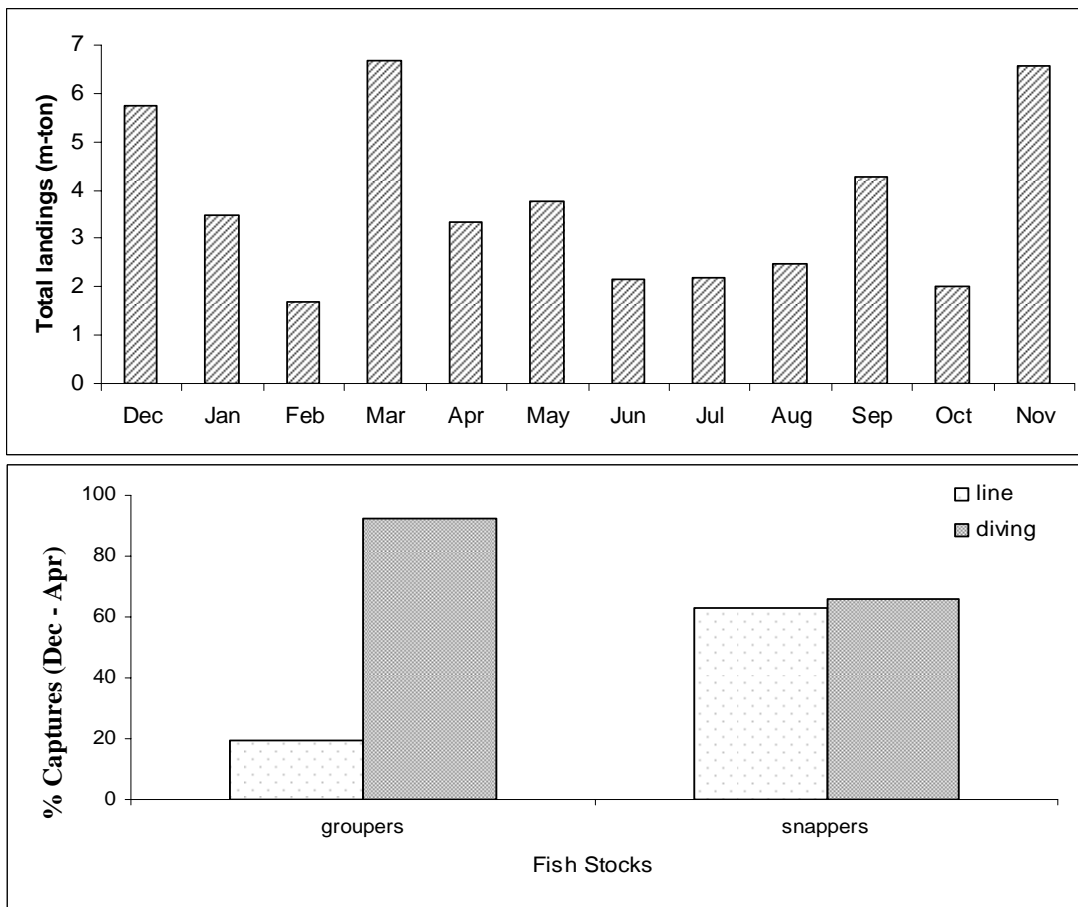
From the 67.8 m-ton landed in OPSC in 2001 (Medina 2004), it was observed that groupers were caught mostly in single trips from November to April coupling with their reproductive season (Figure 3). It is remarkable to observe how groupers landed in OPSC during 2001 season accounted for more than 90% from artisan divers and for more than 60% from line fishers.

Groupers in SAI and other southern reefs present a sharper decline. Indeed, Castro (2005) estimated artisan fish landings in this section to be around 156 m-ton/year. However, there has been a shift in species composition since at present landings are dominated by pelagic fishes accounting for more than 70% while groupers and snappers remain high (10% of the total fish landings) only at most remote reefs (Figure 4). Captures exhibited monthly peaks in December, February, March and May, as observed in previous fishing areas across the archipelago.

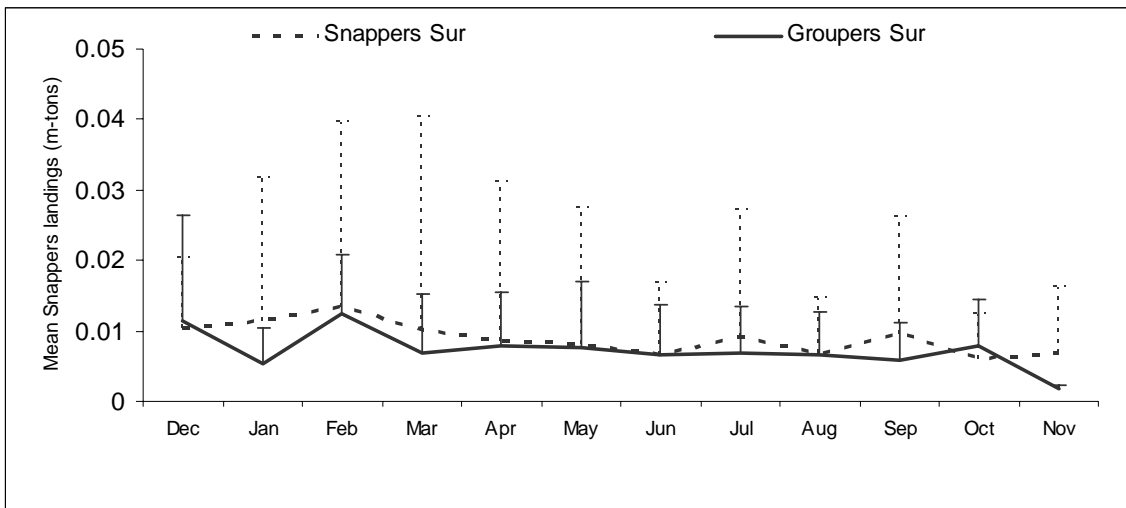
Despite the lack of better quality landing data, there is a consensus among fishers on the reduction in fish abundances and consequently in fishing profits, with a high potential of overfishing. There are expectations that with the establishment of the Seaflower MPA reef fish stocks can recover, thus supplying better income for traditional fishers. Under this context, knowledge on spawning aggregations becomes of particularly interest for keeping functionality of the natural mechanisms helping population recovery.



**Figure 2.** Monthly average of grouper and snapper landings fished in the San Andres Archipelago. Error bars represent one standard deviation. Data supplied by C.I. Antillana represents ten years of observation for around 40 – 60% of total landings. Landing peaks may be displaced by one month because fishing trips usually last more than 30 days.



**Figure 3.** Monthly average of total fish landings for artisanal fish landings in OPSC in 2001. Data was analyzed base on Medina (2004).



**Figure 4.** Monthly average of groupers and snappers landings on the southern reefs. Partial data for three independent years taken from Pomare 1995, and Castro 2005.

### THREATS DUE TO FISHING AT SPAWNING SITES

It is evident that groupers are being caught during its reproductive season, and that there is need to implement fisheries regulations coupling with the SFMPA zoning and conservation strategies and agreements. From observers on three different fishing trips on the northern reefs it was possible to determine for three common species *Mycteroperca bonaci*, *M. venenosa* and *Epinephelus striatus* that a wide variety of fish sizes are being caught. For instance, fished individuals were between 25 to 112 cm fork length in the first case, from 32 to 104 cm FL in the second case, and from 31 to 85 cm FL in the last case (figure 5). In all cases, it was calculated that at around 32.5% of the females were gravid, thus indicating a great threat to their population persistence.

Similar declining trends had been observed in OPSC. The number of current spawners (less than hundreds) has dramatically reduced more than tree times in comparisons with 20 years ago accordingly with old fishermen perspective (Prada et al. 2004). However, reproductive courtship, changes in color patterns and abundance in fish fertilized eggs are indications that functional spawning aggregations are still taken place, thus with enough protection, groupers recovery could happen. Perhaps these species are counteracting high fishing levels by altering movement patterns, thus more research on this aspect is urgently required in order to better understand the complex ecological process of these group of species when facing high mortality rates.

### CONCLUSIONS AND RECOMMENDATIONS

Until present, reef fish fishery within the San Andres archipelago remains unregulated, making difficult the establishment of programs oriented to monitor variation in standardized fish CPUE due to lack of good quality data.

Significant increases in fishing effort by one hand and establishment of large areas which will be closed for fishing on the other hand are two opposite policies, which definitively will generate confusion among users, increasing challenges that fisheries managers need to phase.

There is a diminishing trend in reef fish across the archipelago at both industrial and artisan levels. This trend may cause greater changes in ecosystem productivity, such as the one already observed in San Andres insular shelf, where a shifting baseline in fish species community composition has been experienced during last ten years.

Protection of spawning aggregation sites within the archipelago atolls need to be determined in order to protect these particular areas, critical for population conservation and recovery. The implementation of the recent established multiple use Seaflower MPA will indeed provide such a protection if coupled with appropriate fisheries management regulations.

The existence of functional grouper and snapper reproductive aggregations observed at the OPSC insular shelf are providing valuable scientific information in relation with group and individuals behavior. Active movement between SPAG sites are now believed to be a new strategy of the species to counteract intense fishing mortality. More research on this aspect is needed.

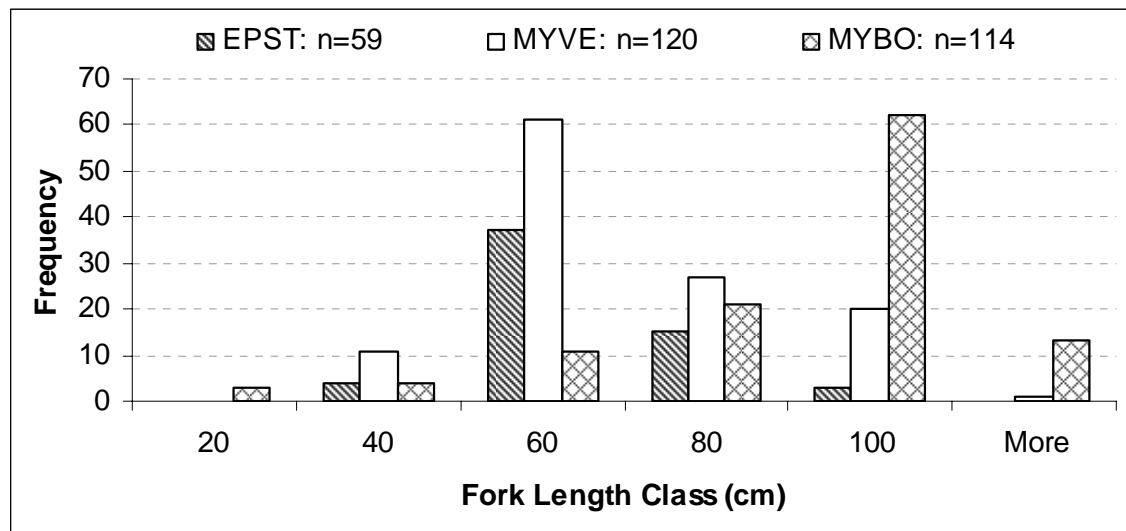
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**Figure 5.** Histogram of fork length classes for three common groupers fished from Jan-May/05 in the San Andres Archipelago. EPST = *Epinephelus striatus*, MYVE = *Mycteroperca venenosa*, MYBO = *Mycteroperca bonaci*.

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