

A Preliminary Investigation of Fishery Catch and Effort on the Jamaican South Coast and on Pedro Bank

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ABSTRACT

The preliminary results of investigations carried out between 1989 and 1991 are presented. The data collection process involved a series of interviews in which candidate fishermen were randomly selected. These interviews were confined to the island's south coast and Pedro Bank. The authors investigated fishing effort and gear usage between the two localities in an attempt to determine differences in fishing effort, catch rate and seasonality.

There was a significant variation between the gear-type distribution on the south shelf and the Pedro Bank. The south shelf was characterized by a situation of exploitation by a multitude of gear types whereas Pedro Bank was exploited by virtually a single gear-type, namely traps. The data suggested that pronounced seasonal fluctuations in catch existed.

There were no significant differences between the trap catch per unit effort for the south shelf and Pedro Bank which were estimated at 3.098 kg/trap.

The second most important gear was found to be nets which suggested seasonal variations in catch of 0.319 kg/m²/haul for the high season and 0.075 kg/m²/haul for low season for both localities.

Hook and lines represented the third most important single gear-type with seasonal catch per unit of effort of 13.198 kg/line/trip and 3.032 kg/line/trip for high and low season for both the south shelf and the Pedro Bank.

KEY WORDS: Gear-types, Seasonality, Catch Per Unit of Effort, Jamaica.

INTRODUCTION

The ICOD Jamaica/Belize Reef Management Project was initiated in September, 1989. The aim of this project is to undertake a partial re-assessment of the Jamaican fishing industry and ultimately to propose a management plan which would help to mitigate the overfishing crisis presently experienced in the fishing industry.

SAMPLE SITES

Sampling was confined to the major fish landing sites on the island's south coast and to a limited extent, Pedro Bank. The project design was comprised of two phases- Phase I was designated as the Broad-Scale survey and Phase II, the Intensive survey. The aim of Phase I was to collect data concerning general levels of fishing effort and catch in the areas concerned.

Figure 1A illustrates the locations of the various sample sites which were visited. A total of twenty-three sites were visited, however, three of these sites were no longer utilized by fishermen as landing sites. (See Appendix I for details of beaches visited).

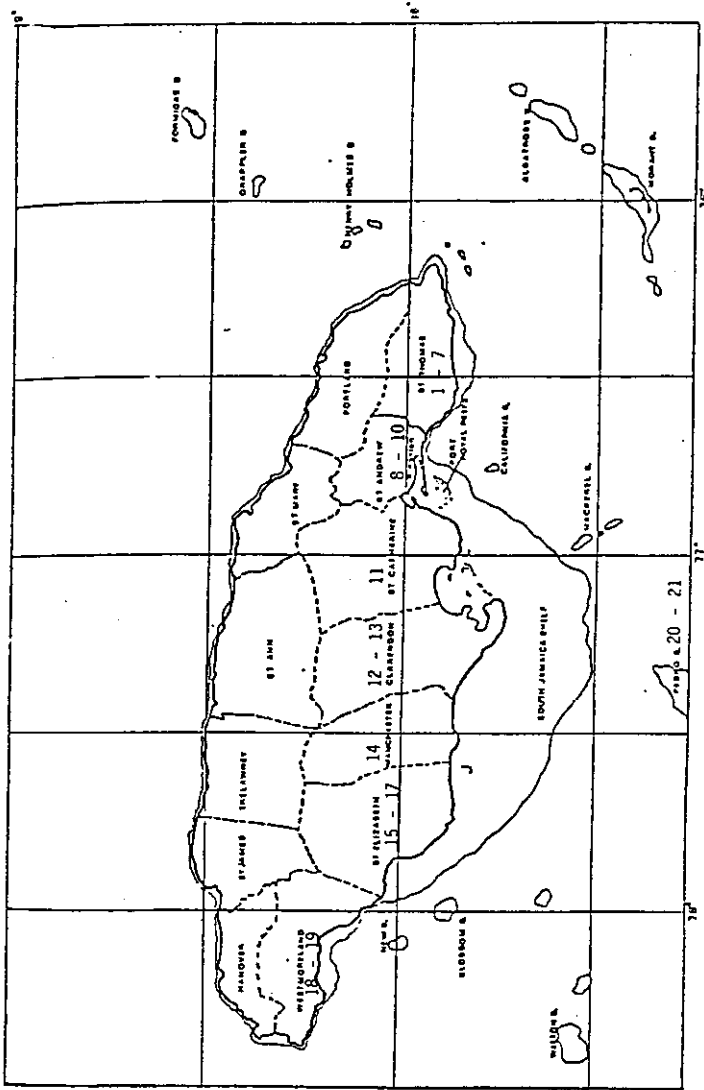


Figure 1A. Broad scale survey sample sites (from Munro and Thompson, 1973).

METHODOLOGY

Candidates were randomly selected at each of the various beaches visited. Each boat captain was then interviewed by standard questionnaires on selected aspects of the fisheries. The data were then entered into a Lotus 1-2-3 spreadsheet and subsequently analysed with the aid of a statistical package. The fishing grounds presently utilized by the fishermen were coded for analytical purposes (See Figures 1B and 2, also Appendix II for details). The data which were collected were analyzed on the basis of similarities between the fishing grounds.

RESULTS and DISCUSSION

Gear-types

The typical gear types utilized in the industry included traps, nets, hand-lines, and spear-guns. For the individuals operating on the island's south shelf, traps continue to be the most frequently utilized fishing gear. This was also reported by Munro and Thompson (1973). The majority of the fishermen continue to obtain their catch using a combination (*i.e.*, two or more) of different gear-types (See Figure 3A).

In the case of the fishermen operating on Pedro Bank (See Figure 3b), a distinct change in the pattern of gear usage was observed; a total of 97% of the candidates interviewed utilised traps only (See Figure 4). The opinion of the fishermen was that the choice of gear deployment on the bank was attributed to:

- a) traps were seen as a passive means of fishing.
- b) the problem of cooling the catch.
- c) frequency of trap hauling was determined by the visits of fish buying boats from the mainland.

Munro and Thompson (1973) reported the second most important gear to be hand-lines. The data collected in this study suggests that at present this category is now comprised of nets.

The third most important gear was found to be comprised of various hook and lines (hand-lines).

FISHING GEAR ANALYSIS

Traps

Mesh Size Distribution. Munro (1983) noted the fact that in the Jamaican fishing industry, most of the catch was taken by the predominantly smaller mesh traps. A possible solution proposed by Munro was for the introduction of a minimum mesh size of 5.0 cm (2").

From the responses obtained (See Figure 4), it is obvious this situation has remained unchanged for over fifteen years. The most frequently utilized mesh size at present is 3.10 cm (1.25"). This situation is similar on both the south

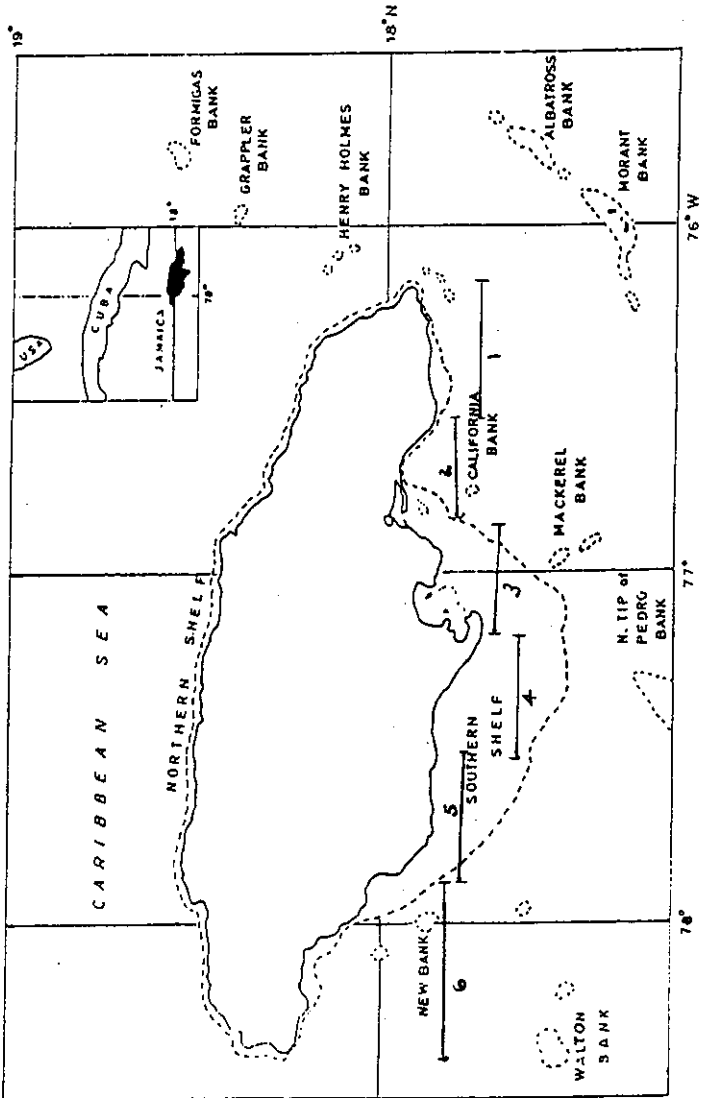


Figure 1B. Designation of south shelf fishing grounds.

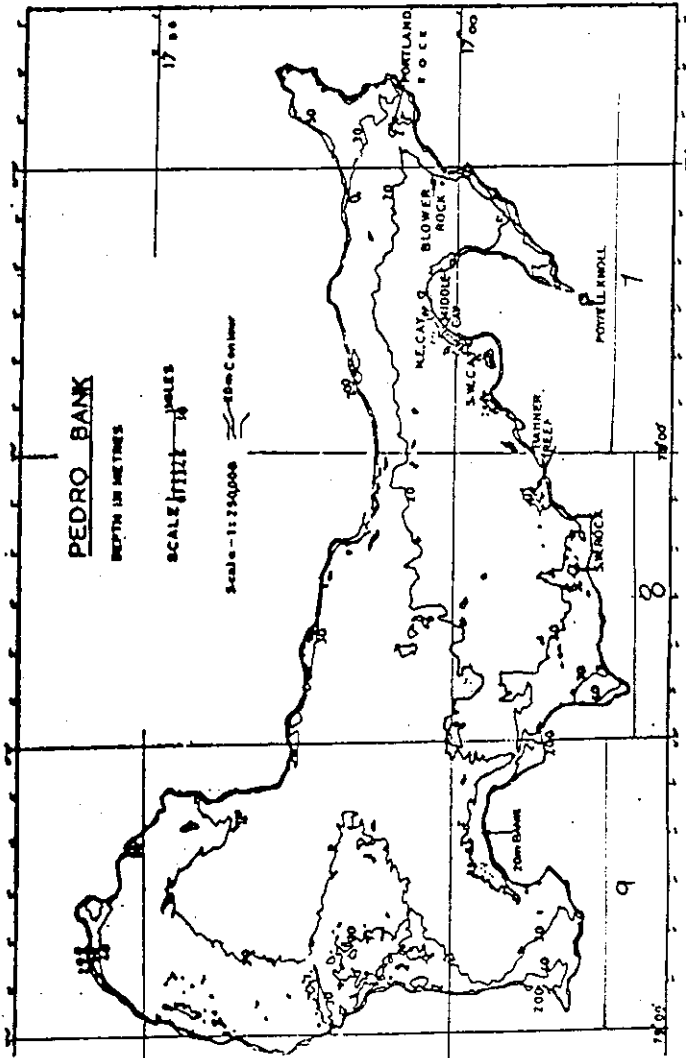


Figure 2. Designation of Pedro Bank fishing grounds.

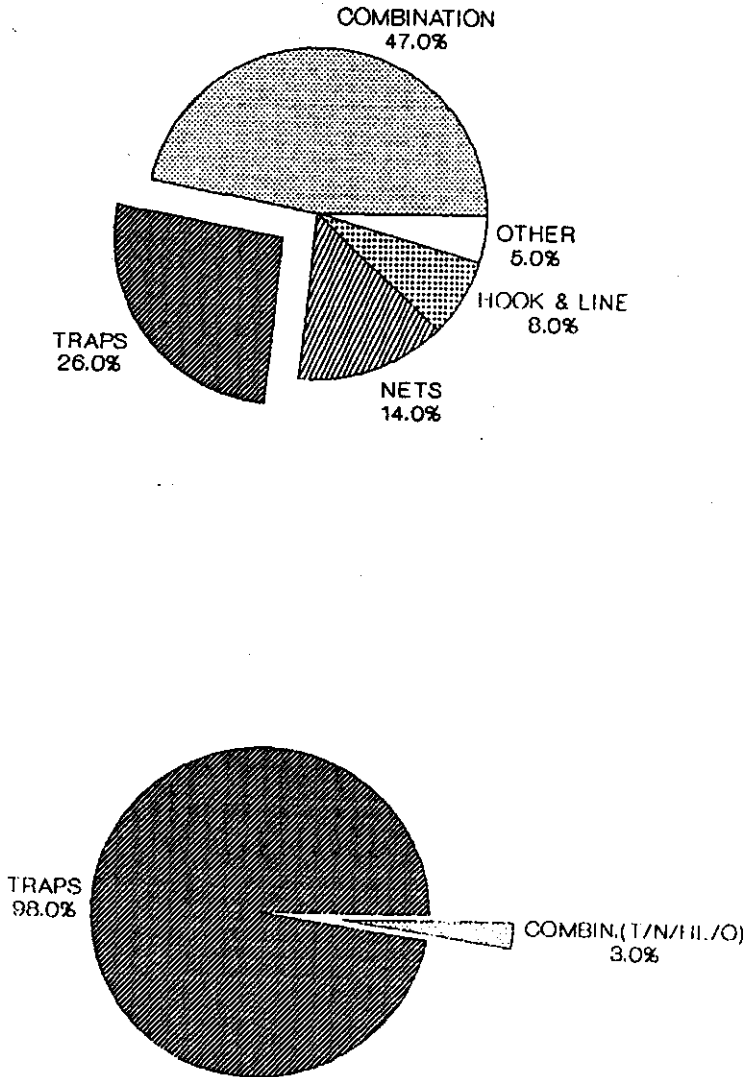


Figure 3A. The distribution of South Shelf gear types. **3B.** The distribution of Pedro Bank gear types.

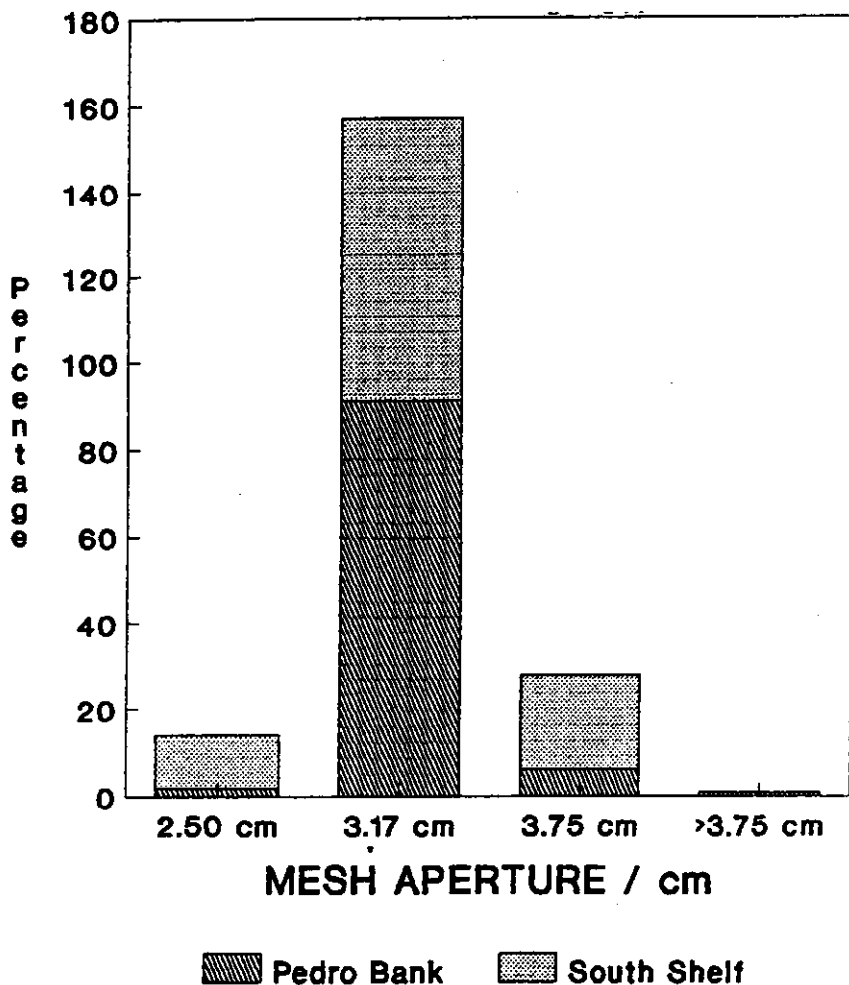


Figure 4. The distribution of mesh sizes on traps for Pedro Bank and the South Shelf.

shelf and on Pedro Bank. It is, however, interesting to note that the use of the smaller 2.50 cm (1") mesh is claimed to be less popular.

Indeed, in some instances the fishermen claimed to utilize this mesh on a seasonal basis (especially in August) in an effort to target the highly prized Goatfish (*Pseudupeneus maculatus*). There are also other individuals utilizing the 2.5 cm (1") mesh all year round.

Soak Time. Figure 5A illustrates the average soak time for traps set on both the south shelf and Pedro Bank. From the responses it is clear that there is no significant difference between the two localities ($F(1,122)=0.462$). In most instances, traps were allowed to soak for approximately three days between hauls.

Catch Per Unit Effort (Cpue). Figures 5B and 5C illustrate the average catch per trap in the high and low seasons respectively. The fishermen claim to observe distinct changes in the catch rate on a seasonal basis.

It is interesting to note the claim by fishermen is that there is no significant difference between the CPUE(shelf) and the CPUE(Pedro) in the so called high season ($F_{(1,119)}=0.324$). From the responses this would suggest an overall mean catch rate of approximately 3.098 kg/trap/haul in the areas considered.

In the case of the estimation of low season CPUE for traps, the fishermen's responses suggested significant differences existed between that observed on the island's south shelf and the Pedro Bank ($F_{(1,125)}=5.903$). The claim was that the average low season trap CPUE(shelf) is in the region of 0.485 kg/trap/haul and the CPUE(Pedro) was estimated at 0.812 kg/trap/haul. It is hoped that a thorough sampling during this period should yield a more reliable estimate of this parameter.

The authors referred to Munro's (1980) survey which was conducted in Jamaican waters. By grouping values obtained for areas on Pedro Bank which were similar to those presently under investigation, the researchers obtained crude estimates of trap CPUE of 2.872 kg/trap for Pedro Bank and 0.894 kg/trap for the southern shelf.

The value obtained for Pedro Bank is reasonably close to that which was estimated from the data which were collected for predicted high season trap catches.

The estimate of CPUE for the south shelf based on data which were extracted from Munro (1980) falls well below the estimated low season CPUE collected in the present survey. It should be noted that the data which were collected by Munro (1980) represented a relatively low catch derived from a relatively small quantity of traps (a total of 95 traps yielded a total of 84.9 kg over a total of 5 cruises). It is possible that these data may not have been representative of the true commercial catch rate.

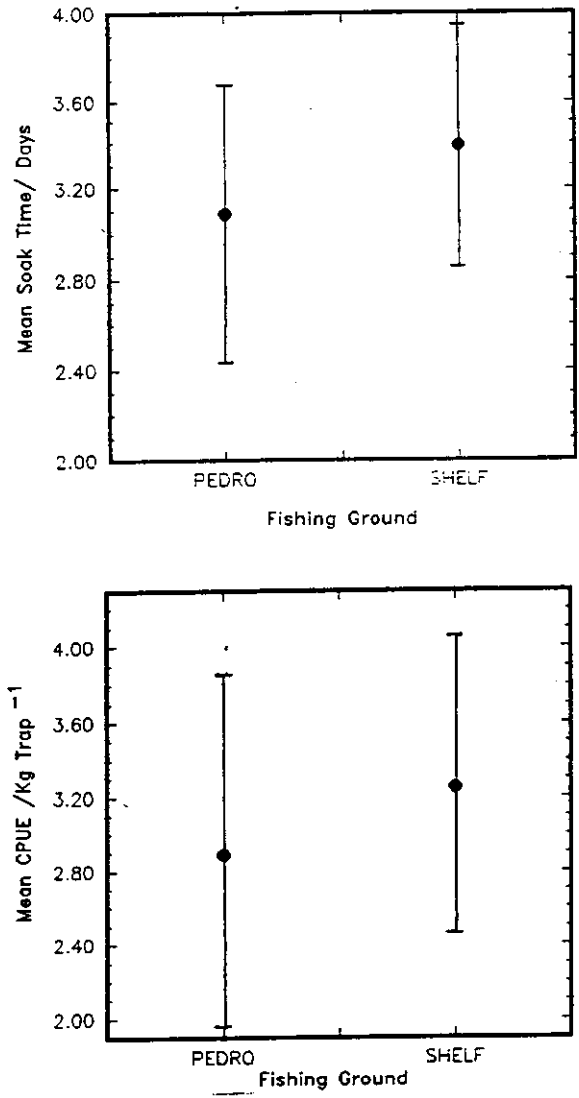


Figure 5A. The distribution of mean soak time (traps) for Pedro Bank and the South Shelf. **5B.** The distribution of mean catch per unit of effort (traps) for Pedro Bank and the South Shelf - HIGH SEASON.

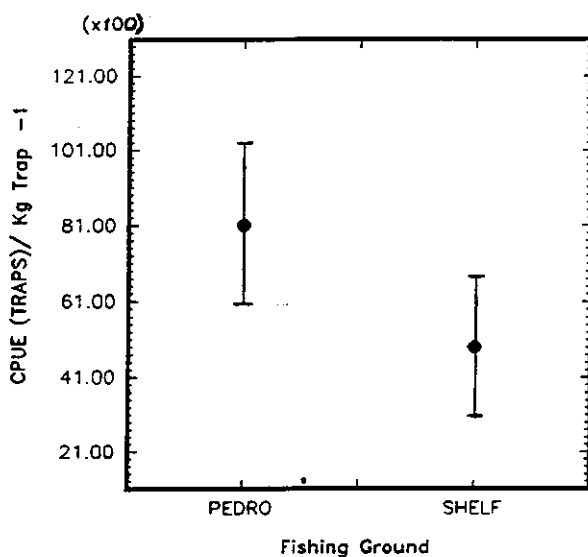


Figure 5C. The distribution of mean catch per unit of effort (traps) for Pedro Bank and the South Shelf - LOW SEASON.

Nets

Types. As a result of the virtual absence of fishing nets being operated on Pedro Bank, most of the net-fishermen who were interviewed operated on the south shelf. It must be noted that the type of nets which were considered in the data collection process were those which targeted coral reef species and not small pelagics (e. g., Clupeids). These nets were the so-called "drop nets".

Figure 6 illustrates the distribution of the various types of nets encountered in the field sampling. The nets were grouped into general categories based on their relative height in the water column thus separating the nets on the basis of the species which were targeted.

The types of nets which float at the surface comprised 12% of all nets and tended to harvest the non-reef restricted species (e. g., Jacks) (see Hartsuijker, 1984). The catches which were derived from these of such gear were not considered in this study.

The other group (i. e., bottom set nets) comprised the majority (88 %) of nets used. Thus most of the net fishermen on the south shelf exploited true coral reef species (Field sampling did not include individuals operating sprat-nets).

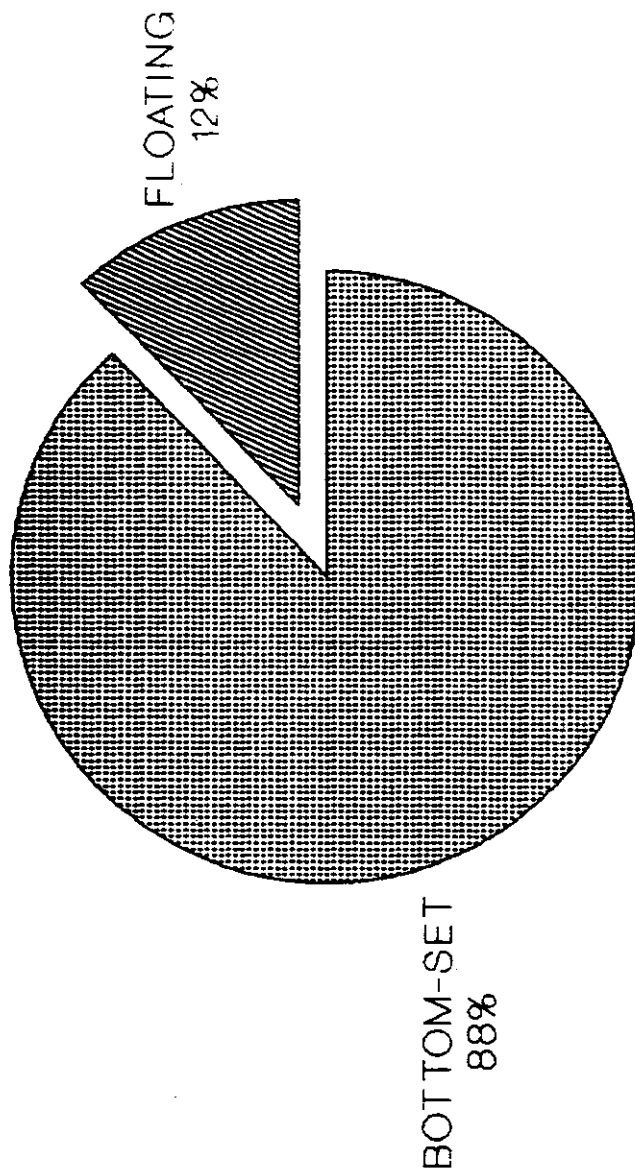


Figure 6. The distribution of net types utilized on the Pedro Bank and South Sheff.

Mesh Size: The responses indicated no significant difference in the various mesh sizes used by the fishermen ($F_{(7,40)}=0.203$). Figure 7A illustrates the distribution of the mean mesh sizes utilized on the various fishing grounds. The mesh sizes for the areas investigated ranged from 4.70-5.60 cm (1.87"-2.25"). It was common practice for the fishermen to have more than one mesh size hung on the fishing net.

Soak Time. This factor remained relatively constant over the study areas. Based upon the responses, there was no significant difference in the average soak time ($F_{(7,40)}=0.674$). Nets were hauled, on an average after approximately two hours (2.23 hours) (see Figure 7B).

Number Of Hauls. There was no significant difference between the mean number of hauls made per trip ($F_{(7,40)}=1.238$). This was estimated to be three hauls (2.92) (Figure 7C). This factor is greatly dependent upon the dimension of the net being deployed.

Catch Per Unit Effort. There was no significant difference in the mean CPUE observed for the the south shelf and Pedro Bank in either the high season ($F_{(7,30)}=0.968$) or the low season ($F_{(7,40)}=1.054$). The data indicated an overall mean value of 0.319 kg/m²/haul for the high season observations, and 0.075 kg/m²/haul for the low season. This would suggest an approximately four-fold increase in total landed catch by nets in the high season (Figures 8A and 8B).

Hook and Line

Types: The most frequently utilized type was the drop-line, which accounted for 86% of all hook and line fishing. This was described by Aiken (1984) as being comprised of a single line with between 1-15 hooks.

The other hook and line types were longlines. These were basically of two types; the bottom and the floating longline. In both instances, the gear comprises a single line with a multitude of hooks. The bottom longline is set to target demersals (especially Lutjanids) whereas the latter type is set to target the mid-water species (e. g., Jacks) (Figure 9).

From the data collected, it is apparent that most boats carried an average of 5 (4.56) drop-lines with each man working an average of 2 lines.

Catch Per Unit Effort: For the designated fishing grounds, there was no significant difference in the average CPUE for hook and line in both the high and low seasons between areas ($F_{(5,38)} = 0.445$ and $F_{(6,38)} = 1.034$ respectively) (Figures 10A and 10B).

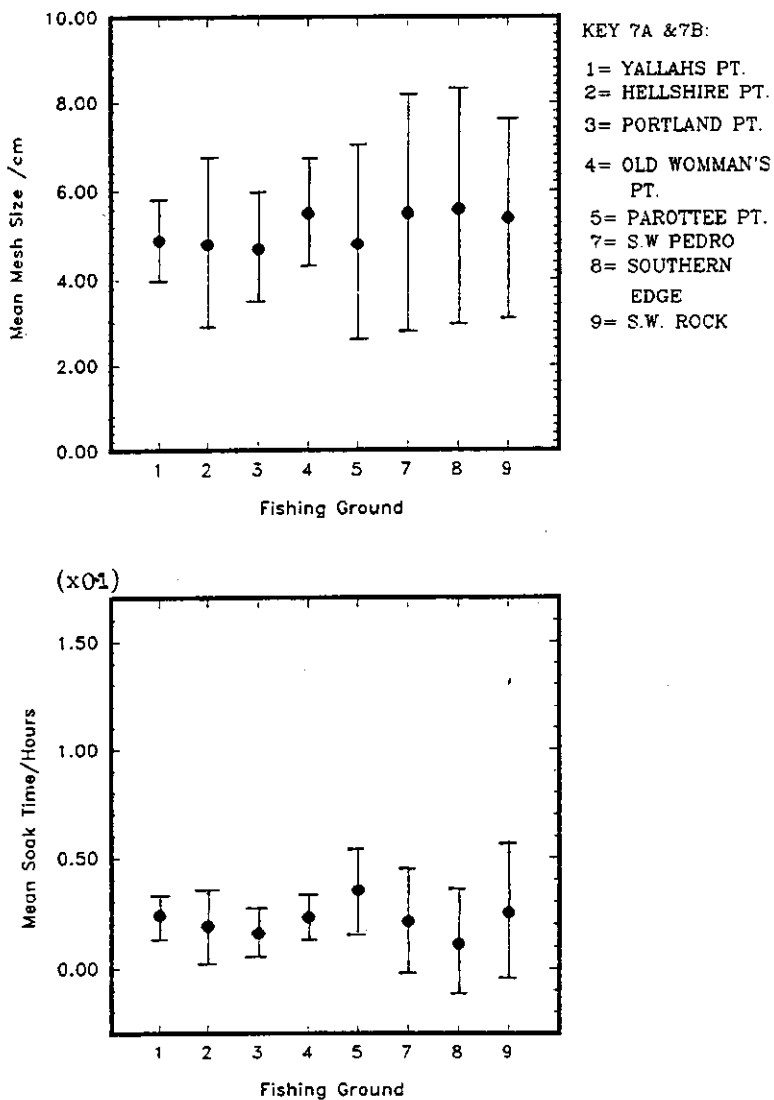


Figure 7A. The distribution of mean mesh size (nets) for Pedro Bank and the South Shelf. **7B.** The distribution of mean soak time (nets) for Pedro Bank and the South Shelf.

Non-Peer Reviewed Section

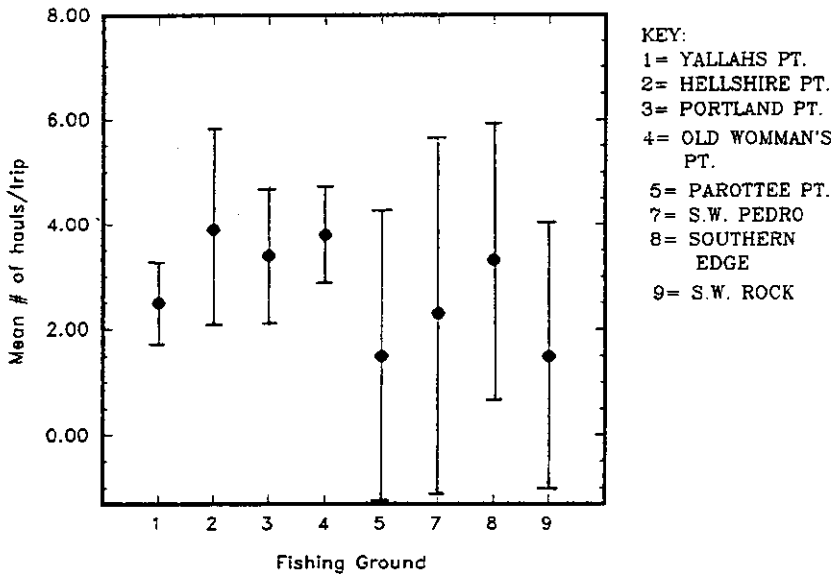


Figure 7C. The distribution of mean number of hauls per trip (nets) for Pedro Bank and the South Shelf.

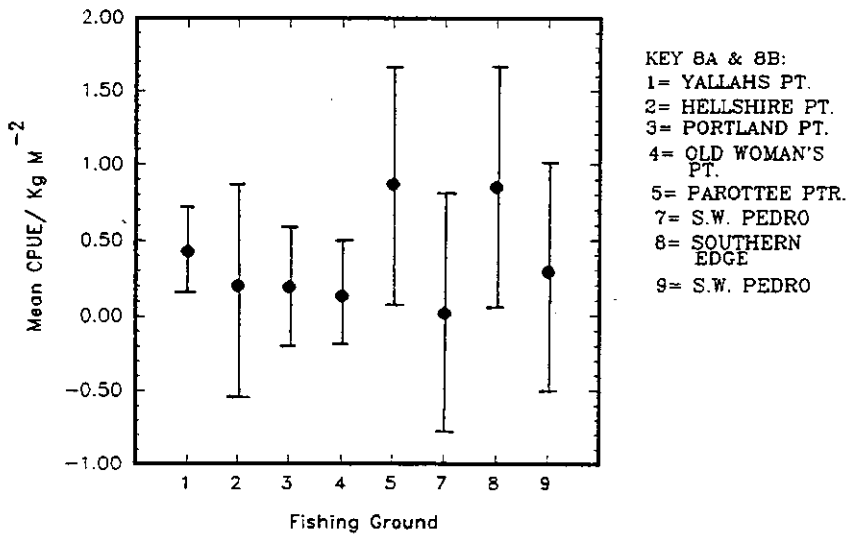


Figure 8A. The distribution of mean catch per unit of effort (nets) for Pedro Bank and the South Shelf - HIGH SEASON.

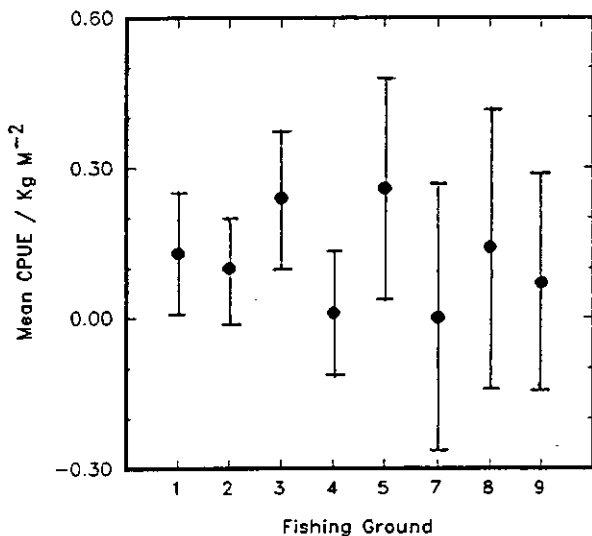
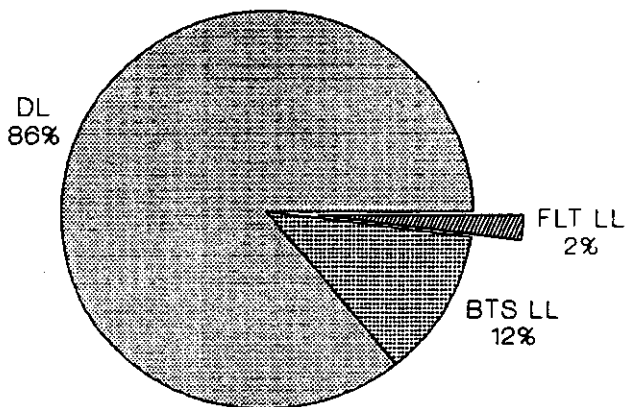


Figure 8B. The distribution of mean catch per unit of effort (nets) for Pedro Bank and the South Shelf - LOW SEASON.



FLT LL=Floating long line, **BTS LL=**Bottom set long line, **DL=**Drop line .

Figure 9. The distribution of hook and line types utilized on the Pedro Bank and South Shelf.

The data suggest a high season average CPUE of approximately 13.198 kg/line/trip, which is claimed to be dramatically reduced to 3.032 kg/line/trip in the low season.

The data do not, however, offer any indication of possible changes in the catch species composition that may be related to so called seasonal fluctuations. It is possible that high season catches may be dominated by a few species, hence, indicating possible aggregations.

FISHING TRIPS

The fishermen claimed that significant differences exists between the average number of fishing trips per week conducted on the south shelf and Pedro Bank ($F_{(1,150)} = 11.921$). The data collected suggest that the fishermen operating on the south shelf tend to make more frequent trips to fish (Figure 11A). Average fishing trips ranged from three to four (2.72 to 3.79) trips per week for the Pedro bank and the south shelf, respectively.

This greater frequency of fishing trips on the island's south shelf may be a result of the prevalence of "fish pot stealing," which is a grave problem in many areas. Thus increased vigilance may be the reason for this increase in fishing effort rather than higher catches. Alternatively, the slightly lower frequency of trips to the Pedro Bank may be attributed to the periodic visits of fish buyers from the mainland.

FISHING RANGE

This is the average distance from shore in which fishing occurs. The data suggest that the fishermen appear to be utilizing significantly different fishing range for the south shelf and Pedro bank ($F_{(1,150)} = 7.271$). It would appear that the average fisherman resident on the Pedro cays is fishing much further from shore than the average individual operating on the shelf from the mainland.

Mean values calculated for both localities were 41.73 km (26.08 miles) for Pedro cays-based fishermen and 28.06 km (17.54 miles) for the south shelf fishermen (Figure 11B). This may be an indication that the areas around the Pedro cays are indeed overfished and the fishermen have now reached the limits for fishing from the cays dictated by fuel capacity.

Upon closer examination, the data suggest that the areas designated 7 and sections of 8 (Figure 2) are heavily fished both by individuals who are resident on the Pedro Cays and also individuals who operate from the mainland.

SEASONALITY

Over the years, many fishermen claimed to have observed seasonal fluctuations in the catch rate through the year. Fishermen's responses suggest a definite high season occurring during the latter half of the calendar year with a

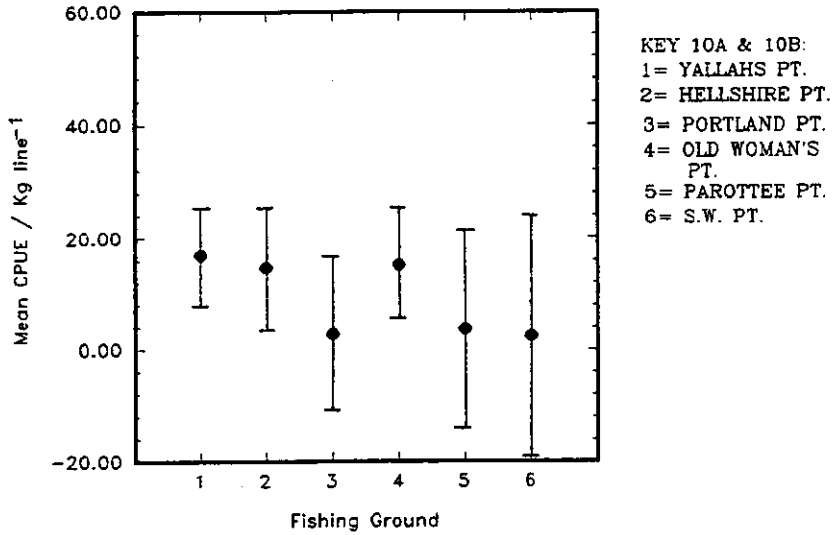


Figure 10A. The distribution of mean catch per unit of effort (hook and line) for Pedro Bank and the South Shelf - HIGH SEASON.

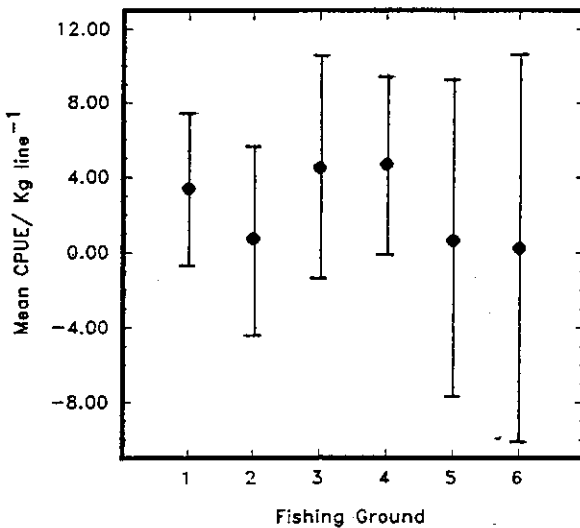


Figure 10B. The distribution of mean catch per unit of effort (hook and line) for Pedro Bank and the South Shelf - LOW SEASON.

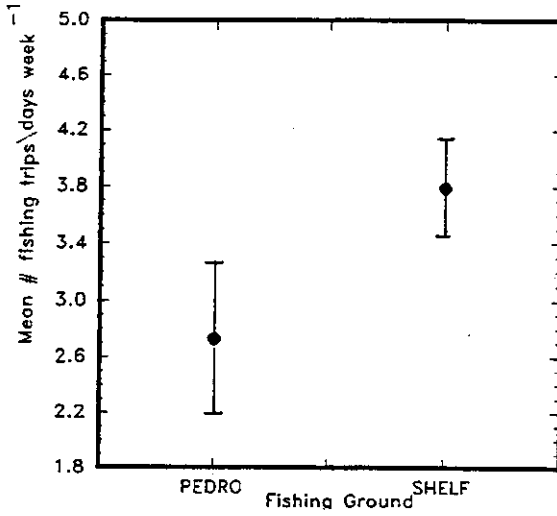


Figure 11A. The distribution of mean number of fishing trips for Pedro Bank and the South Shelf.

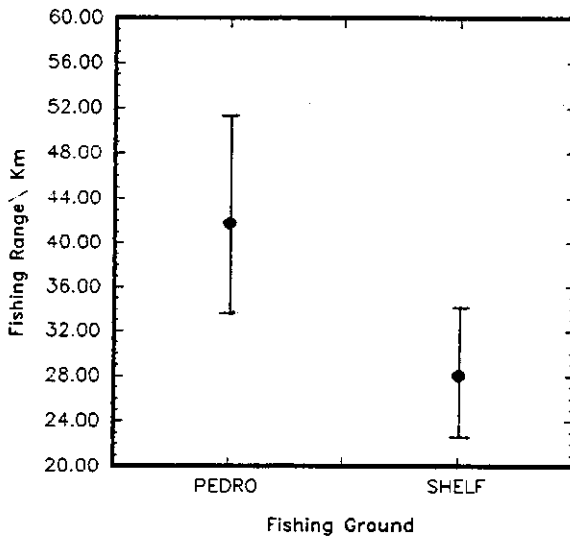


Figure 11B. The distribution of mean fishing range for Pedro Bank and the South Shelf.

possible maximum between August and October. This period was also mentioned by Hartsuijker (1984) (Figure 12A and 12B).

Hartsuijker (1984) noted that seasonality was most pronounced for certain species and concluded that seasonal fluctuations in catch were not due to changes in fishing effort but were due rather to an unavailability of fish stocks. It is likely that seasonal fluctuations may be primarily due to aggregations or probably more frequent fishing trips due to improved weather conditions (see below).

With respect to the low season, most individuals have indicated this to occur during the first half of the year, namely between the months of January to July (Figure 13A and 13B).

The reasons for the low season suggested by the fishermen are many and varied. A common belief held by the fishermen is that the fish have all gone off to breed. It is interesting to note that the so called low season corresponds to that time of year when the island experiences strong offshore winds and trips to sea may be difficult at that time.

It is therefore possible that the reduction in catch might be as a result of constraints in the fishing effort limited by the weather and not a reduction in fish catch, a possibility which was previously ruled out by Hartsuijker (1984).

CONCLUSION

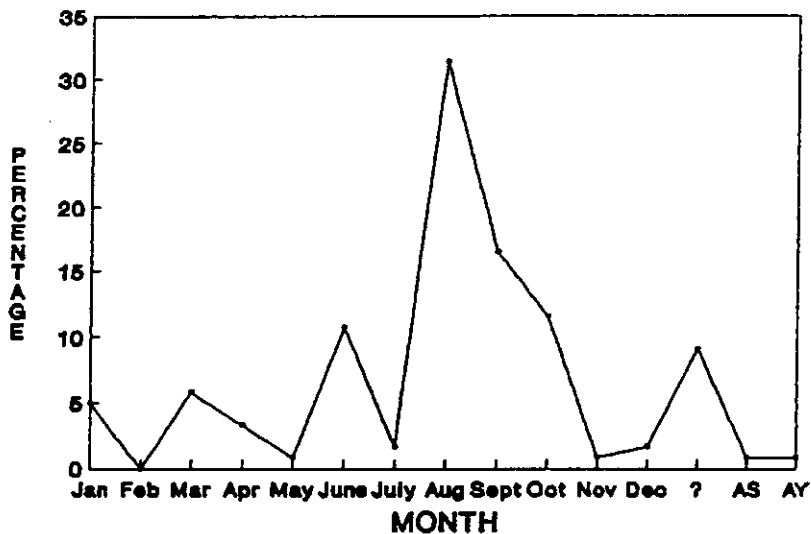
It is clear that the fishing industry has experienced many changes in the period between the last major survey of the fishing industry and the present study. Such changes included the more subtle changes in gear pattern usage. Other factors have apparently remained relatively constant over the years (*e.g.*, trap soak, mesh size etc.).

The catch continues to be poor in many areas, despite the high level of fishing effort which is exerted. This has been noted by many previous workers, and it is generally accepted that maximum sustainable yield has been surpassed. It is, however, of interest to determine the present levels of yield for the exploited areas.

PROJECT IMPROVEMENT

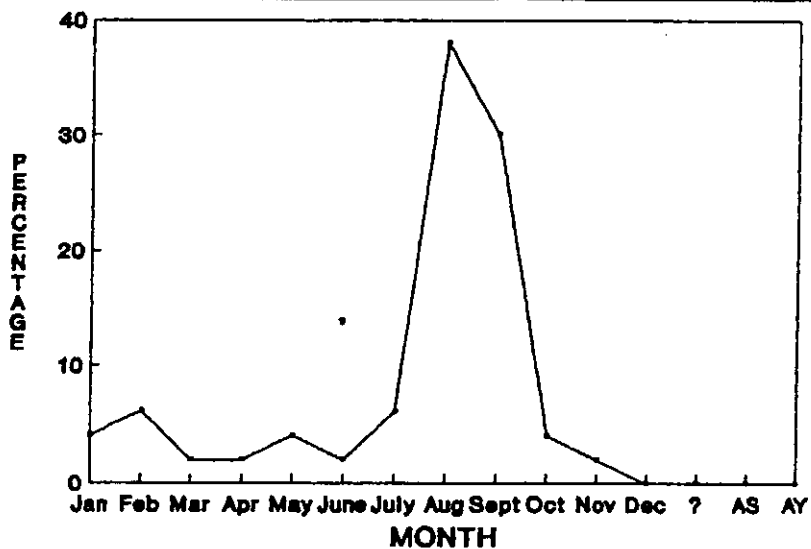
As was previously mentioned, the broadscale survey was to provide the authors with an indication of general levels of catch and corresponding effort. The authors are of the opinion that the estimates of CPUE for the various gear-types were subjected to unavoidable bias since the results were based solely upon opinions rather than by direct observations.

Additionally, the wide extent of the sample sites did not facilitate the collection of sufficient detailed information concerning fishery biological data (*e.g.*, species composition) and fishing effort. It is hoped that such shortcomings



?- Uncertain, AS- After a storm, AY- All year

Figure 12A. The distribution of High Season occurrences by South Shelf fishermen.



?- Uncertain, AS- After a storm, AY- all year

Figure 12B. The distribution of High Season occurrences by Pedro Bank fishermen.

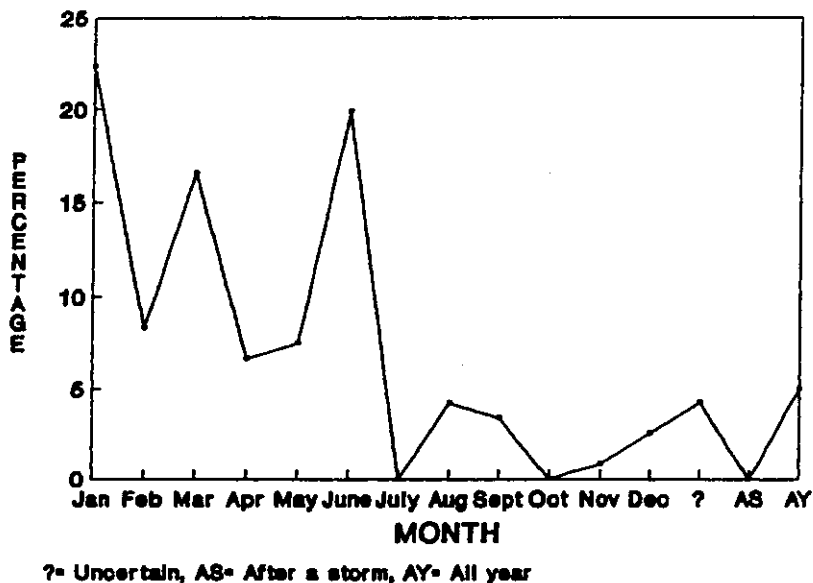


Figure 13A. Opinions on Low Season occurrences by South Shelf fishermen.

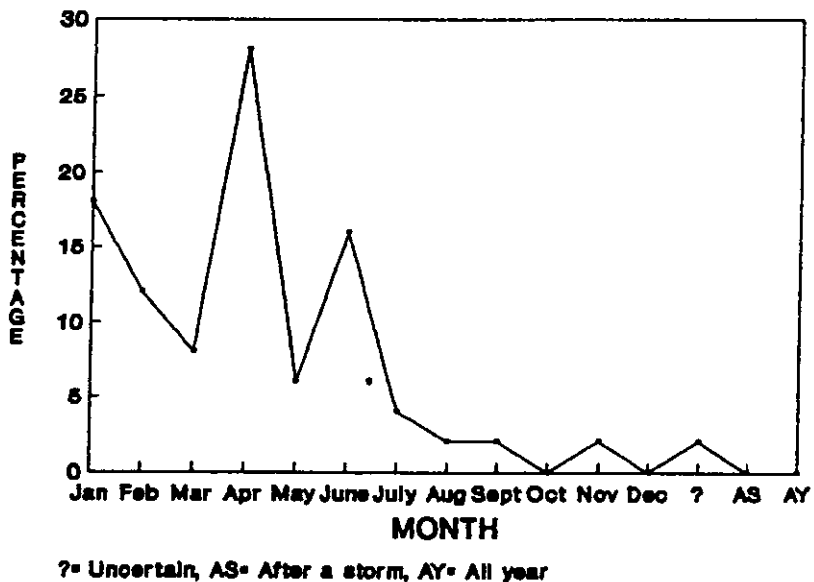


Figure 13B. Opinions on Low Season occurrences by Pedro Bank fishermen.

may be alleviated by the intensive collection of catch and effort data during the second phase of the project.

ACKNOWLEDGEMENTS

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APPENDIX I.

A List of sample sites visited during the Broad Scale Survey
Code/Fishing Beach Parish.

- 1 Holland Bay, St.Thomas
- 2 Rocky Point, St.Thomas
- 3 Dalvey, St.Thomas
- 4 Port Moran, St.Thomas
- 5 Leith Hall, St.Thomas
- 6 Morant Bay, St.Thomas
- 7 Yallahs, St.Thomas
- 8 Port Roya, Kingston
- 9 Rae Town, Kingston
- 10 Greenwich Town, Kingston
- 11 Old Harbour Bay, St.Catherine
- 12 Rocky Point, Clarendon
- 13 Farquhar's, Clarendon
- 14 Alligator Pond, Manchester
- 15 Parottee, St. Elizabeth
- 16 Great Bay, St. Elizabeth
- 17 Treasure Beach/ Billy's Bay, St. Elizabeth
- 18 Scott's Cove, Westmorland
- 19 Whitehouse, Westmorland
- 20 Middle Cay, Pedro Bank
- 21 N.E Cay, Pedro Bank

APPENDIX II

Details of designated fishing grounds (South Shelf and Pedro Bank)
Fishing Ground Code

- Location1 S.E. Point-Yallahs
- Point 2 Yallahs Point-Hellshire
- Point 3 Hellshire Point-Portland
- Point 4 Portland Point-Old Woman's
- Point 5 Old Woman's Point-Parottee
- Point 6 Parottee Point-S.W.
- Point 7 N.W. Pedro-S.W. Pedro
- Point 8 Nothern Edge-Southern Edge
- Point 9 E. Pedro-S.W. Rock