

The ICOD/UWI/Jamaica/Belize Reef Fisheries Management Planning Project - A Caribbean Cooperative Research Project

**KARL AIKEN, J. ANTHONY KOSLOW, ANTOINETTE CLEMETSON,
STEPHANIE AUIL, PETER ESPEUT, and FRANCISCO GALVEZ**
ICOD/UWI/Jamaica/Belize Reef Fisheries Management Planning Project
University of the West Indies
Department of Zoology, Mona
Icod/uwi/Jamaica/Belize Reef Fisheries Management Planning Project

ABSTRACT

An international project was initiated in 1989 to examine relationships between fishing effort and catch in reef fisheries of Belize and Jamaica as a possible basis for their management. Broad-scale surveys were carried out initially of the reef fisheries of Belize and along the South coast of Jamaica. These were followed by intensive, approximately one year surveys at representative sites in each country in order to obtain seasonal data on catch, effort and gear use. Socio-economic surveys of the fishermen were carried out in both countries to assess the social and economic importance of the fishery and the implications of fishery management to the fishing communities. Summaries are presented of the data, followed by a brief discussion of their biological, socio-economic and management implications. Generally, results showed that fishing effort is still high on the Jamaican south shelf and that catch per unit effort is low. The socio-economic component has helped to reveal that the multiple-use of canoes by groups of fishermen may have disguised up to the present time, even higher levels of fishing effort. The Belize scalefish fishery is dominated by hook-and-line gear and generally is not showing signs of overexploitation.

INTRODUCTION

The ICOD/UWI/JAMAICA/BELIZE Reef Fisheries Management Planning Project, hereafter called "the project" is a true international cooperative research programme which had an initial budget of Canadian \$382,000, of which ICOD, (the International Centre for Ocean Development in Halifax, Nova Scotia, Canada) provided 70% of that total and the University of the West Indies, and the Governments of Jamaica and Belize, the remaining 30%.

This fisheries project has been a two year cooperative exercise between the organizations just mentioned above, but specifically, the Department of Zoology and the Institute of Social and Economic Research (ISER) at the UWI's Mona Campus and the Fisheries Departments of Jamaica and Belize. This is the first joint fisheries project between these last-named fisheries departments. The project officially began in October, 1989 and is funded until March, 1992.

An important, indirect benefit of the project was the upgrading of the Fisheries Departments of both countries; the project staff was not housed at the

University campus but at the two Fisheries Departments, with the exception of the project leader. Also of note is the use of external consultants and an information officer. The project employs directly two research assistants (one in each country), an information officer (Jamaica only) and one non-technical staffer (driver).

The general objective of the project is to assist in the development of comprehensive management plans for the reef fisheries of Jamaica and Belize. The specific objective of the project is to establish these plans by: (1) Developing resource management plans based primarily upon Surplus Production models for the reef fish communities and socio-economic information. These plans are being specifically designed around a strategy of community-based resource management, that is, a system in which appropriate user groups are involved in determining what are best termed "practical methods" of controlling fishing effort, and (2) Training Jamaican and Belizean personnel in fishery management issues. This training is focusing on the fisheries harvesting, administration and research sectors. A number of persons are also undertaking higher degrees based on project data. The project was thought to be necessary due to the very poor state of the Jamaican reef fishery and although the state of Belize in reef fishery was far better, that country's lack of scalefish fishery management plan.

The Jamaican fishery has been characterized since about 1975 by several classic negative factors such as scarcity of quality commercial fish, an increase in the percentage of lower-valued species, generally smaller body sizes, and markedly reduced catches per boat. Another indicator of the decline of the reef fisheries is the high level of fish-pot stealing as the competition for the diminishing resources becomes more fierce. The fisheries of Jamaica have been described by Munro (1974), Munro and Thompson (1974) and its status discussed by Aiken and Haughton (1987) and Aiken and Haughton (in press). The reef fishery, despite its condition, is estimated to produce an average of approximately 7,000 tonnes per annum in recent years. The fishery is an open access one based on an artisanal fishery operated by about 4,500 canoes operated by approximately 12,000 men, fishing principally with traps and nets. Since 1989 there has been a thriving Queen conch (*Strombus gigas*) fishery on Pedro Bank with most of the catch being exported to the U.S.A. There is unanimous agreement however, that the resources are under intense fishing pressure, and there is great need for management of all the fishable resources.

Belizean fishery resources in contrast, are considerable. Lobster, conch, fish fillets and whole fish are exported from Belize in substantial quantity. The fishery is comprised of approximately 1,200 fishermen, 800 of whom are organized into the four major export oriented cooperatives (see Figure 3) and the remainder are independent, catching scalefish for the local markets. Much of the success of Belize's export fishery is due to the development of fishing

cooperatives. The cooperatives secure export markets each year and collect, process, and package all products for export. In recent years there has been a slight decline in levels of catches of lobster and conch. Scalefish catches are still relatively stable, though at a low level, due to traditionally low local demand. There are regulations for lobster and conch but none for scalefish, and thus the project set out to gather background information on which to base the management plan for reef fish.

METHODS

The management plan is being based on a variation of the Schaefer/Fox Surplus Production Model whose features rely on the comparisons of fishing effort versus catch level. The optimal levels of fishing effort can then be related to the simple quantitative relationship between catch rate and fishing effort per unit of reef area. It should be noted here that socio-economic information is also being used to modify the management recommendations. The project uses a modification of the simple Schaefer/Fox model called the Munro and Thompson plot. The difference is that the Munro/Thompson variation uses effort and catch at representative sites over one year with data from different fishing grounds, whereas the original model uses a data series over several years. Once these levels of fishing effort (e.g., numbers of vessels per square kilometer of shelf) are determined, then recommendations are made regarding modification of numbers and limitation of new entries into the fishery. This theory is the "core" of what is planned.

The project, therefore, is concentrating on collecting current data in both Jamaica and Belize on; (1) fishing effort (number of boats, fishing areas, number of gears of various types used, days per week fished, seasonal variation in fishing, etc.); (2) fish catches by major categories, estimated weights and species or families where possible, along with other relevant biological data; and (3) calculating catch per unit effort based on the foregoing. We also collect general data on fishing areas, fishing techniques, gear types and other equipment, fishermen's opinions on changes in the fishery for the last five years, and their attitudes towards possible management regulations.

The data collection program was divided into two parts. First, a broad-scale survey of 24 sites on the south coast (Figure 1) and Pedro Bank (Figure 2) in Jamaica and at several sites in Belize; and second, an intensive survey of six selected representative sites in both countries. Data on effort and catch was collected during personal interviews on beaches at cooperatives or at the homes of fishermen. Data was entered on special questionnaire forms.

For both countries a stratified random sample of 20% of all fishing boat captains and their crew was carried out. In Belize, because of ease of sampling in that country, length frequency of four species (*Epinephelus striatus*, *Lutjanus griseus*, *Ocyurus chrysurus* and *Haemulon sciurus*) were gathered in order to

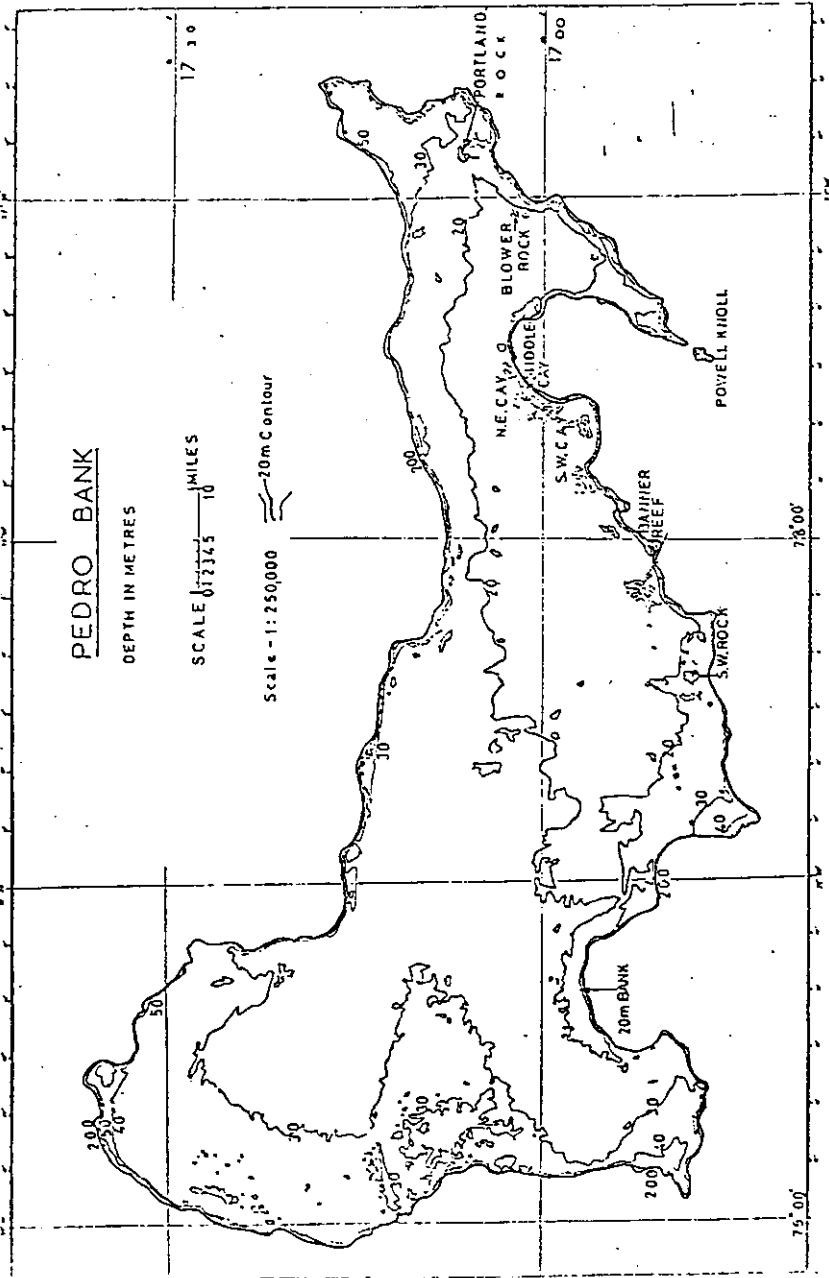


Figure 2. Pedro Bank, showing place names mentioned in the text (adapted from Munro & Thompson, 1973).

estimate growth and mortality. In Belize, due to the organization of the vast majority of the fishermen into cooperatives, use was made of the centralized landing, sorting, processing and storage facilities, following permission given by the cooperatives.

The initial or broad-scale operational/biological survey was conducted over one year in both countries and set the groundwork for the intensive survey conducted for another year. During broad-scale survey, the research assistants travelled to each of the ten sites at least twice every two months (for Jamaica, rather more frequently for Belize) and for the intensive survey, at least twice per month to the five or six special landing sites for the second year. These guidelines applied in both countries.

Due to the fact that coral reefs provide most of the harvestable resources and productivity is directly related to the distribution of corals, the project also gathered limited data on the categories and percentage substrate cover by category (live coral, seagrass, etc.). This is part of a habitat mapping program and we do not report further on this.

Importantly, an effort was made to collect socio-economic data by interviews conducted by trained fieldworkers in both countries due to the desire to allow the user group (the fishermen) to have input into the management plan. We attempted to use this data to estimate: (1) the importance of fishing and the dependence of persons on it, fishing costs and incomes, annual activity cycles; (2) the implications of possibly reduced fishing activity through overfishing or management restrictions; and, (3) the dependence of Jamaica on fish from Belize.

This project also employed an Information Officer whose role was to explain the objectives of the program and how important it was to cooperate and to provide accurate information with team members.

RESULTS

Because of the great dependence of this project on travel, all efforts were made to optimize data collection so that on many occasions a team of up to four persons visited the sites in Jamaica during the broad-scale study, often including the project leader, who helped to coordinate initial activities. Results from Belize are based on trips to sites by the research assistant employed by the project in that country.

It should be noted that this paper will only give a general overview of the main results as the detailed results will be published separately. Table 1 lists the Jamaican broad-scale and intensive survey sites where interviews were conducted. Table 2 summarizes the main features of fishing activities from the broad-scale study only, as the intensive study in Jamaica is not completed. It shows that nearly 180 interviews were done, and the boats at the sites visited, mean depths fished, gears used trips per week. Table 3 shows comparable

Proceedings of the 44th Gulf and Caribbean Fisheries Institute

Table 1. Sample sites, broad-scale and intensive surveys, in Jamaica.

Brd.	Old Pera, St. Thomas (eastern sites)
Brd.	New Pera, St. Thomas
Brd. / Int.	Port Morant, St. Thomas
Brd.	Yallahs, St. Thomas
Brd.	Holland Bay, St. Thomas
Brd.	Dalvey, St. Thomas
Brd.	Rocky Point, St. Thomas
Brd.	Port Royal, Kingston
Brd.	Rae Town, Kingston
Brd. / Int.	Greenwich Town, Kingston
Brd. / Int.	Old Harbour Bay, St. Catherine (central)
Brd.	Rocky Point, Clarendon
Brd.	Alligator Pond, Manchester
Brd. / Int.	Farquhar's Beach, Clarendon
Brd.	Alligators Pond, Manchester
Brd. / Int.	Great Bay, St. Elizabeth (western)
Brd.	Treasure Beach, St. Elizabeth
Brd.	Parottee, St. Elizabeth
Brd. / Int.	Scott's Cove, Westmoreland
Brd.	Whitehouse, Westmoreland
Brd.	North East Cay, Pedro Bank

Table 2. A summary of fisheries characteristics, from the south coast of Jamaica.

Number of fishermen interviewed =		174
Number of boats =		1232
Average depth (m) fished	(east) =	61
	(central) =	53
	(west) =	63
Gear Types (%):	Traps(%) =	71
	Nets =	31
	Hook and Line =	32
	Spearing =	3
Effort		
Aver. # fishing trips / week =		2.73 (3)

features of activities at Pedro Bank (see Figure 2). Results are discussed in the next section of this report.

Table 4 is a summary of the socio-economic survey, showing that only one third of the fishermen owned their boats. Many appeared to borrow from friends. Most had engines, and these were largely less than five years old. Table 5 provides a list of the sites examined in Belize. Table 6 shows that nearly one

Non-Peer Reviewed Section

Table 3. A summary of fisheries characteristics on Pedro Bank, Jamaica.

Number of fishermen= (resident on cays)		562
Number of boats=		125
Average depth fished (m)		
	East=	36
	Central=	45
	West=	34
Gears(%)		
	Traps (%)=	100
Effort		
Aver. # trips / wk.=		3.79 (4)

Table 4. A summary of socio-economic results (Jamaica).

Time spent net fishing	37Hrs./Wk.
Boat Ownership	
Own boat	32 %
Borrow	28 %
Who owns boat:	
Self	31 %
Family	14 %
Friend	53 %
Other	2.7 %
Boat motorization:	
Motorized	90.7 %
Engine age (< 5 yrs.)	70 %
Marketing	
Retail catch directly	83 %
Use "higglers"	50 %
Literacy	
Literate	48 %

half of the scalefish is taken not by traps as in Jamaica but by handlines. Table 7 suggests that more than one-half of the Belize fishermen believed they had detected a decrease in fish catches. However, nearly all said that types (species) remained the same. A summary of the socio-economic survey of the fishery is shown in Table 8 which indicates that one quarter of the fishermen used sailboats with engines. Incomes averaged the equivalent of about US \$25,000

Non-Peer Reviewed Section

Table 8. A summary of socio-economic results for Belize, C. A.

Boats		
	Sailboat use	25 %
	Age (~ 5 yrs.)	43 %
	Engine use	45 %
	Length (m)	7
	Material	Mahogany
Nets		
	Age (~ 5 yrs.)	53 %
Incomes		
	Aver. annual	US \$ 25,000
Literacy		
	Literate	58 %

Table 5. Sample sites, broad-scale and intensive surveys in Belize.

BROAD-SCALE STUDY SITES	INTENSIVE SITES
Sartaneja	Caribena Cooperative, San Pedro
San Pedro	Northern Cooperative, Belize City
Caye Caulker	National Cooperative, Belize City
Belize City	Belize City Market, Belize City
Mullins River	Placentia Cooperative, Placentia
Stann Creek	
Hopkins	
Independence	
Placentia	
Monkey River	
Punta Gorda	

Table 6. A summary of fisheries data from the Belize Scaefish Fishery.

FISHING METHODS	
Handline	45 %
Free Diving	24 %
Traps	16 %
Net	15 %

Table 7. Perceived changes in fish catch, size, and type, (Belize).

(% OF FISHERMEN)	CHANGES IN:		
	CATCH	SIZE	TYPE
DECREASE	55	36	-
INCREASE	4	3	-
SAME	23	55	97
SEASONAL DECREASE	11	6	-
N / A	7	-	2
DIFFERENT	-	-	1

per annum, far in excess of earnings by their counterparts in Jamaica. Nearly 60% of fishermen interviewed were literate.

DISCUSSION

It must be reiterated that this paper deliberately restricts itself to a brief general discussion of the preliminary survey results. A detailed analysis is in preparation.

There is evidence from several sources, (Munro, 1974; Hartsuijker and Nicholson, 1982; Aiken and Haughton, 1987; Koslow and Wicklund, 1988) that levels of fishing in the Jamaican fishery are very high, and are above those which produce optimal yields, (Aiken and Haughton, 1987; and Aiken and Haughton, in press). The evidence for the status of the Belize reef fishery indicates that the scalefish component is in much better state than that of Jamaica.

The present survey (see Table 2) generally confirms the presence of an intense fishing effort on the Jamaican south shelf.

Of note is the finding that high levels of net fishing are taking place and that this change away from the use of traps may be directly related to high incidence of trap piracy. Others have switched to hand lines from traps for this same reason. The average depth fished by traps on the south coast varies with the sector, in other words, deeper in the east, moderate in the center and deeper in the west. This is largely a result of the submarine topography where deeper water is close to shore in the east and less so in the other areas (see Figure 2). Perhaps the most pertinent finding in the gear usage section was the pronounced shift from traps to other gear types due to trap theft. If this trend continues, nets will, for the first time, become the predominant gear. Other aspects of the biological survey will be reported elsewhere.

The socio-economic survey showed that fewer Jamaican boat captains owned their vessels (see Table 4) than had previously been imagined. Of note was the prevalence of vessel borrowing. Again this is counter to the previous

assumption that most boats were operated by one group of fishermen. This finding has profound implications for the estimation of fishing effort as one boat may fish several times per day or may go to sea each day with successive groups of fishermen, resulting in an underestimation of overall total fishing effort if based solely on numbers of boats. Engine age was low, suggesting that lifespan was short. This may be due to a shortage of spares or the low-maintenance regime in which many Jamaican fishermen operated.

The great majority of fishermen claimed to market their catch directly which was not what was observed at the sites. Most fishermen were seen to sell directly to higglers who in turn marketed the fish for a mark-up. Approximately half of the fishermen claimed to be literate, but the true level is thought to be lower, perhaps closer to 40%.

The results for the fishery study in Belize (see Tables 6 and 7) suggest that those parts of the reef fishery examined are not presently exhibiting signs of overexploitation. Essentially, the broadscale baseline study showed that 97% of the fishermen interviewed stated that the type of fish presently caught showed the same characteristics as those taken five years ago. A total of 36% of the fishermen interviewed stated however, that they noticed a decrease in fish size, and 55% noticed a decrease in fish catch. These observations suggest that, though not overexploited, the scalefish fishery is not completely unexploited.

The socio-economic results (see Table 8) showed that one quarter of all fishermen interviewed used sailboats, and half of them had engines that were less than five years old. Almost 60% were literate, and the mean annual income (gross) was the equivalent of US \$25,000. Belizean fishermen then, generally earned more money than their Jamaican counterparts, and this may be related to the Belizean cooperatives being organized for exports. Additional results of this project will be published at the conclusion of all the intensive surveys.

ACKNOWLEDGEMENTS

This project was made possible by a grant, Project No. 870138, to the then Marine Sciences Unit, Zoology Department, UWI, Mona, from the International Center for Ocean Development, (ICOD) of Halifax, Nova Scotia, Canada. We also acknowledge the assistance of ICOD administrative officers Peter Flewelling, Christopher Milley, and John Carter. This project could not have been conducted without the close cooperation of the Directors of the Fisheries Departments of Jamaica and Belize, Roy Mooyoung and Vincent Gillett. The authors wish to specially acknowledge their help throughout the project. Professor Ivan Goodbody, acting Director of the UWI, Mona, helped put the project together with the co-author J.A. Koslow, was the first project manager and after, gave freely of his time and advice. We thank Professor J.E. Greene, Director of the Institute of Social and Economic Research, Mona, for his cooperation and advice and also Mr. Milton Haughton, then local project

consultant, who provided initial guidance to us. Part-time project information officer Warren Nicholson assisted at sample sites in 1991. We also hereby acknowledge the contribution of Wendy Parchment, Zaidie Neufville, Michael Siva, Camille Lampart and Dahlia Gillings. We are grateful also to the captain and crew of the M.V. Dolphin, Fisheries Division, Jamaica and to the drivers and boat crews of the Belize Fisheries Department who safely transported researchers to and from various sites. Lastly, we acknowledge with thanks, the continuing assistance and cooperation of the Zoology Department, UWI, Mona.

LITERATURE CITED

- Aiken, K.A. 1984. Technical aspects of the Jamaican fishing industry. Annex 1, Vol. 2. Identification of a project for the development of the artisanal fisheries sector. IICA, OAS, Kingston, March: 192pp.
- Aiken, K.A. and M.O. Haughton. 1987. Status of the Jamaican reef fishery and proposals for its management. *Proc. Gulf Carib. Fish. Inst.*, Martinique: 38: 469-484.
- Aiken, K.A. and M.O. Haughton. 1987. Regulating Fishing Effort; The Jamaican experience. *Proc. Gulf Carib. Fish. Inst.*, 40:139-150
- Espeut, P.A. and S. Grant. 1990. An Economic and Social Analysis of Small-Scale Fisheries in Jamaica. Prep. for FAO economic and social study of fisheries of English-speaking Caribbean, August: 227pp.
- Koslow, J.A., F. Hanley and R. Wickland. 1988. Effects of Fishing on Reef Communities at Pedro Bank and Port Royal Cays, Jamaica. *Marine Ecology-Progress Series* 43: 201-212.
- Munro, J.L. 1974 The biology, ecology, exploitation and management of Caribbean reef fishes. Part VI. Summary of biological and Ecological data pertaining to Caribbean reef fishes. Zoology Department, University of the West Indies, Mona. No. 3.
- Munro, J.L. and R.W. Thompson. 1974. The biology, ecology, exploitation and Management of Caribbean reef fishes. Part II. The Jamaican fishing industry, the area investigated, and the objectives and methodology of the ODA/UWI Fisheries Ecology Research Project. Zoology Department, UWI, Mona. No. 3: 44pp.
- Nicholson, W. and L. Hartsuijker. 1982. The state of the fishery resources of Pedro Bank and the south shelf. *Third Working Party on Assessment of Marine Fishery Resources*. Kingston. May, 1982. *FAO Fish. Rept.* 278 *Suppl.*:215-254 pp.