

Status of the Morant Cays Fishery, Jamaica's Second Largest Off-shore Reef Fishery

RACHEL J. PEARS¹ and ZSOLT SARY²

¹*University College of London, London, UK*

*(present address: 13 Pine Tree Avenue
Humberstone, Leicester, LE5 1AL, UK)*

²*Fisheries Improvement Programme*

University of the West Indies, Jamaica

*(present address: #1703-9595 Erickson Drive
Burnaby, BC, V3J 7N9, Canada)*

ABSTRACT

Jamaica's off-shore reef fisheries make an important contribution to the total national catch, and they employ hundreds of people who exploit these remote reef resources from tiny, oceanic cays. The status of these off-shore fisheries, and their organization, are little known. The Morant Cays is the second largest Jamaican off-shore reef fishery which exploits several small shallow banks south east of Jamaica. The Morant Cays and the banks around them are also of great scientific interest because of the assemblage of endangered organisms they support, and as a control site in the study of the severely degraded inshore reefs.

This study represents the first detailed assessment of the artisanal offshore reef fishery of the Morant Cays. It documents the present status of the fishery by examining catch and effort data to determine catch per unit effort, individual fish weights, catch composition, and mean length of the most common species. The study also describes the characteristics of the fishing community, the fishing activities and techniques, and the relative proportions of fish within the various categories of fish sold, consumed and discarded. Preliminary conclusions are drawn on the degree to which the Morant Cays have been impacted by fishing activities and recommendations are made for appropriate conservation strategies.

KEY WORDS: Fishing effort, Jamaica, reef fisheries

INTRODUCTION

The Jamaican fishing industry is predominantly a small-scale coral reef fishery which can be broadly divided into two sectors: the inshore fishery operating on the island shelf and proximal banks from mainland landing sites, and the offshore fishery operating on oceanic banks from small, remote cays. The inshore reef fishery is relatively well studied, and its state is generally considered to be heavily over-exploited (for example Munro, 1983; Koslow *et al.*, 1988; Koslow *et al.*, 1994, Sary, 1995). The status of the offshore reef fishery is much less well known. Much of the offshore reef fishery is based on two groups of tiny remote cays: the Pedro Cays whose fishers exploit the very large Pedro Banks south of Jamaica, and the Morant Cays whose fishers harvest

Proceedings of the 49th Gulf and Caribbean Fisheries Institute

several smaller banks, including the Morant Bank, east of the island. Here, the Morant Cay reef fishery is described for the first time in detail.

The Morant Cays

The Morant Cays are located 64 km south-east of Jamaica (Figure 1) on the southeastern edge of the Morant Bank (Figure 2). Several other shallow coralline banks occur in this region. These banks are typical of others found in the west-central and southwestern Caribbean (Figure 3), which are relatively flat, with depths seldom exceeding 45m and averaging 20 - 40m, dropping sharply at the edges to great depths (Munro, 1983). The Morant Bank rises abruptly from depths in excess of 1000m to a plateau with four small cays. The area of the Morant Bank within the 200m isobath is approximately 17,000 hectares. The Morant Bank is the second largest bank in the vicinity of Jamaica, but it is much smaller than the 0.8 million hectare Pedro Bank (Table 1).

Table 1. Areas of major shelves and banks around Jamaica, after Munro 1983.

Shelf/Bank	Area Of Shelf Within The 200m Isobath (X 1,000 Ha)	
South coast shelf and nearby banks	292)	
North shelf	50)	342
Pedro Bank		804
Morant Bank		17
Salmon Bank		13
Total		1,176

The Morant Cays form an arc of four small sandy cays, surrounded by a windward string of coral reefs (approximately 7 km in length), as well as extensive soft coral and seagrass (*Thalassia testudinum* and *Syringodium filiforme*) habitats (Michael *et al.*, In prep.). All of the cays are small, about 200 - 600 meters in length, and only a few meters in elevation above sea level. NE Morant Cay supports the small community of artisanal fishers who exploit the reef fish resources of the Morant and neighbouring banks. The other cays are uninhabited.

The artisanal reef fishery at the Morant Cays did not begin to develop until some years after the adoption of mechanised canoes in Jamaica which began in the 1950s (Espeut, 1992). It is generally believed that fishers were using NE Cay as a base at least as far back as the mid-1960s, but this is only confirmed

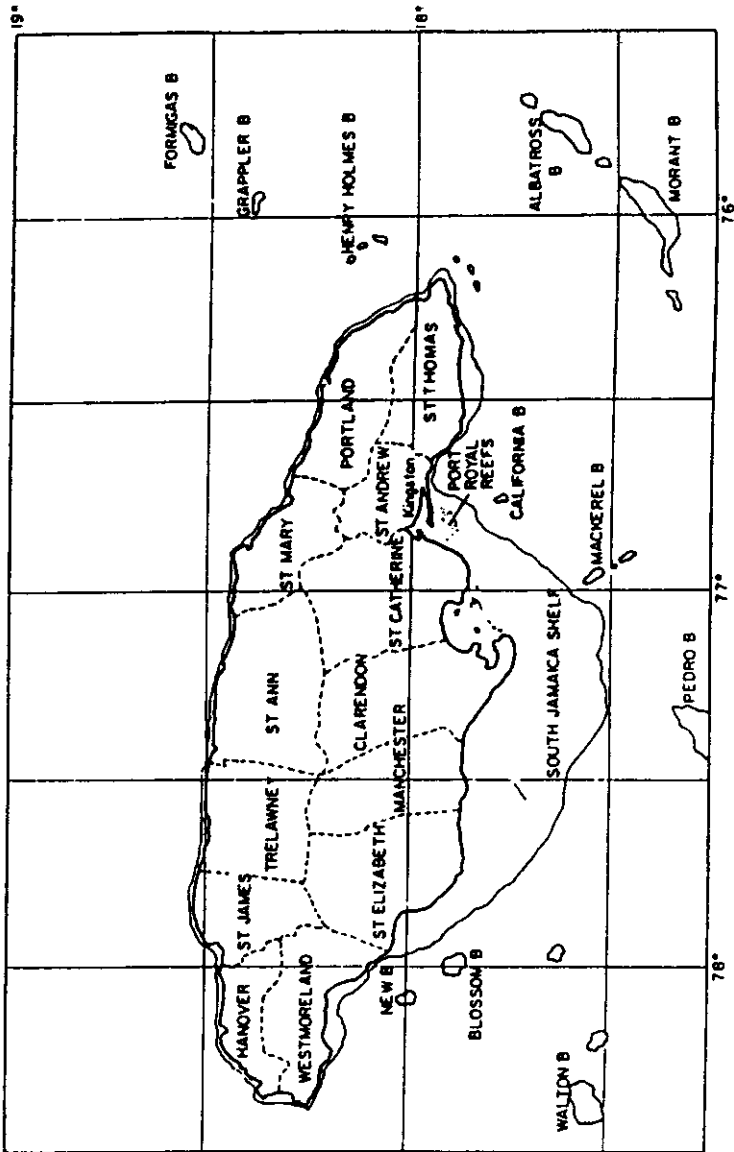


Figure 1. Map of Jamaica showing extent of shelf areas (less than 200 m) and positions of proximal oceanic banks (from Munro, 1983).

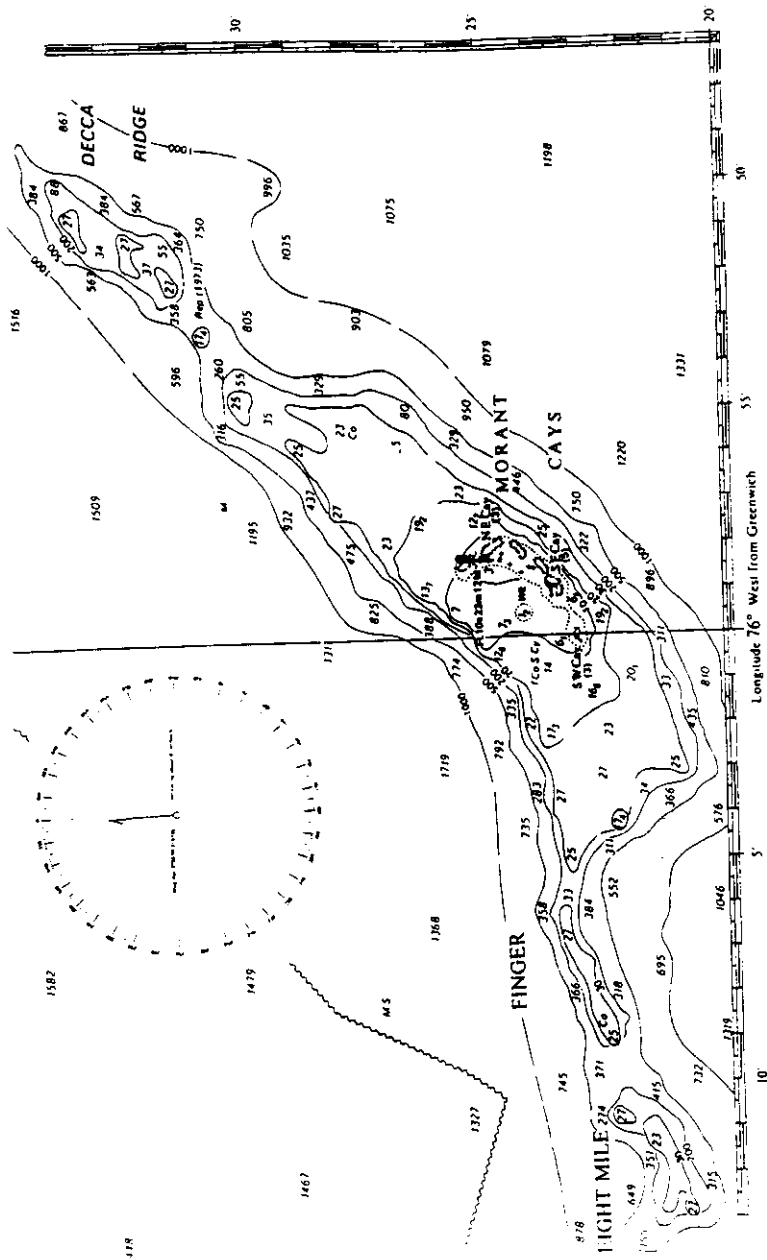


Figure 2. Map of the Morant Bank indicating fishing grounds referred to in the text. Adapted from Admiralty Chart 255. 1979.

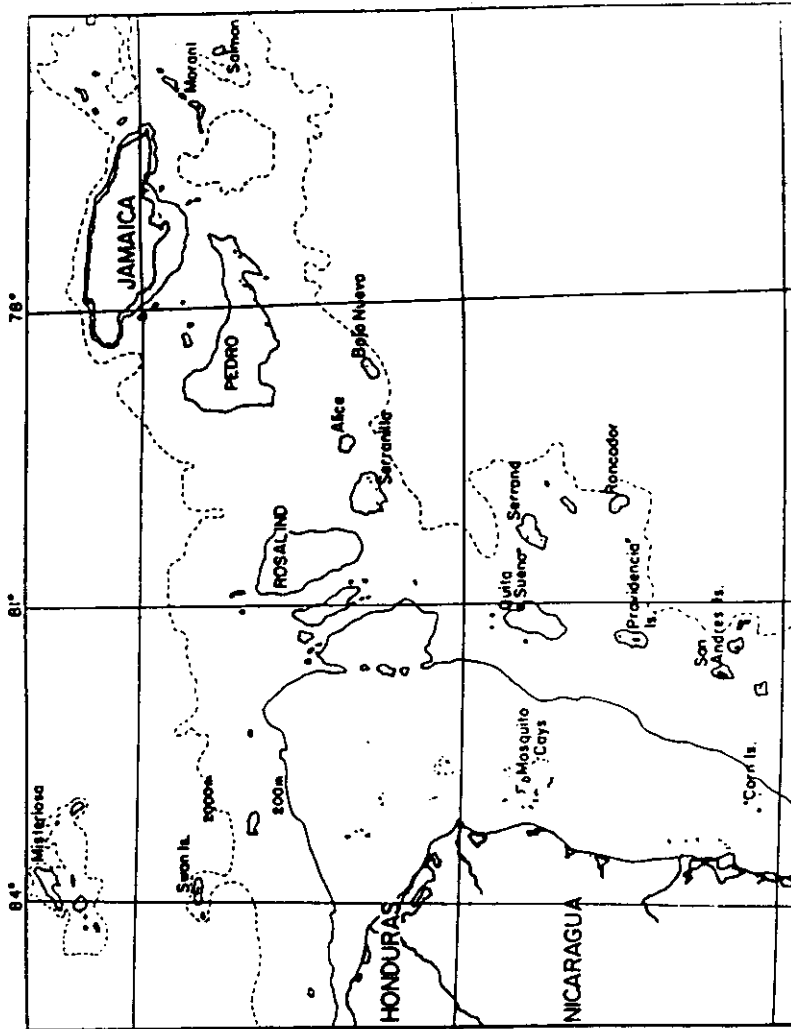


Figure 3. Map of west-central Caribbean, showing locations and extent of oceanic banks, including Pedro, Morant and Salmon Banks, (from Munro, 1983).

by the memory of older fishermen. "Booby" eggs (*Sterna fuscata* and *Anous stolidus*) were collected in large numbers to be sold on the mainland until 1982 when the seasonal protection of the nesting site on SE Cay began to be enforced (Haynes, 1987).

Development of the Morant Cays fishery has been dictated by the activity of supply boats, called "packers", and tempered by the remoteness and harshness of the area. It seems that fishing effort built up relatively gradually, reaching a peak in 1988 immediately prior to Hurricane Gilbert. Not only was Gilbert destructive, resulting in considerable loss of gear and infrastructure (Aiken, 1989), but the memory of the hurricane also had the effect of keeping many people away. Since Gilbert, fishing effort has built up quite slowly to its present level.

Importance Of The Study Site

The Morant Bank and the Cays are of special conservation and research interest in Jamaica. The cays are home to interesting bird populations, including the largest seabird colonies in Jamaica (Sutton and Aiken, 1992). South East Cay and South West Cay are important nesting sites for endangered *Eretmochelys imbricata* (hawksbill turtle) and *Dermochelys coriacea* (leatherback turtle) (*Ibid.*). The Morant Cays' sub-littoral habitats and their zonation patterns are believed to be unique in Jamaican waters, such as their unusually deep mixed coral zone (Michael, 1995). In addition, the cays have a fascinating geomorphology and interesting terrestrial habitats (Steers, 1940; Sutton and Aiken, 1992). The area is also of historic interest and have eco-tourism and recreation potential (Sutton and Aiken, 1992).

It is believed that the marine life of the banks are relatively little disturbed by human activities, and thus the area is considered important as a potential marine conservation site, and a biological control site in the study of inshore Jamaican reefs (Head, 1988). For example, the coral reefs of the Morant Bank, which are free from major terrestrial run-off, could contribute a great deal of information to the debate on the relative roles of land-based pollution and over-fishing in the recent decline of many inshore reefs in the region (Woodley, J.D., pers. comm.). The marine habitats of the Morant Cays provide an important refuge for many marine plants and animals that are increasingly threatened elsewhere in the region. Given the oceanographic setting, up-current from Jamaica, the Morant Bank might have the potential to 'seed' other areas, thus the conservation of the bank's fish populations could be important for fish recruitment in the region (Munro, J., pers. comm.) and for the replenishment of other marine life. The need for studies of the marine communities of the Morant Cays was also identified as a priority by the International Union for Conservation of Nature and Natural Resources (IUCN) with a view to declare the area as a marine park or conservation area (Head, 1988).

In theory, the Morant Cays are already protected under The Morant and Pedro

Cays Law of 1907 (amended 1953), which prohibits unlicensed trespassing, killing or disturbance of birds, egg collecting and fishing or turtle hunting within three miles (4.8 km) of the cays. Licenses are issued for fishing and used to be issued for egg collection. However, the law is completely in abeyance due to the difficulty of policing and enforcement at such a remote site (Head, 1988).

Previous Research

Prior to 1995, little was known about the marine communities of the Morant Cays due to the logistical difficulties of working offshore. A very limited assessment in December 1982 included a traverse swim over the reef area and visual observations from a helicopter (Head, 1988). Observations on fish populations were that 'far more large fish, especially of groups like triggers and snappers, were seen than would be expected on any inshore reef.' Other research on the geography and vegetation of the Morant Cays, and their avifauna, is described by Haynes (1987) and Sutton and Aiken (1992).

In 1995, the Morant Cay Research group undertook a pioneering diving expedition to the area and carried out the first baseline survey of the marine communities of the Morant Cays. The survey confirmed the biological importance of this area (Michael, 1995). No published information exist on the oceanographic conditions of the Morant Bank, except that the reefs are highly exposed, with heavy wave action over back and fore-reef (Head, 1988).

Very little has been known regarding the status of the Morant Cays fishery or its contribution to the Jamaican fishing industry as a whole. The ODA/UWI Fisheries Ecology Research Project (FERP), made a trap fishing visit to the Morant Cays, but only a small amount of catch data from the area (one night of trap fishing) was presented in the final report (Munro, 1983). Some other fishery research cruises are reported to have visited the area (including trips made by *M.V. Alcyon* and *M.V. Dolphin*), however data from these cruises is not readily available. No previous catch and effort data or length frequency information has ever been collected or published, and the characteristics of the fishers, fishing areas or organisation of the fishery were undescribed.

Objectives

This study represents the first detailed assessment of the artisanal offshore reef fishery of the Morant Cays. The primary objective of this report is to document the present status of this fishery by assessment of landed catch and effort data from the Morant Cays trap fishery, to determine a) catch per unit effort, b) individual fish weights, c) catch composition, and d) mean length of the most common species. The study also describes the characteristics of the fishing community, the fishing activities and techniques, and the relative proportions of fish within the various categories of fish sold, consumed and discarded. A further objective is to draw preliminary conclusions on the degree to which the Morant Cays have been impacted by fishing activities and make

recommendations for appropriate conservation strategies.

METHODS

Catch and effort and socio-economic data was collected at the Morant Cays during July and August 1996 by members of the Morant Cay Research diving group, the Fisheries Improvement Programme (FIP) of the University of the West Indies, and the Fisheries Division of the Ministry of Agriculture, who were based at a temporary research camp on South East Cay, and made frequent visits to the fishers community on North East Cay by inflatable boats.

Pilot Study

During the first week of the study period, a pilot study was initiated at the cays to determine the feasibility of proposed data collection methods. Informal discussions were held with fishers and packer boat operators in order to introduce the research study to them, to gauge the level of cooperation to be expected during catch and effort data collection, and to incorporate their views in developing the data collection methods which would cause the least disruption to fishing activities. An important part of this initial phase of the project was a formal meeting called specifically to explain the projects objectives, and to request fishers cooperation. All of the fishers present at the Cay as well as the crews of packer boats and other vessels stationed in the area were invited to this meeting.

Many members of the fishing community were already familiar with the Morant Cay Research diving expedition from the previous year. Additional assistance in establishing contact with the community and initiating the study were provided by a member of the Salem Fishermen's Association from St. Ann parish of mainland Jamaica, who joined the project on the invitation of FIP.

A mixture of qualitative, and where possible quantitative survey methods were used such as direct observations, interviews with key informants, group discussions, semi-structured interviews and standard questionnaires (adapted from Espeut, 1992), in order to become familiar with the fishery and the transfer of the catch to the packer boats. In addition, further information on fishing activities was obtained by accompanying cooperative fishers to sea. Methods of data collection were tested and refined. In order to test the questionnaire surveys, a fisher from each age group (< 30 years, 30 - 50 years, > 50 years) was interviewed and questionnaires were completed. Information obtained regarding the organisation of the fishery and local customs was then used to develop sampling methodology.

Landed Catch Survey

Assessment of the catch composition primarily focused on trap catches since this gear accounted for the majority of the fishing effort of the Morant Cays fishery. In addition, a small number of line catches were observed. Cooperative

fishers were asked to return to SE Cay (where the research team was based) with their catch, enabling data collection to take place by a trained team of data collectors, before the catch was transferred to the packer boats at the NE Cay. The fish in the catch were sorted to species, counted and weighed to the nearest 0.05 kg. Effort information was also collected on the number and mesh size of traps, soak time, and fishing ground(s).

Data on number of fish and weight of catch by species, and number of traps hauled were available for the 1 month period 31 July to 31 August 1996 for the fishing ground within 12 kms of the Morant Cays. Mean catch-per-unit-effort (CPUE) of all fishers sampled (as number of fish/trap/haul, and kg/trap/haul) was calculated. Mean individual size of fish was calculated for the month. Finfish and shellfish were included in the calculations.

Species were categorised in family groups [based on Koslow *et al.*, 1988, except that species not included in any fish group by Koslow *et al.*, 1988, were added to the Miscellaneous (MIX) category due to their low frequency in the catches], and mean CPUE of each group and their contribution to the total catch (as percentage of total number and of total weight) were calculated for the one month period.

Commercial Fish Categories

Informal interviews with packer boat operators were conducted to ascertain the various commercial categories of fish used in the sale of the catch to the packer boats. Observations of the sorting and sale of fish from the fishers to the packer boats were made throughout the study period. From these observations and interviews, the general species composition of each commercial category, and the relative contribution of each to the total catch, was described.

Discards

Catch and effort data collection and direct observations were used to estimate the proportion of the trap catch that is thrown away at sea during fishing operations or at the cays during sorting (by weight and number of fish). Formal questionnaires and informal interviews were used to establish reasons for discarding, and to investigate possible options to reduce discard of fish.

In order to become familiar with the process of discarding fish, fishers were first accompanied to sea to observe discarding of fish at all stages of fishing operations, from the hauling of fish traps to the eventual sale of the catch to the packer boats, without interfering directly in the process. Catch and effort data on discards were then collected from a sample of co-operative trap fishers, at sea and during the transfer of the catch to the packer boats. The fishers were asked to throw any discards into crates rather than into the sea; the number of species discarded was then noted, and their total weight and number determined. Information on number of traps and mesh size was collected from fishers. A small number of fish were still thrown straight into the sea by the fishers

Proceedings of the 49th Gulf and Caribbean Fisheries Institute

(mostly fish which were deemed to pose a danger to the crew such as rays, scorpion fish, etc.) and the numbers and weights of these were visually estimated. The mean catch-per-unit-effort of discards (in kg/trap/haul and number of fish/trap/haul) and the mean proportion of total catch discarded (by number and weight) was calculated.

Fork Length of the Most Common Species

Length frequency data for *Sparisoma aurofrenatum* (redband parrotfish) in the landed catch at the Morant Cays fishery were collected (to the nearest millimetre) during July and August 1996. This species was selected because it was the most abundant species in the catch and because the data from the Morant Cays could be directly compared to data on the same species from Discovery Bay, mainland Jamaica. Information on trap mesh size was also collected. Mean length of sampled *Sparisoma aurofrenatum*, and the proportion of terminal phase males, caught in 1.25 inch mesh traps were calculated.

RESULTS

The pilot study confirmed that fishers were interested in participating in the research project. The group meeting was very well attended, with about forty-five fishers and packer boat crew members taking part (approximately two thirds of the community). There was general agreement to take part in data collection. The meeting also emphasized the fishers interest in management of their fishery and the establishment of a cooperative group on the cays. Three preliminary questionnaire interviews were completed successfully which suggested that the main questionnaire survey would also receive a favourable reception from the fishers.

Present Status of the Morant Cay Fishery

The Fishing Area – The Morant Cays are located approximately 70 km southeast of Jamaica and they are reached in approximately three hours by small craft from the nearest mainland ports in the parish of St Thomas (Yallahs, Morant Bay, Port Morant, Bauden), and in approximately five hours from Kingston.

The fishing beach of North East (NE) Morant Cay has 46 huts constructed mainly of wood and corrugated steel (normally housing between one to four fishers per dwelling), three small shops (one with a video 'showhouse') and a lighthouse. There is no fresh water source on any of the Morant Cays and conditions are very basic. No sanitation facilities exist.

The fishing ground most regularly fished from the Morant Cays is the Morant Bank within 12 km of the cays. Other less used areas are the southwestern part of the bank which is called "Finger" approximately 14 km from NE Cay, Eight Mile Bank approximately 22 km southwest of NE Cay, Decca Ridge approximately 16 km northeast of NE Cay, and Salmon Bank

approximately 50 km to the south-east of the Morant Bank (Figure 2). In addition, a small amount of hook and line fishing, directed at pelagic and deep-slope species, takes place on the slopes and in deep water (> 200m) surrounding the banks.

Very little is known about the marine habitats of the Morant and neighbouring banks, however a detailed description of the shallow water habitats of the Morant Bank is in preparation (Michael *et al.*, *in prep.*).

The Fishers – The Morant Cay fishing industry consist of the following players: 1) fishers who are actually based on North East Morant Cay for extended periods of time, from a few weeks to over a year, 2) packer boat crew who ply between the mainland and the cays to ferry supplies to resident fishers and take the catch back to mainland markets and 2) fishers in 'run-across' boats who actually fish on the banks but are not based at the cays for long periods of time, and take their own catch back to mainland markets; and (iv) the crew of other motorized vessels which occasionally visit the banks, including foreign industrial vessels exploiting *Strombus gigas* (queen conch) and *Panulirus argus* (spiny lobster) from the Morant and neighbouring banks (this segment of the fishery is not considered further in this report). The basic set-up is similar to that of Pedro Cays (see Grant *et al.*, 1995).

Questionnaire interviews were conducted with a total of 61 fishers. The number of fishers based at North East Morant Cay at any one time during July and August 1996 ranged from 60 to 80. The list of licensed fishers registered within the Licence and Registration System (LRS) of the Jamaica Fisheries Division in June 1996, suggested that only 12 fishers held valid licences to fish from the Morant Cays (< 15% of actual number of active fishers there). However, some others may hold licences from other mainland Jamaican landing sites. A third of the fishers have been fishing from the Morant Cays for all of their fishing careers. Amongst the remainder, almost half have moved to the Morant Cays within the last two years (Table 2).

Fishers reside only temporarily on the cays, while their permanent residences are on mainland Jamaica, where many have wives and families. Typically, fishers stay on the cays for 3 - 4 months and then return to the mainland for 1-2 months before repeating the cycle. However, this patterns may vary greatly between individuals. Some stay on the cays for only a few weeks a year, and there is one fisher who has been on the cays for a continuous stretch of 19 months. Fishers generally make arrangements with family members or friends to maintain and use fishing gear, boats, and other possessions on the cays during their absence. For example, trap owners often arrange for someone else to haul their traps while they are away, and the earnings from the catch are shared.

Proceedings of the 49th Gulf and Caribbean Fisheries Institute

Table 2. Number of years fishing experience and number of years in the Morant Cays fishery, of fishers based at Morant Cays during July and August 1996, show as percentage of respondents to formal questionnaire (Appendix 1). Number of respondents was 45.

Range (in years)	<2	3 - 9	10 - 19	>20
Years fishing experience	2%	49%	36%	13%
Years in Morant Cays fishery	31%	38%	27%	4%

All of the fishers are male, aged between 14 and approximately 70. The age distribution of the fishers is shown in Table 3. No women are normally present on the cays, since under the terms of the Morant and Pedro Cays Act women or children are not allowed to live on the cays. Occasionally boys under the age of 14 do visit the cays for a few days with older family members.

Table 3. Age of fishers based at Morant Cays during July and August 1996, shown as percentage of respondents to formal questionnaire (Appendix 1). Number of respondents was 61.

Age (in years)	<30	30 - 50	>50
	43%	39%	18%

The breakdown of primary roles of the cay's residents within the fishery is presented in Table 4. Ninety seven percent of residents are active fishers, 8% are involved in other businesses on the cays (shopkeepers or fish trap builders), and 3% are not active fishers.

Fishing Gears – An estimated 400 - 500 fishing trips per month are made by resident fishers at the Morant Cays. The main fishing method used is the Antillean Z-trap, and trap fishing accounts for an estimated 80% of all fishing trips. The traps are constructed by the fishers at the cays using galvanised mesh 'chicken wire' and wooden sticks brought from the mainland.

There are an estimated 973 fish traps currently in use at the Morant Cays (mean number of traps is 12 per fisher, or 25 per trap owner), virtually all of which are 1.25" mesh. Most of the traps (883, 91%) are set less than 12 km from NE Cay, while approximately 70 traps (7%) are set on Eight Mile (22 km from NE Cay), all of them owned by two fishers, and 20 traps (2%) on Decca

Ridge (16 km from NE Cay), all owned by one fisher. Fishers set their traps in depths of between 6 and 60 m, with the majority in the 30 to 50 m depth range. Only a few fishers use bait in their traps. Typically, traps are soaked for three days, although weather conditions or absence of 'packer boats' may dictate a longer soak. The mean soak time of 252 sampled traps was 3.2 days.

Table 4. Primary roles of residents on the Morant Cays in the fishery, shown as percentage of respondents to a formal questionnaire. The number of respondents was 61.

Role	Owner/Captain	Captain	Crew	Other
	25%	13%	54%	8%(1)

Hook and line, spear, and net fishing also takes place. An estimated 25% of fishing trips made during the study period involved hook and line fishing, 5% involved spear fishing, and less than 1% involved net fishing. A small amount of fishing effort is also directed at pelagic species and deep-slope species using hook and line.

Over half of the fishers use more than one gear type. However traps are the primary gear type for 84% of the active fishers, 10% are primarily spear fishers and the remainder (6%) use hook and line as first choice.

Fishing is conducted from fibreglass reinforced plastic (FRP) boats, which are 8 to 9 meter long, open type canoes, each powered by generally one 40 to 75 horsepower outboard engine. Approximately 18 active fishing boats are currently based at the Morant Cays, but only eleven are registered as fishing from the Morant Cays in LRS database (June 1996). Five of the fishing boats are owned by people *not* currently resident on the cays. Four of the fishing boats are jointly owned by two or more family members residing on the cays. In addition, two or three temporarily inactive boats were stationed there awaiting repairs.

Several 'packer boats' bring fuel, water and other supplies for the fishers. Once a packer boat arrives at the cays, the fishers go out to sea to haul their traps and then sell their catch to the packer boat. The packer boats generally stay at the cays for three to five days, continuously buying fish in an effort to fill up their large hold areas (2000 - 4000 kg) before returning to the mainland to market the catch. Approximately 35 packer boat trips were made during July and August, 1996.

In addition, 'run-across' boats regularly use the cays as a temporary base (staying for up to six days) to conduct their own fishing activities, but they do not buy fish from resident fishers on the cays. Most of these boats are the same FRP type canoes as the resident fishing boats. Approximately 36 run-across trips were made by such open canoes, and two trips were made by a larger vessel

Proceedings of the 49th Gulf and Caribbean Fisheries Institute

with a compressor on board (based at Port Antonio, Jamaica) during the same period.

Lack of packer boats or adverse weather conditions were observed to prevent fishing activity by Morant Cay fishers on several occasions. Several unsuccessful fishing trips (no catch) were observed for all gear types in use, when strong currents prevented fishers from locating fish traps or deploying their other gears. Rough seas and strong currents also result in loss of gears.

The Catch – A total of 252 fish traps, all 1.25 inch mesh, were sampled from the Morant Bank fishing grounds within 12 kms of the cays, between 31 July and 31 August 1996 (one month period).

Catch Per Unit Effort – The catch performance characteristics of sampled traps is summarized in Table 5. A total of 4,769 fish, weighing 746.22 kg were taken by the 252 sampled fish traps. The mean soak time of sampled traps was 3.2 days. The mean catch rate of the trap fishery on these fishing grounds is therefore 2.96 kg/trap/haul or 18.9 fish/trap/haul of commercially valuable fish. These figures do not include fish which were discarded (see section on discards).

Table 5. Summary of catch performance characteristics of fish traps sampled at the Morant Cays from 31 July to 31 August, 1996. All fish traps sampled were 1.25" mesh.

CHARACTERISTICS

N (Number of traps hauled)	252
Mean kg/trap/haul	2.96
Mean number of fish/trap/haul	18.9
Mean weight of individual fish (kg)	0.16
Mean soak (days)	3.2
Number of finfish species	50

Individual Fish Weights – The mean size of finfish was 0.16 kg, and only 10 finfish species had mean size greater than 0.30 kg (*Lutjanus apodus*, *Sparisoma chrysopterum*, *Haemulon carbonarium*, *H. plumieri*, *Balistes vetula*, *Priacanthus arenatus*, *Cantherhines macroceros*, *Scorpaena plumieri*, *Urolophus jamaicensis*, *Pomacanthus paru*) of which only the first six are commercially marketable. The most valuable of these are the schoolmaster (*Lutjanus apodus*; the heaviest species recorded at mean size of 1.22 kg) and the redbtail parrotfish (*Sparisoma chrysopterum*; mean size 0.31 kg).

Catch Composition – Catch composition of fish traps is shown in Table 6. The most dominant family group, both in terms of numbers and weight, is the

small parrotfish (SSC), which accounts for one third of the total catch (35.5% of the total number and 32.5% of the total weight). The next most dominant groups by numbers are the surgeonfish (ACN, 21.8%) and squirrelfish (HOL, 15.9%), but they are less significant in terms of weight (HOL, 12.5%, ranked third; ACN, 11.6%, ranked fourth) than the trigger and filefish (BAL, 20.9%, ranked second). Other groups accounting for more than 4% by weight are the small groupers (SSR, 6.9%) and the large parrotfish (LSC, 4.8%). Of these, only the small groupers number more than 4% of the catch. The high value jacks (CAR), snappers (LUT) and goatfish (MUL) are rare (< 1% by number of total catch) and large groupers (LSR) are completely absent from the sampled catches (two species of large groupers were observed in trap catches during the study period but not in the samples).

On the species level, by far the most dominant species by weight is the redband parrotfish (*Sparisoma aurofrenatum*) comprising 24.0% of the catch, and the queen triggerfish (*Balistes vetula*), comprising 18.6% of the catch. Only three other species account for more than 5% of the total weight each: the squirrelfish (*Holocentrus rufus*), the princess parrotfish (*Scarus taeniopterus*), and the ocean surgeon (*Acanthurus bahianus*). In terms of numbers, five species each account for more than 5% of the total catch. These are the redband parrotfish (27.7%), the ocean surgeon (16.1%), the squirrelfish (11.3%), the queen triggerfish (9.0%), and the princess parrotfish (*Scarus taeniopterus*, 7.8%). Thirty six of the 50 species of finfish caught are rare (<1% of the total number of fish caught). Many valuable species such as most groupers and snappers are extremely rare or completely absent from the catch. There were a total of 50 species of finfish and one species of shellfish in the samples. Finfish account for 99.9% by number and 99.7% by weight. The only shellfish species recorded was the spiny lobster (*Panulirus argus*).

In addition, there were 14 other species of finfish and one species of shellfish which were observed in trap catch but not in the samples, and 11 other species observed in the catches of other gears but not in traps. Thus the total number of species encountered was 75 finfish, and two shellfish. Hawksbill turtle were also caught incidentally by net and deliberately by speargun.

Sorting of Fish – The catch is sorted during fishing operations when many unmarketable, or fish potentially dangerous to the crew, are discarded. Most of the sorting however takes place at the packer boats by the fishers, and the process is supervised by the packer boat crew. Depending on the type, and for certain species the size, fish are either sold, consumed locally or discarded. Commercial categories for trap and spear catches are “Quality”, “Common”, and “Trash”. Lobster are sold separately. Hook and line catches are also usually sold separately, but most these fish sell as “quality” fish.

Table 6. Catch composition of fish traps sampled at the Morant Cays between 31 July and 31 August 1996, shown by numbers of individuals and by weight (kg) for each fish group. Groups modified from Koslow *et al.*, 1988. Only finfish are shown.

Code	Group	Family	# Fish	% of Total	W (kg)	% of Total	kg/Trap/Haul
SSC	small parrotfish	Scaridae	1694	35.5	242.70	32.5	0.96
BAL	trigger & file fish		485	10.2	156.32	20.9	0.62
HOL	squirrelfish	Holocentridae	758	15.9	93.65	12.5	0.37
ACN	surgeonfish	Acanthuridae	1042	21.8	86.43	11.6	0.34
SSR	small groupers	Serranidae	236	4.9	51.75	6.9	0.21
LSC	large parrotfish	Scaridae	117	2.5	36.00	4.8	0.14
HAM	grunts	Haemulidae	107	2.2	24.15	3.2	0.10
TET	puffers & boxfish		104	2.2	19.5	2.6	0.08
LUT	snappers	Lutjanidae	12	0.3	12.7	1.7	0.05
MIX	miscellaneous		154	3.2	12.07	1.6	0.05
MUL	goatfish	Mullidae	41	0.9	5.4	0.7	0.02
CAR	jacks	Carangidae	16	0.3	3.6	0.5	0.01
LSR	large groupers	Serranidae	0				0.00

Commercial Categories – The “quality” fish category includes the largest parrotfish, snappers, groupers, jacks, and goatfish, and generally they are bought by the packer boats for J\$50/pound. (US\$3.15/kg). The “common” fish category generally includes most parrotfish, grunts, and wrasses, and they are bought for about \$30/lb. (US\$1.90/kg). The “trash” fish category tends to include small sized parrotfish, larger sized surgeonfish, the queen triggerfish (*Balistes vetula*), squirrelfish, and a few miscellaneous species (e.g. *Priacanthus sp.*), which are generally bought for J\$24/lb. (US\$1.50/kg). Lobsters are generally bought for J\$100/lb. (US\$6.30). Unmarketable fish are the smallest individuals of some species, small surgeonfish, most file and triggerfish, puffer and boxfish, and many miscellaneous fish (such as *Chaetodon sp.*, *Equetus sp.*, *Scorpaena sp.*, etc.).

The estimated proportion of the total catch weight for each category are: “quality” fish makes up 13% of the catch, “common” fish 25%, “trash” fish 44%, and unmarketable fish 18%. Unmarketable fish are either consumed locally or discarded. However, many other fish, especially “quality” fish, are also selected for local consumption, which are either consumed fresh by fishers, salted for later consumption (called “corn fish”), or sent back to family and friends on the mainland (via the packer boats). Over 40 species are consumed locally.

Discards – Fish may be discarded because it is 1) too small or an unmarketable species caught incidentally during fishing operations (by-catch), 2) excess to requirement, or 3) spoiled.

Excess catch is rare, but occasionally fishing activity is poorly coordinated between the fishers and the packer boats, and whole catches may be rejected if the packer boat has already reached full capacity. Spoilage of fish may be a problem, especially if mechanical failure or other delays cause an unintentional extension of a fishing trip. Only packer boats carry sufficient ice to store fish, and if the fisher does not reach the packer boat quickly, or if there is no packer boat stationed at the cays, the catch may spoil. By-catch is normally the largest component of the discard. These fish are rejected by the packer boats because they are not easily marketed on the mainland.

During data collection, six boats were accompanied to sea to monitor discards, and a total of 137 traps were sampled (mean soak time was 3.2 days). Twenty two species were found to be discarded all the time, and seven species were discarded only when small. The mean weight of discarded fish was 0.11 kg. The mean weight of discarded fish was 0.57 kg/trap/haul, and the mean number of discarded fish was 5.3 fish/trap/haul. If these figures are added to the mean catch per unit effort of commercially valuable fish, of the mean total catch per trap of the Morant Cay fishery is 3.10 kg/trap/haul, or 21.1 fish/trap/haul.

Fish Fork-Length – The fork lengths of 863 *Sparisoma aurofrenatum*

(redband parrotfish) were measured, and the mean size was calculated to be 191 mm. Forty four percent of the fish sampled were terminal phase males. The largest individual was 237 mm (terminal phase) and the smallest was 108 mm (initial phase).

DISCUSSION

Jamaica's inshore reef fisheries are believed to be one of the most overexploited in the Caribbean (Government of Jamaica, 1994; Hughes, 1994; Roberts, 1995). As a result, the off-shore based reef fisheries have become increasingly important in supplying the island's large population with fresh fish. Despite their growing importance, the state of these off-shore reef fisheries has never before been investigated. This report represent the first assessment of Jamaica's second largest off-shore reef fishery, the Morant Cay fishery.

The Morant Cay fishery has become an important research topic, not only because of its contribution to the Jamaican fishing industry, but also as a control site in the study of inshore reefs. Overfishing of inshore reefs has been blamed for the critical degradation of the reef ecosystem itself (Hughes, 1994). There is, however, vigorous debate over the relative importance of overfishing and land based-pollution to the spectacular decline of Jamaica's inshore reefs. Research in more remote areas, such as the Morant Cays, which are free from terrestrial run-off, could provide important clues to the discussion.

At the same time, the Morant Bank and other nearby banks are of conservation interest as well. The area has been proposed as a marine reserve by the IUCN. Because of their location, upstream from Jamaica, the coral reef ecosystem here could provide seed stock to replenish the overexploited and degraded inshore areas.

A management plan for the Morant Bank requires knowledge of the reef habitats, the commercially important fish stocks, and the key threats to them. At the present time, fishing appears to be the most significant human impact on the Morant Cays. Hence, an important component of a management plan for the cays is outlining strategies for the sustainable use of fishable resources (Sutton and Aiken, 1992). Consequently, understanding the Morant Cays fishery is considered a high priority.

Status of Morant Cays Fishery

The Morant Cays fishery is characteristic of the Jamaican fishing industry in that it is artisanal, small-scale, and that most of the fishers operate independently or in small groups. Traditional Antillean Z-traps are the primary gear used, and fishing takes place from open canoes. There are approximately 18 active fishing boats based at the cays, all of them are eight to nine meter FRP-type boats, each powered by an outboard engine. Many of the boats are shared, which seems to contrast the situation in the Pedro Cays fishery (Grant *et al.*, 1995), and may be an indication of either a less wealthy fishery or of a more co-operative

atmosphere.

Living conditions for the fishers on the cays are generally harsh and infrastructure very basic. Recent additions to the cays infrastructure, such as the new video 'showhouse' and a refrigerator, suggest that the situation is beginning to improve. However, this tiny and remote fishing village is very vulnerable to severe weather conditions, and a hurricane, such as Gilbert in 1988, could devastate infrastructure overnight. Thus, fishers tend not to invest much capital in their dwellings.

Current levels of fishing pressure appears to be relatively high, with fishers making 400 to 500 fishing trips per month, using nearly 1,000 fishtraps, and other gears. According to fishers, however, this level of fishing activity is below the level reached in 1988. It is no longer true that traps are used almost exclusively (as was reported to be the case for the off-shore cays during the early 1970s by Munro, 1983) since approximately one third of the fishing pressure is now from other gear types such as hook and line, spear and gill-net.

Fish Catches and Productivity – Trap catches at the Morant Cays are large compared to some inshore Jamaican fisheries. The catch per unit effort of 1.25" mesh traps at the Morant Cays was 2.96 kg/trap/haul (3.10 kg/trap/haul if discards are included) which is more than three times higher than in Discovery Bay, on mainland Jamaica, even though soak time of traps is similar (data from Discovery Bay is from July-December 1994, in a year when significant improvements in catch parameters were noted after management efforts, and in a time period which included large catches of snappers in October/November; Sary, 1995b). On the family level, the catch of file and triggerfish in 1.25" mesh traps at the Morant Cays (0.62 kg/trap/haul) is 31 times higher than in Discovery Bay; the catch of large parrotfish (0.14 kg/trap/haul) nearly five times higher, and the catch of small groupers (0.21 kg/trap/haul) three and a half times higher (Sary, 1995b). The mean size of fish caught in 12.5" mesh traps at the Morant Cays (0.16 kg) is 33% larger than in Discovery Bay (Sary, 1995b). The mean length of the most common species in the catch of 1.25" mesh traps, the redband parrotfish, is more than 20 mm larger than in Discovery Bay (Sary, 1995a).

Thus, the Morant Cays trap fishery appears to be very productive. Theoretical weekly fish landings from fish traps, assuming each active trap is hauled twice, is of the order of 40,000 fish, weighing approximately 6,000 kg. If the landings from other gear types (estimated to account for 28% of fishing trips made by resident fishers), plus the catch from run-across boats and other vessels, were added, the productivity for the Morant Cays fishery may be in the order of 36 metric tonnes of fish per month. According to statistics for other Jamaican fisheries (unpublished data from Fisheries Division on inshore and Pedro Cays fisheries), the Morant Cays appear to be contributing about 5% of the total national fishing catch while utilizing only 3 or 4% of the effort. This

estimation is consistent with the high catch rates observed at the Morant Cays. Nonetheless, some of the indicators are suggesting that the Morant Cay fishery is over-exploited. Trap catches consist mostly of small, low value fish (mean size 0.16 kg, 44% trash fish). Many of the higher value fish are extremely rare or absent. Wastage in the fishery is high: discards account for 18% of the trap catch by weight, 25% by number.

The Morant Cays fishery is currently supporting several hundred people who are directly involved in the fishery, and their relatives. This includes the 60 - 80 fishers based at the cays during the study period, and perhaps as many Morant Cays fishers again currently on the mainland, plus crew of packer boats, run across boats and other vessels fishing in the area, and also others on the mainland such as vendors and fish-scalers. Clearly, the Morant Cay fishery is an important fishery to the people and the economy of Jamaica.

Factors Affecting the Development of the Morant Cay Fishery

The Morant Cays fishery appears to have remained generally healthier than other Jamaican fisheries, but this is certainly not due to enforcement of fisheries regulations or other management efforts, since the area has received virtually no attention from fishery authorities in the past. The isolation and distance from the mainland is one of the key factors that hampered early attempts to exploit the fishable resources of the Morant Bank and continues to be a factor in limiting development of the fishery today. Lack of fresh water on the cays has made settlement there difficult. Very basic living conditions and lack of sanitation continue to deter people from living at the cays. The harsh weather and sea conditions that are often experienced in the area, including strong winds, squally showers, major storms and hurricanes which can inundate the cays, has discouraged settlement of new fishers, and put resident fishers at risk. Storms and surge result in frequent gear damage and loss. This reduces numbers of active gears in the area and also increases costs to the fishers, thereby discouraging the build-up of the fishery. The high cost of materials to build gears, in any case may be a limiting factor on development.

Packer boat activity directly influences the pattern of fishing at the Morant Cays. Capacity and frequency of packer boats which visit the cays dictate the amount of fish which can be caught and sent back to the mainland for marketing. This appears to be limiting fishing effort at the cays. Packer boats arrive at the cays at irregular intervals, and there is no direct communication between the cays and mainland. Fishing is only for local consumption when no packer boat is stationed at the cays since there are no storage facilities to store any surplus catch. The packer boat activity is very dependent on weather since the journey between the mainland and the cays can be extremely hazardous in rough weather for these small boats. If bad weather prevents packer boats from reaching the cays for an extended period of time, the resident fishers can run dangerously low on basic supplies, such as drinking water. Packer activity is also dictated by

cash flow, since the packers need money for fuel and payment to fishers. Packer boat crews supervise the sorting of catch prior to sale and consequently they influence how much fish is discarded. The packer boat operations are restricted by the availability and ease of marketing the catch back on the mainland. For instance, excess lobster is rejected once the packer has obtained his pre-arranged quota (presumably agreed with hotels or vendors) despite the high price it commands.

Complex social structure and customs are at least partly responsible for retarding further development of the fishery. Various factors such as no women on the cays (as prescribed by The Pedro and Morant Cays Act), separation from families, and lack of things to do when not fishing tend to limit the time a fisher stays on the cays in any one visit.

Management Options for the Morant Cay Fishery

While it is true for any fishery that fishers should play an integral role in planning, implementing and enforcing fishery management measures, this is particularly important for a remote, difficult to monitor fishery such as the Morant Cays. Thus, the formation and the development of a cooperative group among the Morant Cay fishers should be encouraged so the fishers who regularly use the cays may have a meaningful voice in the future of their fishery. This process began during the study period with encouragement from the Morant Cay Research group and the Fisheries Improvement Programme. During the formal meeting which was called to introduce the objectives of the study, the fishers voiced a desire to form a group in order to improve the infrastructure of their fishing base and to develop their fishery. A few weeks later, the fishers came together to elect a committee to lead the Morant Cays Fishermens Association. This group, however, is in its infancy, threatened among many other things by the transient nature of its members, and it should be encouraged to develop by government and NGO fishery organizations.

The fishers main concern appears to be to improve their safety while stationed the cays. They unanimously wanted a permanent communication link established between the Morant Cays and mainland Jamaica. Fishers also would like to improve other aspects of the cay's infrastructure, particularly the construction of sanitary facilities. Ideally, the fishers association should be assisted in building appropriate dry toilet facilities, such as those recently established on mainland fishing beaches, which would not pollute the waters near the cays.

Fishers would also like to see a reduction of the high level of wastage in the fishery. Many fishers suggested that a larger mesh size may reduce the by-catch in the fishery and contribute to the long term health of fish stocks. Thus, it may be possible to encourage the use of 1.5" mesh on the cays, through education programs and economic incentives.

Another suggested possibility to reduce discards was to develop a mainland

Proceedings of the 49th Gulf and Caribbean Fisheries Institute

market for "corn fish" (dried and salted fish produced in the Morant Cays' constant hot breeze) which is very similar (some say superior) to salted cod, an expensive and popular imported item in mainland supermarkets. Excess catch or otherwise unmarketable fish may be dried and stored on the cays, until ready to ship to the mainland.

Eventually, it may be desirable to limit the number of fishers at the cays, through a local licensing arrangement with the fishers association. With the same approach, protected areas of the banks may be established seasonally or permanently. However, at the present time, fishers do not appear to show much support for these management options.

LITERATURE CITED

- Aiken, K.A. 1989. Hurricane Gilbert and its effects on fishery resources. Pages 30 - 39 in: Bacon, P. (ed.). Assessment of the economic impacts of Hurricane Gilbert on coastal and marine resources in Jamaica. CEP Technical Report No. 4. UNEP Caribbean Environment Programme, Kingston.
- Espeut, P. 1992. Fishing for finfish in Belize and the south coast of Jamaica: a socio-economic analysis. Report of a project funded by the International Centre for Ocean Development, Nova Scotia, Canada, and executed by the Fisheries Department, Belize, the Fisheries Division, Jamaica, and the University of the West Indies, Mona, Jamaica. xxxv + 301 p.
- Haynes, A.M. 1987. Human exploitation of seabirds in Jamaica. *Biological Conservation* 41:99 - 124.
- Head, S. 1988. Morant Cays Managed Area. Pages 184 - 185 in: Wells, S. (ed.). *Coral reefs of the world: Atlantic and Eastern Pacific*. UNEP/IUCN, pp.
- Hughes, T.P. 1994. Catastrophes, phase shifts, and large-scale degradation of a Caribbean coral reef. *Science* 265:1547 - 1551.
- 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.
- Koslow, J.A., K.A. Aiken, S. Auil and A. Clementson. 1994. Catch and effort analysis of the reef fisheries of Jamaica and Belize. *Fish. Bull.* 43(3):201 - 212.
- Michael, C. 1995. Interim report: Morant Cay Research, 1995 *Diving Expedition*. Unpubl. Mans.
- Michael, C. Final report of Morant Cay Research. In prep.
- Munro, J.L. (ed.). 1983. *Caribbean Coral Reef Fishery Resources*. International Center for Living Aquatic Resources, Manila. 266 p.

- Sary, Z. 1995a. Responses of an overexploited Caribbean trap fishery to the introduction of a larger mesh size in Discovery Bay, Jamaica. M.Sc. Thesis, University of the West Indies, Barbados. 112 p.
- Sary, Z. 1995b. Progress in the Fisheries Improvement Programme, Discovery Bay, Jamaica. Presented at the 48th Annual Meeting of the Gulf and Caribbean Fisheries Institute, Santo Domingo, Dominican Republic, November 1995.
- Steers, J.A. 1940. Sand cays and mangroves in Jamaica. *The Geographical Journal* 96(5):305 - 328.
- Sutton, A. and K. Aiken. 1992. Offshore Cays. Conrad Douglas and Associates. 23 p. Unpubl. Mans.