Catch Analysis at Discovery Bay, Jamaica: The Status of an Artisanal Reef Fishery

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ABSTRACT

The north coast of Jamaica is fringed by a narrow submarine shelf with a maximum width of one kilometre. Artisanal reef fishing is therefore concentrated in this narrow area, and its impacton fish stocks is believed to be relatively high. Catches at the two beaches located in Discovery Bay have now been investigated for over two years, starting in May, 1989.

In 1990-1991 the estimated total catch by about 60 fishermen was 25 tonnesper year. Catch per unit effort for traps, spears,lines and nets were all low, for example, 0.2 kg/trap/day. The catch was dominated by the herbivorous parrot and surgeon fishes, while preferred families such as snappers and groupers were scarce. An age and growth study using daily rings on otoliths suggests that the ocean surgeon (*Acanthurus bahianus*) is growing very quickly, entering the fishery at an age of 6 months. Length-frequency data suggest that it, and other reef fish species, are suffering a high fishing mortality.

KEY WORDS: Catch composition, growth parameters, overexploitation, Jamaica.

INTRODUCTION

Overfishing of coral reefs has become a widespread problem. One of the impacts of fishing on coral reef fish communities has been demonstrated by Munro (1980) who showed that serranids, lutjanids, and carangids are relatively less abundant in heavily exploited nearshore areas of Jamaica than in remote areas.

The Fisheries Improvement Project has been monitoring the catch of fishermen based in Discovery Bay, which is on the north coast of Jamaica, for over two years (Allison, 1989; Vatcher,1990). As the submarine shelf in this area is not more than one kilometre wide, this artisanal fishery is concentrated into a narrow strip ranging from Rio Bueno to Runaway Bay, a distance of 9 km. Thus by recording catches at Discovery Bay, it is possible to estimate the total catch taken from the adjacent shelf. The fishermen use a variety of gear

types: the Z-trap, spear, hook and line, and nets, of which the first two are most commonly used. Data were collected on total catch, catch composition, catch per unit effort and length and weight of six target species. This report provides a preliminary analysis of some of these data.

METHODS

There are two fishing beaches in Discovery Bay, about 1 km apart. When beach data was first collected in May 1989, both beaches were monitored on a daily basis. This routine was changed in February 1990 when monitoring was reduced to twice a week; once to collect catch composition and total catch data and once to collect length-weight data. In July, 1990, sampling was reduced to only once a week at the beach so as not to further inconvenience the fishermen and to ensure continued cooperation. "Beach days" are assigned evenly to the different days of the week, but are randomly selected. Catch per unit effort was calculated monthly for each gear used.

Length-weight data were collected from all gear types for the following six species: *Acanthurus bahianus* (ocean surgeon), *Sparisoma viride* (stoplight parrotfish), *Epinephelus cruentatus* (graysby), *Sparisoma aurofrenatum* (redband parrotfish), *Holocentrus rufus* (squirrelfish) and *Mulloidichthys martinicus*. (yellow goatfish). .A graduated board (in mm) was used to measure the fork length (FL) of the specimens. This is the distance from the anterior end with the mouth closed to the end of the middle caudal rays. This is equal to the total length (TL) in species with truncated or rounded caudal fins. The fish were weighed to the nearest 5 g, using OHAUS scales ranging from 100-2000g.

Pannella (1971) re-examined the microstructure of fish otoliths and concluded that the rings present were formed on a daily basis. Subsequent studies have confirmed the presence of these daily rings, which have been used in determining the age of larvae and juveniles of tropical fish (Ralston, 1976; Brothers, 1980,1982).

The sagittae otoliths of forty-three *Acanthurus bahianus* from a range of sizes were removed and mounted on glass slides using flo-texx mounting medium. They were then ground using worn pieces of 600 grade carborundum paper and de-ionized water and polished with 0.1 um diamond grit to remove scratches. The otoliths were viewed on a black and white television connected to a Carl Zeiss photo microscope (final magnification = 2500x). Counts were made starting at the nucleus and moving outward along the long axis. Each otolith was then read three times, and the mean of the counts was the the final value used in computations. These estimates of age and length data were used in the determination of asymptotic length L and growth coefficient K.

RESULTS and DISCUSSION

On our sampling days, total catch was not obtained from all the fishermen in Discovery Bay. This was due to the fact that some of the fishermen do not leave nor return to either of the two beaches. There are at least four groups that have been under- samplied: (1) spearfishermen, who can enter and leave the water at several points, by day or night, (2) fishermen who fish from the rocky shores, especially at night, (3) drive-netters on the shallow fore-reef and (4) hook and line fishermen who go out at night. Moreover, in the bustle of a busy beach, we sometimes missed fish that were sold from a newly returned canoe before we were been able to measure them.

The estimated total catch from the two beaches in Discovery Bay was 25,000 kg in 1990, and 16,000 kg in the first nine months of 1991. The area fished has not been accurately determined. However if we assume that the "territory" of Discovery Bay fishermen extends along the island shelf in each direction halfway to the adjacent fishing beaches of Rio Bueno and Runaway Bay, the shelf area fished is approximately 5km^2. Munro (1983) found that harvests of 4-6 tonnes/km^2/year are attainable, and so the production of 5 tonnes/km^2 for 1990 of largely coral-reef covered shelf is not an unrealistic figure.

Twenty-five tonnes of fish would have been sold in 1990, for about J$825,000. This income would have been shared among about 60 fishermen. Thus the mean income from fishing was J$13,750 (equivalent to about US$1,900 in 1990). Some fishermen expend more effort than others, so a medium income figure would probably be more appropriate.

Catch composition data show that in 1990, 49.17% of the overall catch by weight was made up of parrotfishes (scaridae) and surgeonfishes (acanthuridae), while preferred species such as snappers (lutjanidae) and jacks (carangidae) comprise only 3.55% and 2.94% respectively. A similar situation occured in 1991, with parrotfishes and surgeon-fishes making up 55.59% of the overall catch by weight, while snappers and jacks comprise only 2.98% and 2.31% respectively (Table 1). The groupers (serranidae), at 5.01% (1990) and 4.85% (1991) of overall catch were largely represented by the smaller species such as the coney (*Epinephelus fulvus*) and graysby (*E. cruentatus*). This catch composition is characteristic of an over-exploited fishery (Munro,1983; Koslow, Hanley and Wicklund, 1988; Russ and Acala, 1989).

The average catch per unit effort data are presented in Table 2. Catches per trap per day of soak, at around 0.2 kg, are very low; an order of magnitude less than those estimated on the south coast by Clemetson and Aiken (this volume). Net figures include drive netting, which is a form of fishing now carried out on the shallow fore-reef at Discovery Bay, made possible due to the destruction of *Acropora palmata* from Hurricane Allen in 1980.

Table 1. Catch composition by family/groups for Discovery Bay. Values are % by weight in rank order.

FAMILY / GROUP	1990	1991
Scaridae	36.15	42.68
Acanthuridae	13.02	12.91
Miscellaneous	9.89	8.37
Holocentridae	8.8	6.82
Pomadasyidae	5.29	5.08
Serranidae	5.01	4.85
Lutjanidae	3.55	2.98
Clupeidae	3.23	2.79
Carangidae	2.94	2.31
Mullidae	2.55	1.56
Crustacea	1.9	1.44
Muraenidae	1.44	1.39
Mollusca	1.22	1.32
Priacanthidae	1.03	1.24
Gerridae	0.81	1.18
Diodontidae	0.76	0.8
Ostracidae	0.72	0.69
Pomacentridae	0.63	0.59
Monacanthidae	0.60	0.45
Balistidae	0.22	0.45
Scombridae	0.02	0.11

Table 2. Average catch per unit effort in Dicovery Bay by gear type.

	1990	s. d.	N	1991	s. d.	N
Pot (kg / day soak)	0.17	0.07	405	0.22	0.06	338
Spear (kg / hr)	0.79	0.17	222	0.75	0.16	164
Hook / Line (kg / hr)	0.67	0.39	69	0.47	0.12	91
Net (100 m) (kg / hr)	1.38	1.2	20	0.82	1.27	9

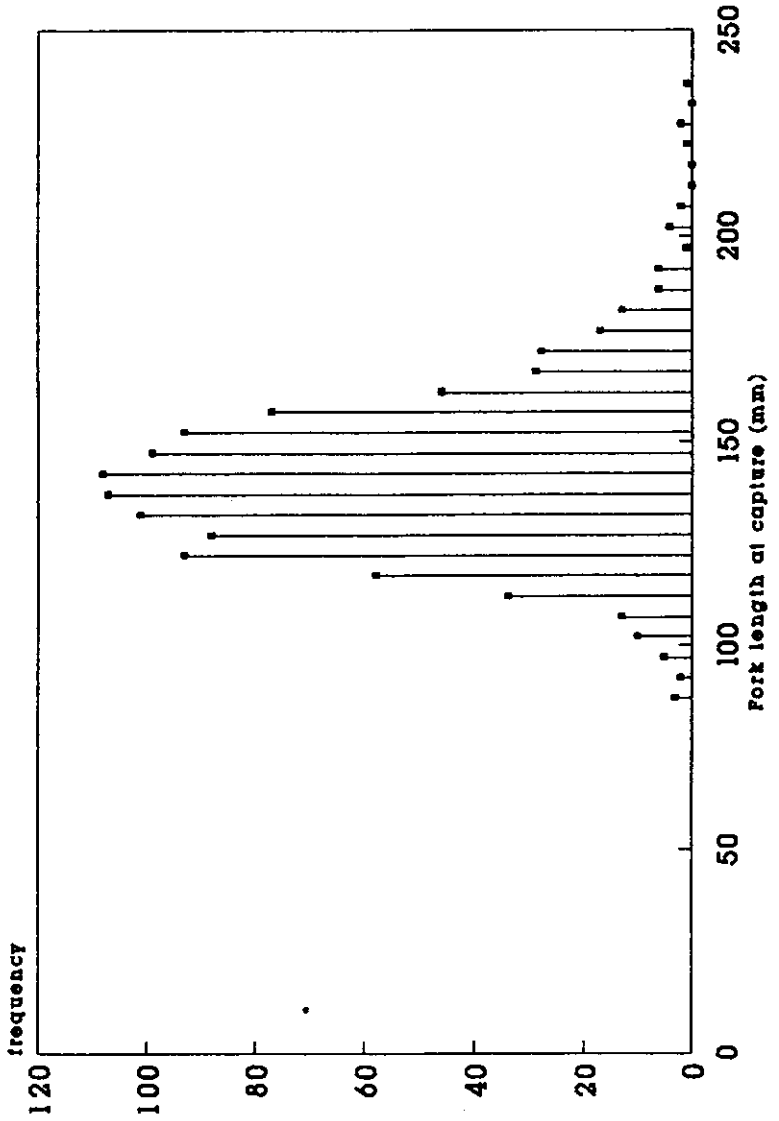

Figure 1. Length frequency distribution of *Acanthurus bahaianus* (Ocean Surgeon) captured by all gear types at both beaches in Discovery Bay, August 1990 to September 1991.

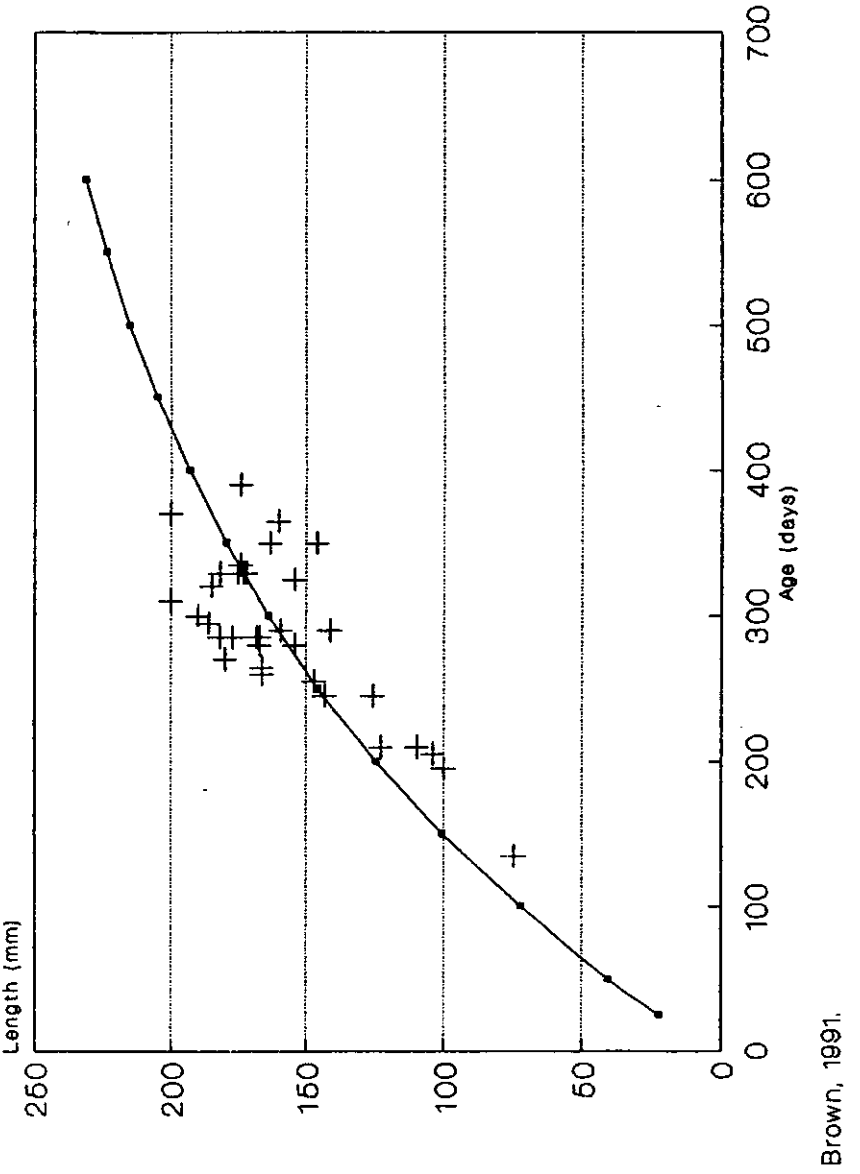

Figure 2. Growth rate of *Acanthurus bahaianus* (Ocean Surgeon) in Discovery Bay.

The age and growth studies (Brown, 1991) indicate that the Loo *Acanthurus bahianus* is 270 mm. This is very close to the estimate of 280 mm provided by Munro (1983) and suggests that the daily aging technique is valid for this species. The K value of 1.06 (0.0029 on a daily basis) indicates that growth is relatively rapid.

Length data from catch samples of the selected species show that the majority are being caught when small; larger fish are rare in the samples (Figure 1). Growth rates estimated for *Acanthurus bahianus* (Brown, 1991) suggest that they enter the fishery at about six months old and are nearly all captured before they are one year old (Figures 1 and 2). Our length frequency data will allow us to estimate growth parameters, of the selected species using the ELEFAN program, but these analyses are incomplete at present.

In conclusion, the preliminary analysis of our data tends to confirm what has long been suspected: that the coral reef fish communities in the vicinity of Discovery Bay have suffered heavy exploitation.

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