Effects of the Increase in Trap Mesh Size on the Discovery Bay Fishery

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ABSTRACT

In 1991, the Fisheries Improvement Project (C.I.D.A./Trent University/University of the West Indies) initiated a programme to increase the average mesh size of the fish traps used in Discovery Bay, Jamaica (Sary *et al.*, 1996). In a two-for-one exchange, the project collected 250 small-mesh traps (3.3 cm; "1 inch" and 4.1 cm; "1.25 inch") from fishermen and handed out 6270 m^2 of larger size (5.5 cm; "1.5 inch") mesh, enough to construct approximately 500 new traps. As a result, the percentage of the large mesh traps increased from 3% to 70% in this small, artisanal fishery. However, due to the subsequent unavailability of the large mesh, this programme has not been completed.

Nevertheless, continued monitoring of catches on the fishing beaches has shown an increase in length-at-first-capture, and a change in size frequency distribution of redband parrotfish (*Sparisoma aurofrenatum*), that could be attributed to the change in gear.

The mesh exchange programme has not yet significantly improved the catches in Discovery Bay for several reasons: 1) the remaining 30% small mesh traps still have a substantial impact on this heavily exploited fishery; 2) there are several gear types besides traps that are contributing to overfishing; and 3) some effects such as increases in spawning and recruitment may not show up in the data for several years. However, the trends detected are valid incentives to complete the exchange programme and to encourage starting new ones elsewhere in the Caribbean.

INTRODUCTION

Background

Overfishing has been recognised in Jamaica for many years (Munro, 1983; Aiken & Haughton, 1987) and has recently been documented at Discovery Bay, on the north coast (Miller *et al.*, 1996; Picou-Gill *et al.*, 1996). Antillean Z-traps, made of sticks and mesh wire, are the principal gear used to harvest reef fish in Jamaica. In Discovery Bay, until recently, the two kinds of mesh wire most commonly used have maximum apertures of only 3.3 cm and 4.1 cm (known as the "1 inch" and "1.25 inch" mesh). Note that, maximum aperture refers to the largest opening accross the wire and is not equivalent to the imperial measurements given. These retain such small individuals of economically important species that fish of more valuable size become scarce and the reproductive potential of the stock may be reduced. These effects, coupled with the concentration of effort onto a very narrow, but accessible fringing reef system, have led to particularly severe overfishing on the north coast of Jamaica.

After simulation studies on the likely effects of different mesh sizes on the multi-species reef fishery, Munro recommended (in 1974) an increase to "two inch" mesh. This seemed the best compromise between marketing requirements, the utilization of all available species, and the protection of the greatest proportion of immature fish. The Fisheries Division of the Ministry of Agriculture encourages a progressive increase in mesh size; at their recommendation, only "1.25 inch" and "1.5 inch" (maximum aperture 5.5 cm) mesh are normally available from the Jamaica Co-operative Union, the principal source of fishing gear. This source no longer stocks "1 inch" mesh but, because chicken farmers use it, it can still be bought in hardware stores.

The "Two-for-One Mesh Exchange"

While many fishermen recognised the ill effects of "fine mesh" on the fishery, further progress towards the general use of larger mesh sizes was unlikely because: (a) they were reluctant to suffer the initial burden of reduced catches, and (b) they thought it would be futile to make the change individually, and impossible to organize simultaneous change collectively. These obstacles were overcome by the "two-for-one mesh exchange" organized in Discovery Bay by the Fisheries Improvement Project (Sary *et al.*, 1996). This Project (Canadian International Development Agency (CIDA)/Trent University/University of the West Indies) has been working with the fishermen of Discovery Bay since 1988 (Allison, 1989; Vatcher, 1990; van Barneveld *et al.*, 1996).

The Project had budgeted funds to supply larger gauge mesh wire to fishermen (who normally build their own traps), and selected "1.5 inch" since it was readily available and was not too big an increase. The larger mesh was issued in exchange for fish traps, in working order, made of small-gauge mesh. Further, we gave sufficient wire to build two traps, for each one that we took in. In this way we: (1) removed the "fine-mesh" trap from the fishery, (2) replaced it with larger-mesh gear and (3) compensated the fishermen for potential loss of income by increasing the number of his traps.

This process was effective in helping the Discovery Bay fishermen to change their gear (Sary *et al.*, 1996). Up to October 1991, 42 of the 47 active trap fishermen had brought in a total of 199 small-mesh traps, in exchange for 85 rolls (45.7 x 1.52 m; 50 yds x 5 ft) of larger-mesh wire. Before the exchange programme began, 5.5 cm mesh traps made up only 6% of the total number of traps used in Discovery Bay. Six months later, this figure increased to 68%, while 3.3 cm mesh had declined from 21% to 1%. Preliminary data were presented (Sary *et al.*, 1996) on differences in the size-selectivity of the three mesh-sizes that had been used in Discovery Bay. The present paper reviews the further progress of the mesh exchange programme and examines catch data for any changes that could be attributed to the exchange programme.

METHODS

The Mesh Exchange Programme

Up to the end of 1991, 90 rolls (6270 m^2) of 5.5 cm mesh was supplied to fishermen partcipating in the mesh exchange. Forty-four of the 47 active fishermen exchanged traps. Two of the other three men were already using it; only one fisherman refused to take part in the programme.

The fishermen continued to bring in small mesh traps to the Project in the hope of getting more large mesh - in total, 250 small mesh traps were turned in. Unfortunately, since January 1992, the Project has not been able to obtain any more of the large mesh. The Jamaica Cooperative Union, the usual supplier of fishing gear, failed to stock the wire in the beginning of the year, and was still waiting for its order of large mesh to be filled in October 1992. Consequently, the Project was not able to finish the mesh exchange programme despite having funds in its budget to do so. Some fishermen are still owed large mesh since the beginning of the year. Many fishermen have reluctantly turned back to the 4.1 cm mesh since the large mesh is unavailable anywhere on the island. In August 1992, Kaiser Bauxite Company, the major employer in Discovery Bay, offered to ship large mesh wire from the U.S. and donate it to the Project. Unfortunately, this shipment too has yet to arrive.

Consequently, the composition of large mesh traps has not increased in 1992 and is still estimated to be about 70% of all the traps used (based on a recent survey of 49% of active trap fishermen). This figure was possibly higher in the summer months, as the old, small mesh traps gradually broke down or were turned in to the Project, and has now dropped due to the new small mesh traps that are being built for the autumn fish season.

Catch Data

Catches brought in to the two fishing beaches in Discovery Bay, about 1 km apart, have been monitored since January 1989 (Picou-Gill *et al.*, 1996). Since July 1990, catches have been sampled weekly at each beach, on weekdays selected systematically. In other words, each day of the week was sampled at least once at both beaches during each two month period. Data have been collected on catch composition and total catch by weight, and on effort, for traps and other gear types. Since August 1990, fork lengths have been measured on the following six species: the graysby (*Epinephelus cruentatus*), the ocean surgeon (*Acanthurus bahianus*), the redband parrotfish (*Sparisoma aurofrenatum*), the stoplight parrotfish (*Sparisoma viride*), the squirrelfish (*Holocentrus rufus*), and the yellow goatfish (*Mulloidichthys martinicus*).

Data Analysis

Gear selectivity. Length data for five of the six measured species were too few or too irregular for satisfactory analysis. The largest continuous set of fork length data was obtained for *Sparisoma aurofrenatum*. Samples obtained from the catches of all traps in use at the two beaches were pooled by three-month periods, corresponding to the quarters of the year, and given a single mid-quarter date. Using these data, Munro's (1983) estimates of the growth parameters K and L were refined, using the ELEFAN I programmes of the COMPLEAT ELEFAN software (Gayanilo *et al.*, 1989).

Length-converted catch curve analysis was performed on the same data set, using the ELEFAN II programme, with data weighted by the square root of percentage sample size. Instantaneous natural mortality (M) was estimated by Pauly's (1980) equation, built into ELEFAN II, using a sea temperature of 27.5° C. The programme also yielded estimates of total mortality (Z) and thus fishing mortality (F = Z - M). The same programme was used to construct selection ogives and to estimate L50, representing length at first capture (L_c).

The percent composition of the 30 most abundant species in catches by 4.1 cm mesh and 5.5 cm mesh traps were compared for the period of July 1990 to June 1992.

Consequent catch changes. Length frequency distributions of *S. aurofrenatum* caught by 4.1 cm traps were compared for two periods, August 1990 to April 1991 (before the mesh exchange) and August 1991 to April 1992 (corresponding period one year later).

The mean weights of fish caught by all traps were calculated on a monthly basis, and by traps of each of the different mesh sizes.

From the catch data and reported soak times, finfish catch per unit effort (CPUE) was calculated (kg/trap/day) for all traps, and for traps of each of the different mesh sizes.

The total catch of the Discovery Bay trap fishery was estimated for bi-monthly periods between July 1990 and June 1992.

RESULTS AND DISCUSSION

Gear Selectivity

The quarterly length frequency data for *S. aurofrenatum*, from July 1990 to September 1992, are presented in Table 1.

Figure 1. Estimated quarterly L50 values for the redband parrotfish (*Sparisoma aurofrenatum*) between August 1990 and September 1992.

Munro's (1983) estimate of L =260 mm, was unchanged, while his estimate of K at approximately 0.5 was refined to 0.67. The quarterly estimates of Z, M, F, L_{50} and L', derived from these data, are shown in Table 2. Figure 1 plots L_{50} through time for this species, and shows an increase over the period of the trap change from about 155 to about 165 mm. This confirms that the proportion of larger- mesh traps in use at Discovery Bay has indeed increased, and the overall selection ogive has shifted to the right.

One would expect the larger mesh size to sample the reef fish community differently. Table 3 shows the percentage caught of the thirty most abundant species over the two-year period by 4.1 cm and 5.5 cm mesh sizes. Since the larger mesh caught fewer species (77 compared with 90), one might expect specific catch percentages with that gear to be slightly larger. In fact, most species, including *S. aurofrenatum*, show a decline, offset by large increases in a few species, such as the yellowtail parrotfish (*S. rubripinne*), *S. viride* and the blue tang (*Acanthurus coeruleus*).

Consequent Catch Changes

The increase in L_{50} represents a higher survivorship in the smallest previously selected size classes. As these individuals grow, there should be increased recruitment to larger size classes. This could show up as changes in the length frequency distribution, as increases in the mean weight of fish caught - beyond what is expected only by the absence of smaller fish in the catches - and, ultimately, as increases in CPUE and total catch.

Table 4 lists percentage length frequency distributions, plotted in Figure 2, of *S. aurofrenatum* caught in 4.1 cm mesh traps, in a ten-month period before the mesh exchange and the corresponding ten-month period a year later. The distributions are significantly different (Mann-Whitney U-test, $p < 0.001$). The percentage frequencies were converted to cumulative frequencies, presented in Figure 3. It is evident that the later sample includes relatively more individuals in size classes above the early L' (Table 2), fully recruited to the fishery by that gear. Substitution into the von Bertalanffy growth equation of the growth parameters determined above suggest that*S. aurofrenatum* would grow from 155mm to 165mm in only two months, to 180mm in another three months.

Table 5 presents data (total weight, total number, and mean weight) on the bimonthly samples for all species of finfish caught in traps. Tables 6, 7, and 8 present similar data separated into the three mesh sizes. The totals for all traps pooled are more than the sums of the data presented on separate mesh sizes, because they include data collected from mixed trap samples. The mean weights are shown in Figures 4 (all traps) and 5 (separate mesh sizes).

The mean weight of fish trapped has risen since the gear change, due to the mean weight of fishes caught by the 5.5 cm mesh being greater than that retained by the others. There are three possible reasons for this, and we cannot

Table 1. Quarterly length-frequencies for *Sparisoma aurofrenatum*.

Length (mm)	Aug/ Sep90	Oct/ Dec90	Jan/ Mar91	Apr/ Jun91	Jul/ Sep91	Oct/ Dec91	Jan/ Mar92	Apr/ Jun92	Jul/ Sep92
107-111				1					
112-116									
117-121					1				
122-126	2	2		1	1				
127-131	1	3	2	5	2	1		2	
132-136	7	7	4	8	4	1		3	4
137-141	23	12	4	11	10	3	1	8	1
142-146	45	31	24	36	35	13	5	24	8
147-151	58	17	25	45	58	25	17	30	17
152-156	74	54	40	64	92	34	25	58	36
157-161	68	44	43	66	114	38	41	85	70
162-166	39	33	38	69	105	40	44	113	74
167-171	28	27	26	53	72	28	44	97	79
172-176	38	16	30	30	67	34	41	80	67
177-181	22	12	16	23	32	19	24	51	60
182-186	20	10	17	12	19	15	22	47	49
187-191	11	5	7	6	13	13	13	36	35
192-196	3	3	3	5	18	8	12	18	19
197-201	4	2	4	1	6	6	8	16	18
202-206	2		3	2	6	5	4	8	16
207-211				1	2	3	2	2	7
212-216			1		3	1	1		5
217-221					2			1	1
222-226									1
227-231				1			1		
TOTAL	445	278	287	440	661	287	305	679	568

Table 2. Estimated values of Z, M, F, L50, and L' for *Sparisoma aurofrenatum*.

Sampling Period	Z	M	F	L50	L'
Au/Se90	6..9	1.42	5.48	150.41	156.5
Oc/De90	7.73	1.42	6.31	151.67	156.5
Ja/Ma91	6.15	1.42	4.73	154.29	161.5
Ap/Ju91	9.88	1.42	8.46	155.62	166.5
Ju/Se91	7.92	1.42	6.50	155.53	161.5
Oc/De91	5.2	1.42	3.78	154.65	166.5
Ja/Ma92	6.04	1.42	4.62	162.74	166.5
Ap/Ju92	6.71	1.42	5.30	162.96	166.5
Ju/Se92	5.59	1.42	4.17	164.80	171.5

determine their relative contribution. Mean weight will be increased, first, by the escape of fishes that would have been retained by the 4.1 cm mesh and, secondly, by increased recruitment to large size classes. These are direct effects of the mesh change, but there is a third, indirect, effect. Large mesh wire is often used to build bigger traps, which tend to trap more large fishes.

Catch per unit effort (kg/trap/day) is presented in Tables 9, 10, 11 and 12. Table 9 presents data for all traps combined - more than the sum of separate mesh sizes - and Tables 10, 11 and 12 present data for 3.3 cm, 4.1 cm and 5.5 cm mesh respectively.

The results are graphed in Figures 6 and 7. Values vary widely, for which there are several possible explanations. There might be seasonal variation in the abundance or catchability of fish, leading to the late summer peaks in 1990 and 1991; but there was no such peak in 1992. This might partly have been due to increased competition with the operation of drive nets (Picou-Gill *et al.*, 1996) in the last year.

Also, it seems that, as small-mesh traps became scarcer, there was an increase in their effectiveness. This is especially apparent in the very high CPUE values for the 3.3 cm mesh traps that were obtained during the mesh exchange in the summer of 1991.

There was a large increase in the CPUE for 4.1 cm mesh traps in March/April 1992, since which it has fallen, although to levels that are still twice as high as recent CPUE values for the 5.5 cm mesh traps. The effectiveness of these large mesh traps seems to have fallen.

Estimated total catches for the trap fishery in bimonthly periods between July 1990 and August 1992 are presented in Table 13 and shown on Figure 8. Seasonal peaks are again evident, especially in the season of carangids and serranids in September/October (in addition, there was in May 1991 an unusual

Table 3. Comparison of the percent catch composition of 4.1 cm amd 5.5 cm mesh traps indicating thirty commercially important species in the Discovery Bay fishery.

Species	4.1 cm mesh (%)	5.5 cm mesh (%)
Acanthurus bahianus	11.79	9.92
A. chirurgus	1.41	1.08
A. coeruleus	1.83	15.36
Caranx bartholomaei	1.15	0.24
C. hippos	0.00	0.70
C. ruber	1.78	0.70
Epinephelus fulvus	1.72	0.16
E. cruentatus	2.13	1.30
Haemulon flavolineatum	3.35	0.61
H. plumieri	0.99	1.59
H. sciurus	0.38	1.06
Lutjanus analis	1.41	0.37
L. synagris	0.49	0.13
L. apodus	0.68	3.77
L. jocu	0.36	0.86
L. mahogoni	0.06	0.16
Ocyurus chrysurus	1.37	0.26
Holocentrus rufus	5.88	0.68
Myripristes jacobus	0.54	0.24
Mulloidichthys martinicus	1.87	1.02
Pseuduopeneus maculatus	1.54	0.19
Scarus croicensis	3.20	0.66
S. taeniopterus	2.50	0.97
Sparisoma aurofrenatum	20.89	5.65
S. chrysopterum	9.00	10.58
S. rubripinne	1.83	9.39
S. viride	3.56	16.40
Lactophrys polygonia	0.94	0.60
Diodon hystrix	1.41	2.08
Balistes vetula	0.87	3.23

Table 4. *Sparisoma aurofrenatum* length frequencies caught in 4.1 cm mesh traps during two sampling periods.

Midpoint of Length Group (mm)	August 90-April 91		August 91-April 92	
	Frequency	Percent	Frequency	Percent
125	2	0.27	0	0.00
130	4	0.53	1	0.36
135	10	1.33	0	0.00
140	30	3.98	4	1.43
145	57	7.57	12	4.29
150	98	13.0	30	10.7
155	95	12.6	33	11.8
160	117	15.5	42	15.0
165	82	10.9	50	17.9
170	76	10.1	41	14.6
175	62	8.23	19	6.79
180	46	6.11	19	6.79
185	34	4.52	15	5.36
190	19	2.52	4	1.43
195	9	1.20	6	2.14
200	10	1.33	1	0.36
205	1	0.13	0	0.00
210	1	0.13	1	0.36
215	0	0.00	2	0.71
TOTAL	753		280	

influx of Nassau groupers, *Epinephelus striatus*). November 1991 to April 1992 was more productive than the similar period in the previous winter, but the total catch in the summer was much less than last year. This is partly due to the number of traps being about 40% less than the previous year, but the CPUE data confirm that it has not been a good season.

Of course, our study has a sample size of only one, and a duration of little more than one year. There are many confounding factors at work and whatever changes we see, apart from the direct effects of gear selection, it is premature to attribute them to the mesh exchange programme. Nonetheless, we and most of the fishermen are confident that it has been worthwhile, and hope that the process can be sustained and extended in Jamaica, and elsewhere in the Caribbean.

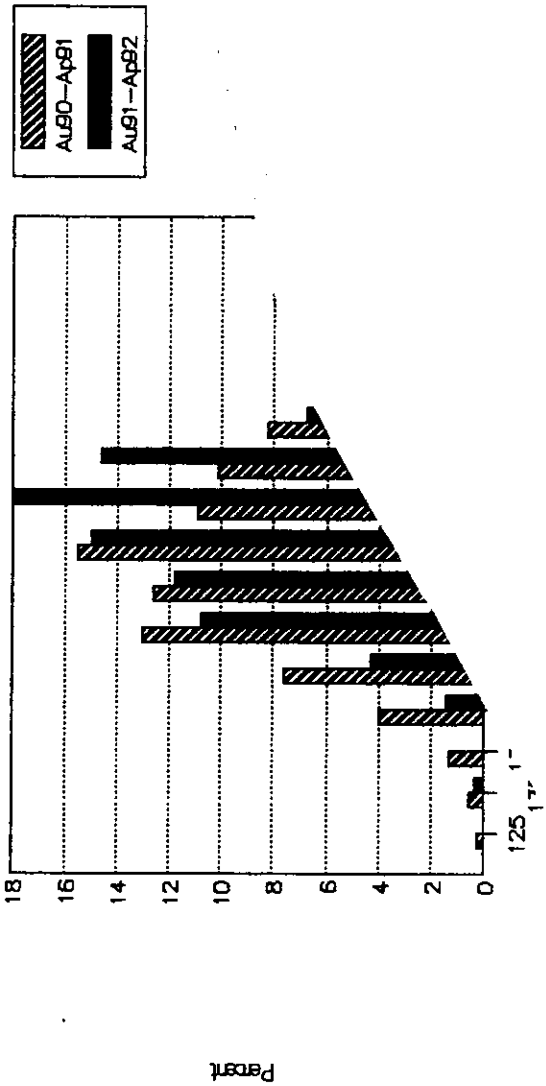

Figure 2. Comparison of percent frequency distributions of *Sparisoma aurofrenatum* size classes caught in 4.1 cm mesh traps between the periods August 1990-April 1991 (before mesh exchange) and August 1991-April 1992 (after the mesh exchange).

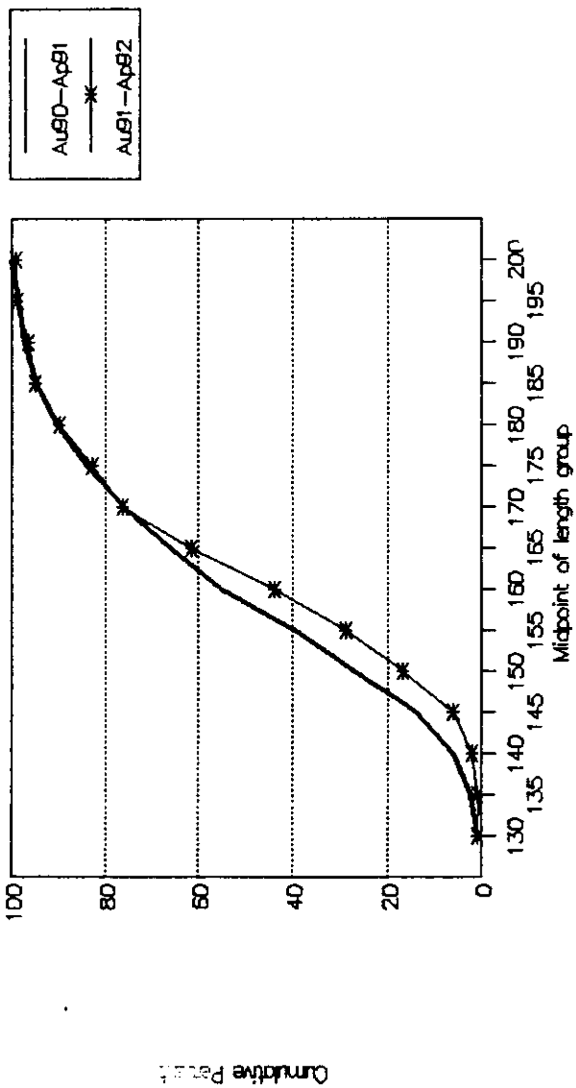

Figure 3. Comparison of cumulative percent frequencies of Figure 2.

Table 5. Mean weight of fish captured in traps (all traps combined) between July 1990 and August 1992 in Discovery Bay.

Sampling Period	Number of Fish in Sample	Total Weight of Sample (kg)	Mean Weight of Fish (kg)
Ju/Au 90	1984	236.61	0.119
Se/Oc 90	3225	377.46	0.117
No/De 90	972	112.26	0.115
Ja/Fe 91	935	111.02	0.119
Ma/Ap 91	1497	168.87	0.114
Totals Before Mesh Exchange	8603	1006.22	0.117
Ma/Ju 91	2516	345.76	0.137
Ju/Au 91	2617	344.28	0.132
Se/Oc 91	1940	313.29	0.161
No/De 91	755	138.59	0.184
Ja/Fe 92	1440	268.12	0.186
Ma/Ap 92	1657	246.77	0.149
Ma/Ju 92	958	119.16	0.124
Ju/Au 92	1535	218.44	0.142
Totals After Mesh Exchange	13418	1994.41	0.149

Table 6. Mean weight of fish captured in 3.3 cm mesh traps between July 1990 and August 1991 in Discovery Bay.

Sampling Period	Number of Fish in Sample	Total Weight of Sample (kg)	Mean Weight of Fish (kg)
Ju/Au 90	247	22.01	0.089
Se/Oc 90	125	12.09	0.096
No/De 90	201	14.15	0.070
Ja/Fe 91	145	11.56	0.080
Ma/Ap 91	108	12.04	0.111
Ma/Ju 91	185	21.04	0.114
Ju/Au 91	246	27.29	0.111
TOTALS	1257	120.18	0.096

Table 7. Mean weight of fish captured in 4.1 cm mesh traps between July 1990 and August 1992 in Discovery Bay.

Sampling Period	Number of Fish in Sample	Total Weight of Sample (kg)	Mean Weight of Fish (kg)
Ju/Au 90	1617	198.11	0.123
Se/Oc 90	2367	276.72	0.117
No/De 90	397	47.32	0.119
Ja/Fe 91	428	52.50	0.123
Ma/Ap 91	905	103.61	0.115
Totals Before Mesh Exchange	5714	625.76	0.119
Ma/Ju 91	1002	146.70	0.146
Ju/Au 91	580	76.15	0.131
Se/Oc 91	330	41.01	0.124
No/De 91	135	15.19	0.113
Ja/Fe 92	125	14.96	0.110
Ma/Ap 92	172	19.45	0.113
Ma/Ju 92	181	16.50	0.191
Ju/Au 92	194	21.43	0.110
Totals After Mesh Exchange	2719	188.19	0.129

Table 8. Mean weight of fish captured in 5.5 cm mesh traps between January 1991 and August 1992 in Discovery Bay.

Sampling Period	Number of Fish in Sample	Total Weight of Sample (kg)	Mean Weight of Fish (kg)
Ja/Fe 91	56	11.78	0.210
Ma/Ap 91	92	13.98	0.152
Ma/Ju 91	11	1.79	0.163
Ju/Au 91	153	26.57	0.174
Se/Oc 91	312	94.21	0.302
No/De 91	377	87.68	0.233
Ja/Fe 92	670	180.38	0.269
Ma/Ap 92	564	125.29	0.222
Ma/Ju 92	365	59.53	0.163
Ju/Au 92	749	129.41	0.173
TOTALS	3349	730.62	0.218

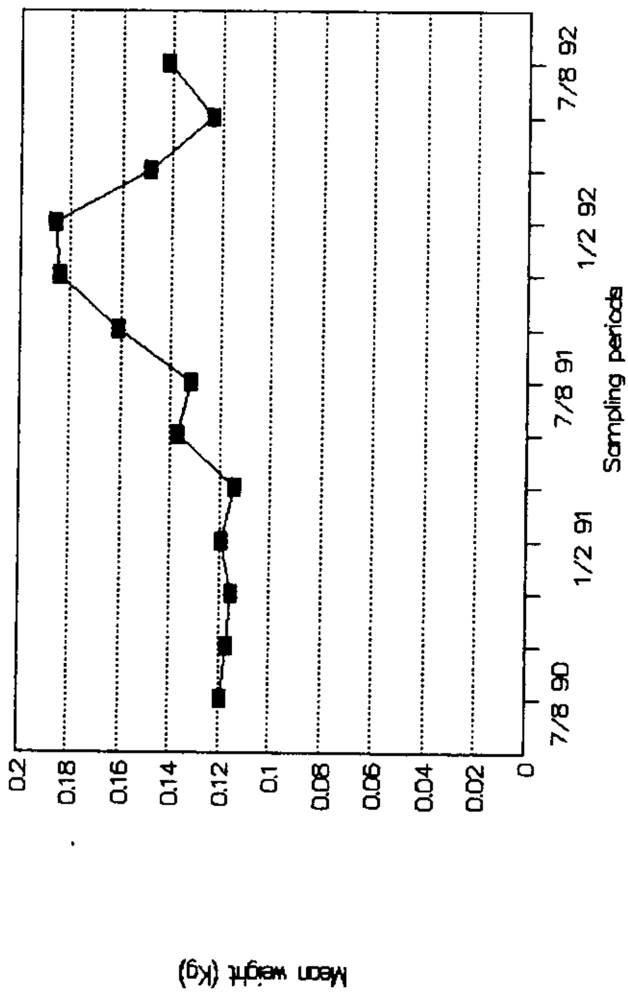

Figure 4. Bi-monthly mean weights of fish caught by traps (all mesh sizes included) between July 1990 and August 1992.

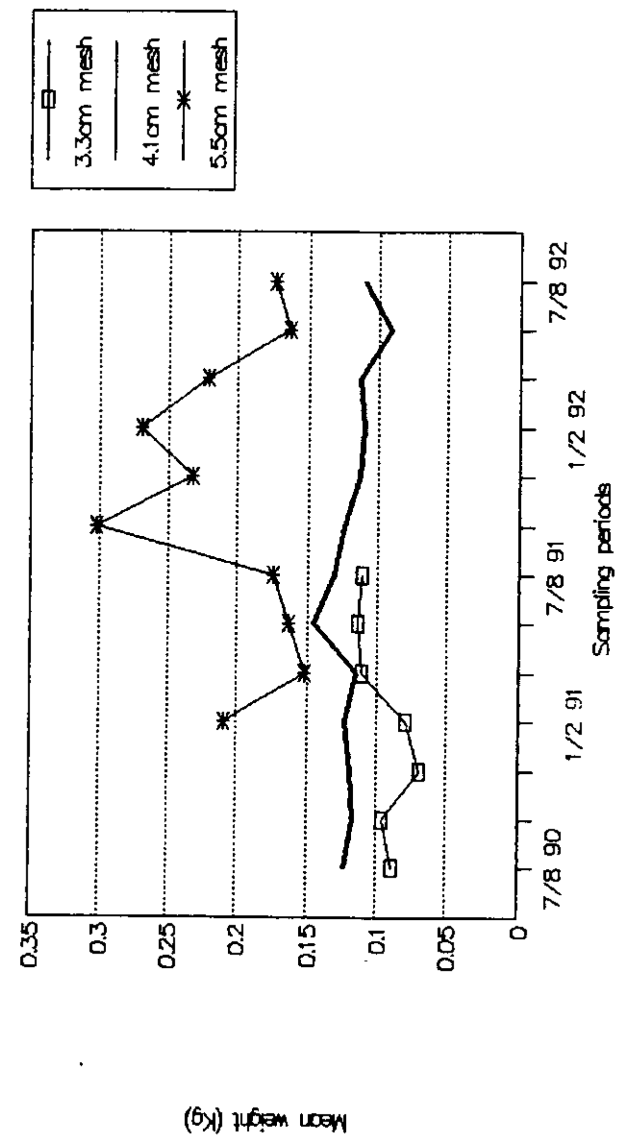

Figure 5. Bi-monthly mean weights of fish caught by traps of various mesh sizes between July 1990 and August 1992.

Table 9. Catch per unit effort of traps (all traps combined) between July 1990 and August 1992 in Discovery Bay.

Sampling Period	Total Weight of Sample (kg)	Number of Traps in Sample	Mean Soak Time of Traps (days)	C.P.U.E. (kg/trap /day)
Ju/Au 90	284.57	365	2.90	0.269
Se/Oc 90	409.31	484	3.18	0.266
No/De 90	102.07	206	3.89	0.127
Ja/Fe 91	149.68	242	3.65	0.169
Ma/Ap 91	162.78	257	3.04	0.208
Totals Before Mesh Exchange	1108.41	1554	3.26	0.219
Ma/Ju 91	338.39	425	2.92	0.273
Ju/Au 91	353.52	441	2.56	0.313
Se/Oc 91	265.38	371	3.60	0.199
No/De 91	172.82	218	6.59	0.120
Ja/Fe 92	258.74	356	4.36	0.167
Ma/Ap 92	252.53	451	4.25	0.132
Ma/Ju 92	136.44	293	4.12	0.113
Ju/Au 92	210.16	374	4.33	0.130
Totals After Mesh Exchange	1987.98	2929	3.90	0.174

Table 10. Catch per unit effort of 3.3 cm mesh traps between July 1990 and October 1991 in Discovery Bay.

Sampling Period	Total Weight of Sample (kg)	Number of Traps in Sample	Mean Soak Time of Traps (days)	C.P.U.E. (kg/trap /day)
Ju/Au 90	16.44	8	5.50	0.374
Se/Oc 90	11.54	15	4.60	0.167
No/De 90	12.11	26	2.50	0.186
Ja/Fe 91	11.56	37	4.35	0.072
Ma/Ap 91	12.02	25	3.24	0.148
Ma/Ju 91	18.57	22	2.00	0.422
Ju/Au 91	28.99	15	2.67	0.724
Se/Oc 91	10.90	3	4.00	0.908
TOTALS	122.13	151	3.42	0.236

Table 11. Catch per unit effort of 4.1 cm mesh traps between July 1990 and August 1992 in Discovery Bay.

Sampling Period	Total Weight of Sample (kg)	Number of Traps in Sample	Mean Soak Time of Traps (days)	C.P.U.E. (kg/trap /day)
Ju/Au 90	248.34	308	2.94	0.274
Se/Oc 90	343.06	394	3.02	0.288
No/De 90	58.07	133	3.14	0.139
Ja/Fe 91	85.70	152	3.12	0.181
Ma/Ap 91	105.75	143	3.22	0.230
Totals Before Mesh Exchange	840.92	1130	3.05	0.244
Ma/Ju 91	176.11	213	2.84	0.291
Ju/Au 91	82.88	118	2.73	0.257
Se/Oc 91	42.56	79	4.90	0.110
No/De 91	24.84	33	4.61	0.163
Ja/Fe 92	13.64	20	2.50	0.273
Ma/Ap 92	32.84	27	2.07	0.588
Ma/Ju 92	16.73	28	2.86	0.209
Ju/Au 92	31.53	51	2.82	0.219
Totals After Mesh Exchange	421.13	569	3.16	0.234

Table 12. Catch per unit effort of 5.5 cm traps between January 1991 and August 1992 in Discovery Bay.

Sampling Period	Total Weight of Sample (kg)	Number of Traps in Sample	Mean Soak Time of Traps (days)	C.P.U.E. (kg/trap /day)
Ja/Fe 91	17.24	11	8.09	0.194
Ma/Ap 91	6.01	6	2.00	0.501
Ma/Ju 91	6.86	10	3.60	0.191
Ju/Au 91	17.79	35	2.66	0.191
Se/Oc 91	61.80	65	6.37	0.149
No/De 91	108.60	87	11.78	0.106
Ja/Fe 92	164.62	180	5.82	0.157
Ma/Ap 92	102.60	176	6.36	0.092
Ma/Ju 92	70.62	141	5.52	0.091
Ju/Au 92	128.56	202	5.85	0.109
TOTALS	684.56	913	6.35	0.118

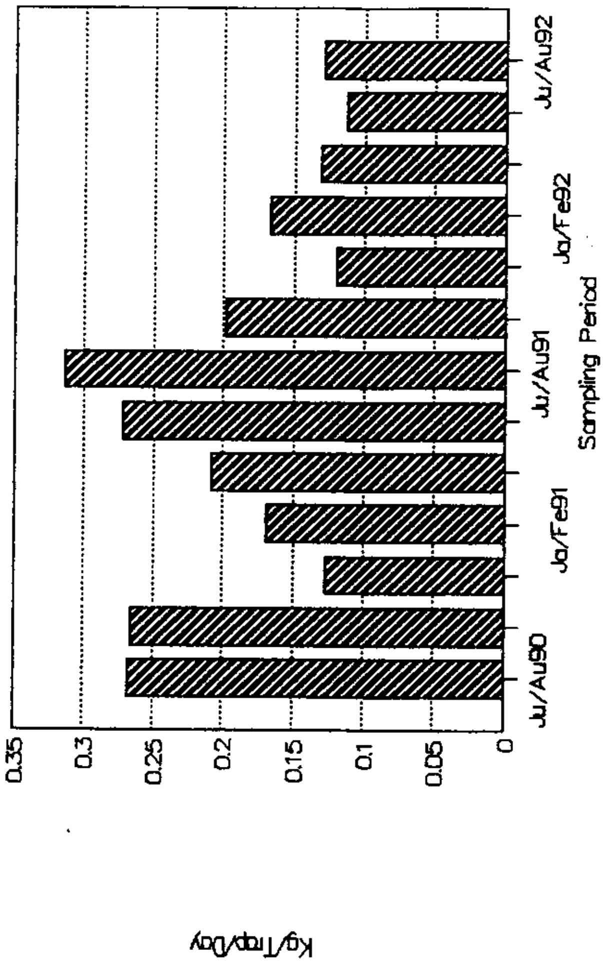

Figure 6. Catch Per Unit Effort (C.P.U.E.) of traps (all mesh sizes included) between July 1990 and August 1992.

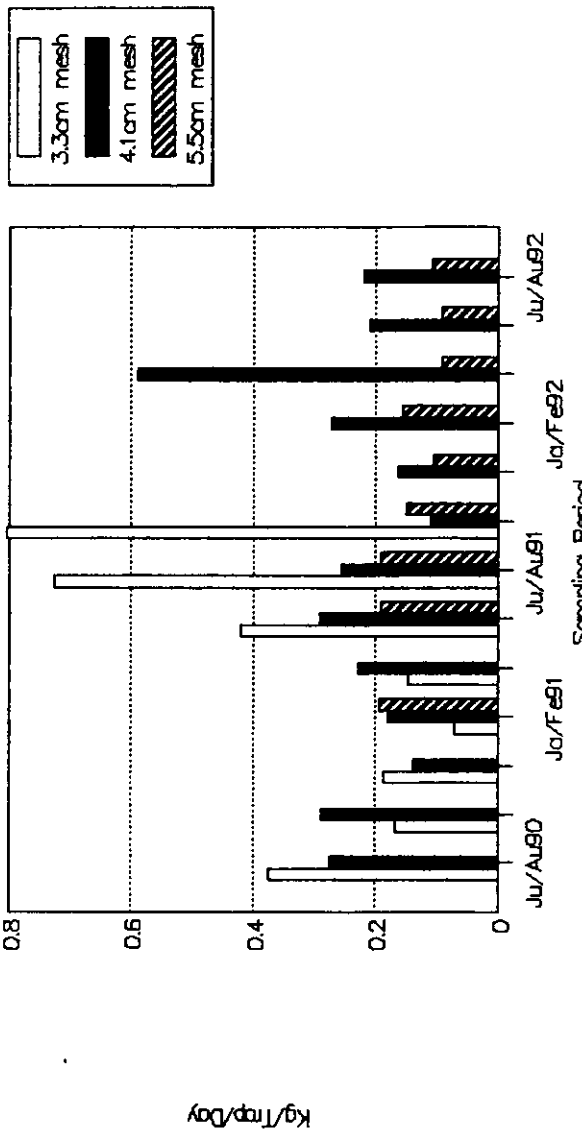

Figure 7. Catch Per Unit Effort of traps of various mesh sizes between July 1990 and August 1992.

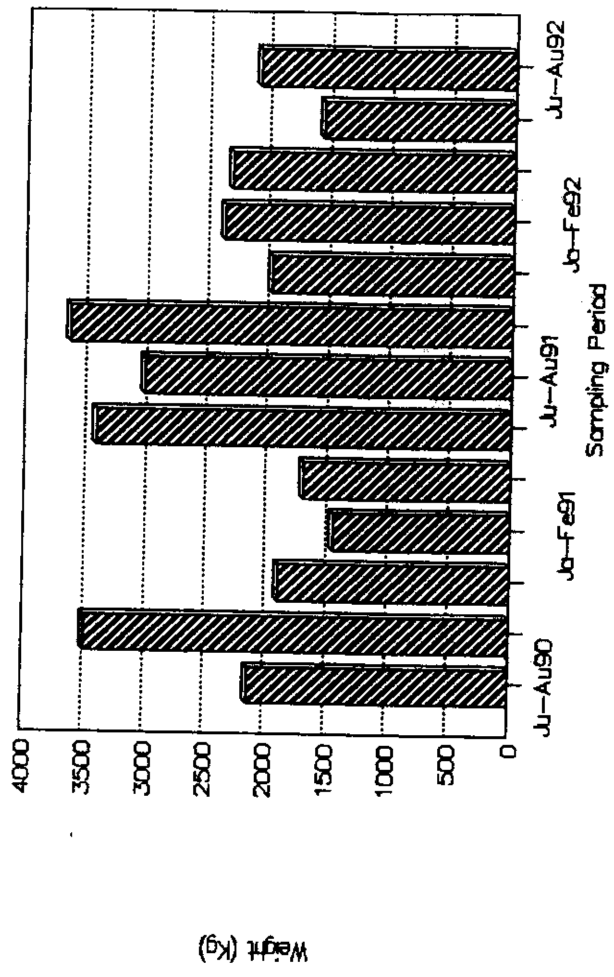

Figure 8. Estimated total bi-monthly catches of the trap fishery in Discovery Bay, between July 1990 and August 1992.

Table 13. Estimated total catches for the trap fishery in Discovery Bay.

Sampling Period	Total Catch (kg)
Jul-Aug 1990	2134
Sep-Oct 1990	3482
Nov-Dec 1990	1885
Jan-Feb 1991	1439
Mar-Apr 1991	1688
Jun-Jul 1991	3404
Jul-Aug 1991	3014
Sep-Oct 1991	3627
Nov-Dec 1991	1961
Jan-Feb 1992	2357
Mar-Apr 1992	2300
Jun-Jul 1992	1564
Jul-Aug 1992	2084

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