Trends in Exploitation of the Wahoo, *Acanthocybium solandri*, by the St. Lucian Pelagic Fishery

PETER A. MURRAY and WILLIANA B. JOSEPH
Department of Fisheries
Ministry of Agriculture, Lands, Fisheries, Forestry, and Co-operatives
St. Lucia

ABSTRACT

Landings of the Wahoo, *Acanthocybium solandri*, represented approximately 14% of total estimated landings in 1988. In the 1988-1989 season, overall landings of Wahoo were reduced by approximately 35% over the previous one-year and five-year periods. Catch per unit effort, CPUE, was also reduced. Over 1988, this study calculates estimates of total mortality coefficient, Z, natural mortality coefficient, M, fishing mortality coefficient, F, and exploitation rate, E. A steady increase in exploitation rate is observed over the five years considered. Length at first capture, L_c, appeared to decrease, from 1982 to 1989, and then increased in 1990. The observed low landings of this species are considered in light of these parameters.

INTRODUCTION

In St. Lucia, large offshore pelagics are caught by trolling. The major fishing areas for these species are on the east and southeast coasts (Murray *et al.*, 1988). Landings of the Wahoo, *Acanthocybium solandri*, represented on the order of 14% of total estimated landings in 1988 (Murray and Nichols, 1990). The fishing season is sharply peaked and does not appear to vary much in timing from season to season (Mahon *et al.*, 1990). While, in general for the southern Windward Islands and Barbados, this season can be considered to extend from September to the following August (*ibid*); in St. Lucia most Wahoo are landed between mid-November and the end of the following July (Murray, 1989), with a corresponding variation in mean lengths (Figure 1).

In the 1988-1989 season, overall landings of Wahoo were down by about 35% over the previous one-year and five-year periods with catch per unit effort, CPUE, also being down (Mahon *et al.*, 1990). They suggest (ibid) that the reduction in fishing effort suggests feedback from the timing of availability, as well as feedback from total catch rates. Variation in fishing effort may also be due to factors external to the fishery (Mahon *et al.*, 1990; also see Murray *et al.*, in press.) The most complete data on landings of pelagics are for the village of Dennery on the east coast (Figure 2). Data for this study were obtained from landings at that site.

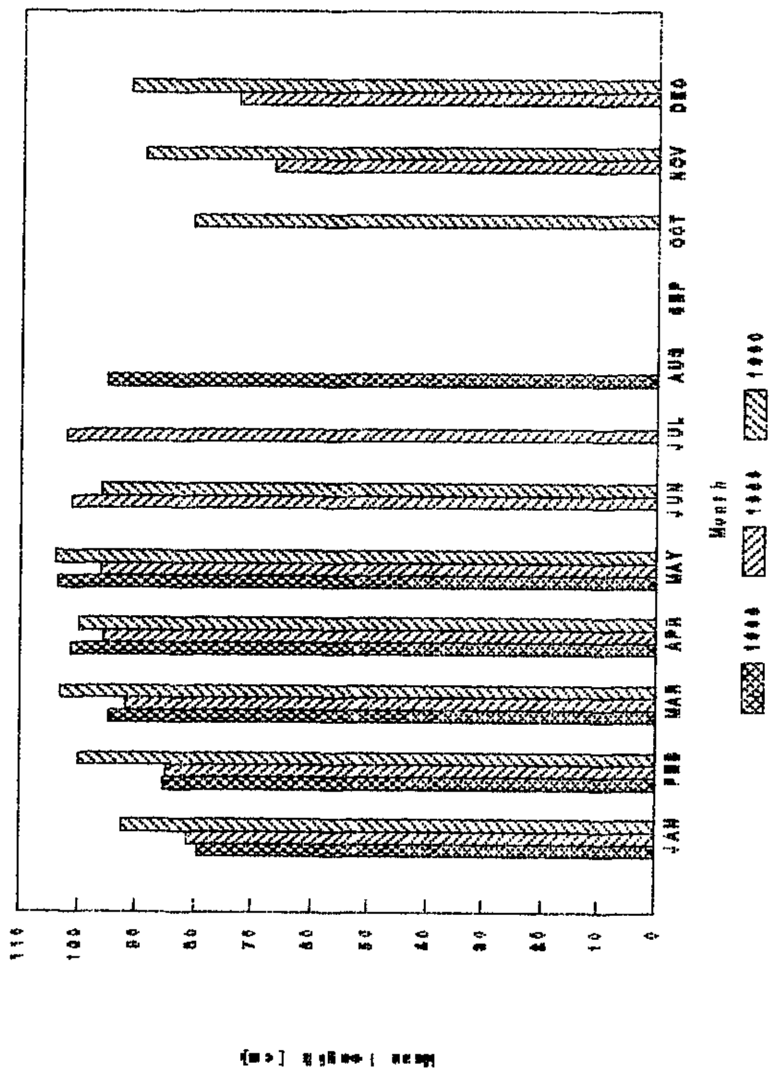

Figure 1. Monthly trend in mean lengths of *Acanthocybium solandri*, 1988-1990.

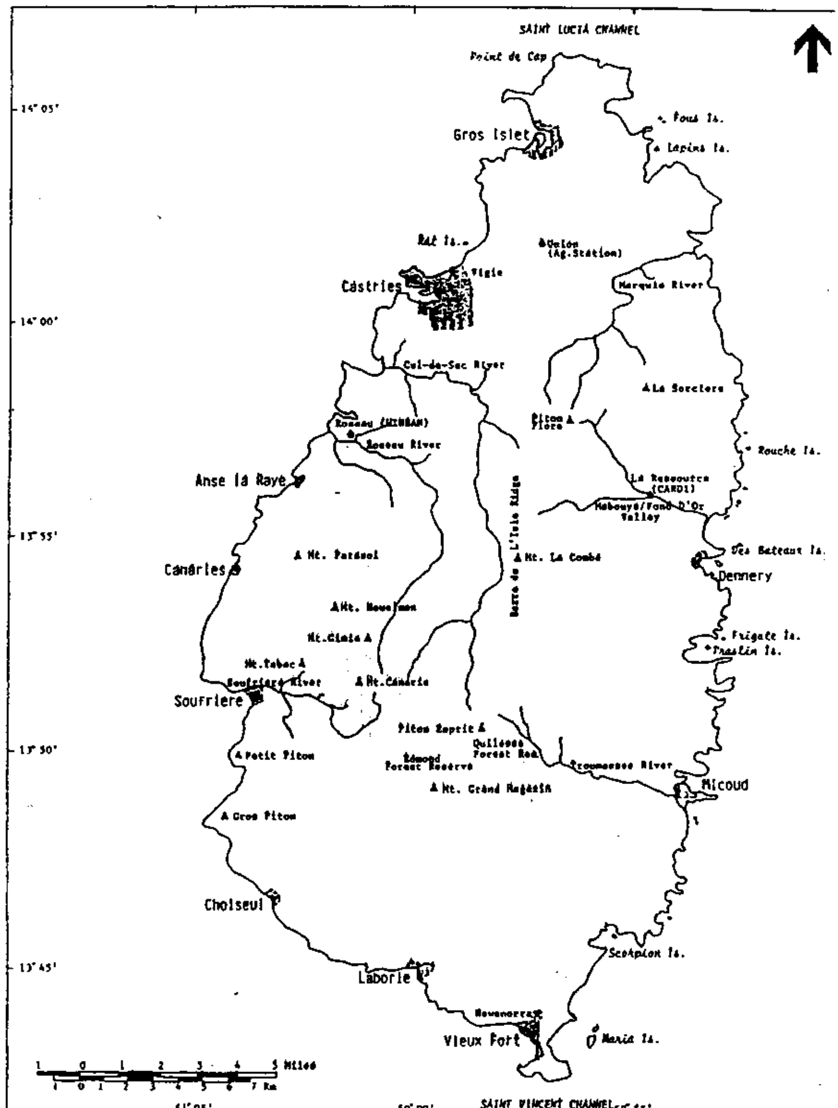

Figure 2. Location map, St. Lucia.

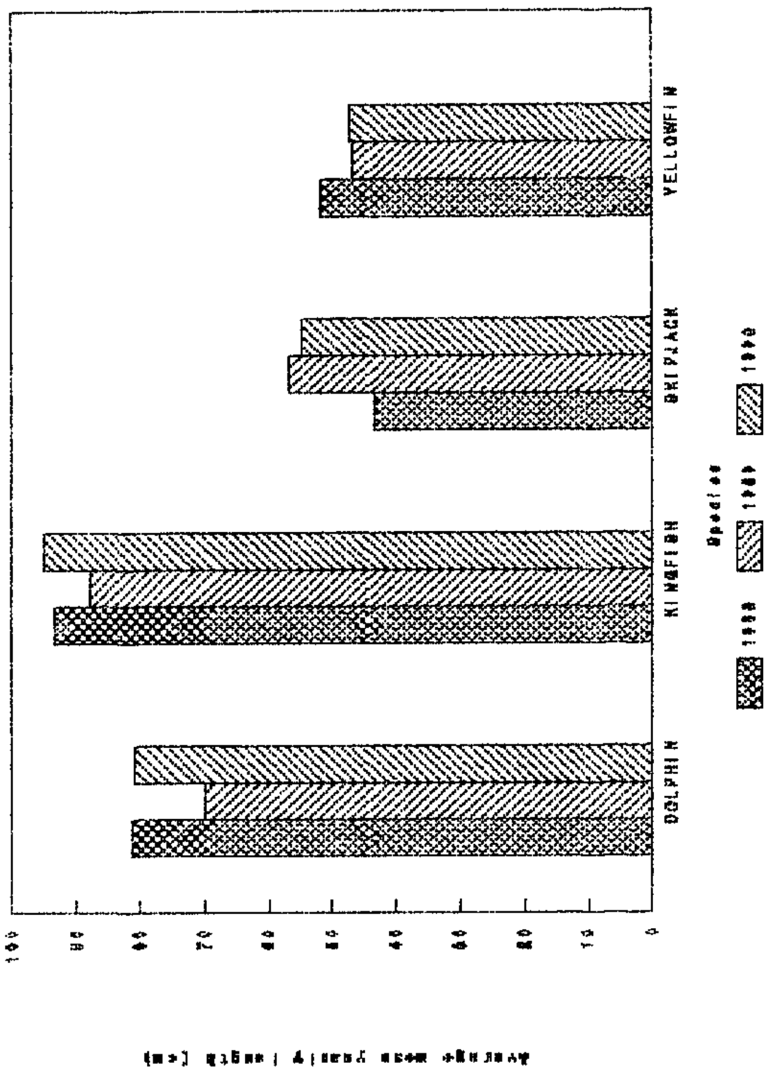

Figure 3. Average yearly mean sizes for the major pelagics, 1988-1990.

METHODS

Length measurements of Wahoo were arranged in five centimeter class intervals (Tables 1-3). The data from all these years were arranged in one-time series. The modified Wetherall plot (Wetheral, 1986; Gayanilo *et al.*, 1989) was then used to obtain a first estimate of the asymptotic length, L . Setting L at this value, the scanning method of Murray and Nichols (1990) was used to obtain a first estimate of the growth rate parameter, K.

These first estimates were used to "seed" ELEFAN I determinations of the parameters. Values obtained for each year's data, analysed separately, were utilised to obtain probabilities of capture and lengths at first caoture, Lc (Gayanilo *et al.*, 1989). ELEFAN O was then used to correct the frequency distributions based on the derived probabilities. The newly obtained frequency distributions were then used to obtain new estimates of L and K by ELEFAN I. These latter estimates were inputted into ELEFAN II's catch curve routine and estimates of total mortality coefficient, Z, and natural mortality coefficient, M, derived. From these, estimates of fishing mortality coefficient, F, and exploitation rate, E, were obtained.

Estimates of Z and M for 1982 and 1983, obtained by Murray and Sarvey (1987), were also used to estimate F (F=Z-M) and E (E=F/Z) for those two years.

The Compleat ELEFAN version 1.11 (Gayanilo *et al.*, 1989) was used for all estimations mentioned above with to- being set at zero.

RESULTS

Table 4 shows the estimates of L and K obtained for the years 1988, 1989, and 1990. Table 5 shows estimated values of Z, M, F, E, and L_c.

DISCUSSION

The increase in exploitation rate observed between 1982 and 1990 supports Hunte's (1985) suggestion that the pelagic fishery of the Caribbean islands is one of the fastest growing ones.

Mahon *et al.* (1990) have decribed decreases in overall landings of pelagics, including Wahoo, in St. Lucia between 1984 and 1990. The lowest landings were in 1989. This corresponds to an observed decrease in the average length of the fish (Figure 3). It could be expected that as the average length of fish in the catch decreases, the size at which a given probability of capture occurs would also decrease. Hence, the decrease in Wahoo length at first capture (the length at which the probability of capture is 0.5) to a value of 70.7 cm in 1989 (Table 5), would follow from the observed decreases in catch and average yearly length. With the natural mortality being of the same order of magnitude in each of the five years considered in this paper, the increase in fishing mortality must be considered.

Table 1. Frequency distribution of Wahoo landed at Dennery, St. Lucia during 1988.

CLASS MID - LENGTH	MONTH 1/15	2/15	3/15	4/15	5/15	8/15
42.5	0	0	0	0	0	0
47.5	0	0	0	0	0	0
52.5	0	0	0	0	0	0
57.5	1	0	0	0	0	0
62.5	5	6	2	0	0	0
67.5	4	7	2	0	0	0
72.5	2	2	0	0	0	0
77.5	4	19	2	0	0	0
82.5	0	2	1	2	0	0
87.5	4	35	16	21	7	2
92.5	20	61	45	91	24	0
97.5	1	10	7	26	10	0
102.5	0	2	2	5	2	0
107.5	0	4	1	11	1	0
112.5	1	1	4	8	3	0
117.5	1	1	7	13	2	0
122.5	1	1	11	5	0	0
127.5	0	0	1	0	0	0
132.7	0	0	1	1	0	0
137.5	0	0	1	0	0	0
142.5	0	0	0	0	0	0
147.5	0	0	0	0	0	0
152.5	0	0	1	0	0	0
157.5	0	0	0	0	0	0

The 400 fishing vessels on St. Lucia at present (Department of Fisheries, unpubl. data) is less than the level obtained between 1978 and 1983 (Murray, 1985). Observations over the last ten years suggest that (particularly for east and southeast coast fishing communities) larger canoes are being built. In addition, fishermen have slowly begun to move into the larger, more stable, Yamaha-designed fiberglass pirogues. If we use the fishing trip as the unit of fishing effort, the use of a larger, more stable, fishing platform begs the conclusion that there would be a larger catchability with, all other things being equal, a consequent increase in fishing mortality. This suggested increased catchability belies the observed decrease in Wahoo catch per trip noted by Mahon *et al.* (1990) between 1986 and 1989. What it can suggest, however, is that the major cause of the observed variability in CPUE is avaiability. If catchability, and consequently fishing mortality, increased over the time period

Table 2. Frequency distribution of Wahoo landed at Dennery, St. Lucia during 1989.

CLASS MID-LENGTH	MONTH 1/15	2/15	3/15	4/15	5/15	6/15	9/15
42.5	0	0	0	0	0	0	0
47.5	0	0	0	0	0	0	0
52.5	1	0	0	0	0	0	0
57.5	0	0	0	2	0	0	0
62.5	6	1	0	0	0	0	1
67.5	9	4	0	0	0	0	5
72.5	4	2	0	0	0	0	2
77.5	23	3	0	0	0	0	1
82.5	5	4	2	0	1	0	0
87.5	17	23	18	6	4	3	2
92.5	13	17	35	33	21	4	2
97.5	2	1	21	13	11	1	1
102.5	2	1	3	7	11	3	1
107.5	3	1	3	3	8	0	0
112.5	2	2	3	2	8	2	0
117.5	1	0	0	0	2	1	0
122.5	0	1	41	0	0	0	1
127.5	0	0	3	1	1	0	1
132.7	1	0	1	1	1	0	1
137.5	0	0	0	0	0	0	1
142.5	0	0	0	0	0	0	0
147.5	0	0	0	0	0	0	0
152.5	0	0	0	0	0	0	0

under consideration; yet CPUE decreased, it may be that "in the case of (these) species...variation in their migratory routes from one year to the next could result in...changes in catch rates which are quite independent of total stock abundance" (Mahon *et al.*, 1990).

It must, of course, be remembered that there is another component to this variability. The component due to errors in the data and in the manipulation of the data (Mahon *et al.*, 1990). There is, indeed, a need for more work to be done on the choice of an index of fishing effort. There is need for an indicator of the extent to which apparant variability in CPUE has been introduced by using the fishing trip as the (unstandardised) unit of fishing effort. This is particularly so when the efficiency of the boat and/or gear may have changed significantly over the past 10 years.

Table 3. Frequency distribution of Wahoo landed at Dennery, St. Lucia during 1990.

CLASS MID - LENGTH	MONTH 1/15	2/15	4/15	5/30	11/15
42.5	0	3	0	0	0
47.5	0	1	0	0	0
52.5	1	0	0	0	0
57.5	0	3	0	0	0
62.5	3	9	0	0	3
67.5	14	11	1	0	5
72.5	2	4	0	0	4
77.5	12	14	2	0	5
82.5	2	5	0	1	4
87.5	3	10	9	2	0
92.5	9	23	17	8	1
97.5	6	37	46	24	2
102.5	2	16	15	15	1
107.5	1	2	11	14	0
112.5	0	3	1	4	0
117.5	1	0	2	1	1
122.5	0	0	0	0	0
127.5	0	0	0	0	0
132.7	0	3	2	6	0
137.5	0	0	0	0	0
142.5	0	0	0	0	0
147.5	0	0	0	0	0
152.5	0	0	0	0	0
157.5	0	0	0	0	0

This contribution again (Murray *et al.*, in press) hints at the question of whether the observed variations in biological parameters should be used to derive management options in isolation of the socio-economic factors, external to the fishery, that impinge on the activities of the fishermen vis-a-vis the fishery.

The utilisation of data from the country's landings of any migratory species is intuitively erroneous. Thus, estimates of mortality and mortality-related parameters would appear to be also erroneous, at least in terms of absolute values. The need for the primary data used for mortality estimation to be representative of the whole population has been emphasized elsewhere (Hoenig *et al.*, 1987; Shepherd *et al.*, 1987). This absence of a truly representative sample will contribute to the "errors in the data and in (its) manipulation". While this may be the case, the trends observed may have some validity and thus,

Table 4. Estimates of L and K for 1988, 1989, and 1990.

YEAR	PARAMETER L	K
~~1988~~	~~158.5~~	~~0.310~~
1989	161.0	0.368
1990	156.6	0.330

Table 5. Estimated values of mortality parameters and length at first capture.

YEAR	Z	M	F	E	L_c
1982	1.17	0.56	0.61	0.52	85.8
1983	1.52	0.58	0.94	0.62	74.5
1988	1.45	0.49	0.96	0.66	72.7
1989	1.75	0.54	1.21	0.69	70.7
1990	2.34	0.54	1.80	0.77	80.0

compare favorably to the work of Mahon *et al* (1990). If nothing else the need for, and the cooperation of regional fishery scientists in, a more broad-ranging study such as the CARICOM Fisheries Resources Assessment and Management Program (CFRAMP) is emphasized.

ACKNOWLEDGEMENTS

The authors would like to thank Mr. Keith Nichols, Fisheries Biologist, Department of Fisheries, St Lucia, for his very useful comments on this paper.

LITERATURE CITED

Gayanilo, F.L., Jr., M. Soriano and D. Pauly, 1989. A graft guide to the Compleat ELEFAN. ICLARM Software 2. International Center for LIving Aquatic Resources Management, Manila, Philippines. 65 p.

Hoenig, J.M., J. Csirke, M.J. Sanders, A. Abella, M.G. Andreoli, D. Levi, S. Ragonese, M. Al-Shoushani and M.M. El-Musa. 1987. Data acquisition for length-based stock assessment: report of working group I. pp 343-353 IN D. Pauly and G.R. Morgan (eds.). *Length based methods in fisheries research.* ICLARM Conference Proceedings 13, International Center for Living Aquatic Resources Management, Manilla, Phillipines. 468p.

Hunte, W. 1985. Marine resources of the Caribbean. pp 38-41 IN Proceedings of the Caribbean Seminar for Environmental Impact Assessment, 1985. Caribbean Conservation Association.

Mahon, R.,F. Murphy, P. Murray, J. Rennie and S.Willoughby, 1990. Temporal variability of catch and effort in pelagic fisheries in Barbados, Grenada, St. Lucia and St. Vincent: with particular reference to theproblem of low catches in 1989. FI:TCP/RLA/*(^# Field document 2. FAO. 74p.

Murray, P.A. 1985. A preliminary look at the status of non-migratory pelagic fish species of St. Lucia, W.I. IN Western Central Atlantic Fishery Commission, 1985. *National Reports and Selected Papers presented at the Fourth Session of the Working Party on the Assessment of Marine Fishery Resources.* Paipa, Department of Boyaca, Colombia, 29 October - 2 November, 1984. *FAO Fish. Rep.* 327 *Suppl.*: 290p.

Murray, P.A. 1989. A compatative study of methods for determining mean length-at-age and von Bertalanffy growth parameters for two fish species. Thesis submitted in fulfillment of the requirement for the degree of Master of Philosophy to the University of the West Indies.

Murray, P., J. Charles, and R. Mahon. 1988. Fishery Data Collection for St. Lucia. Pp. 140-149 IN R. Mahon and A.A. Rosenberg (eds.), 1988. *Fishery Data Collection Systems for Eastern Caribbean Islands.* OECS Fish. Rep. 2.

Murray, P.A., L.E. Chinnery and E.A. Moore, in press. Recruitment of the Queen Snapper, Etelis oculatus, into the St. Lucian fishery: recruitment of fish and fishermen. *Proc. Gulf Carib. Fish. Inst.* **41**.

Murray, P.A. and W.B. Sarvey, 1987. Use of ELEFAN programs in the estimation of growth parameters of the Wahoo, *Acanthocybium solandri*, caught off St. Lucia, West Indies. *Fishbyte* 5(1) :14-15.

Shepherd, J.G., G.R. Morgan, J.A. Gulland and C.P. Mathews, 1987. Methods of analysis and assessment: report of working group II. Pp 353-362 IN D. Pauly and G.R. Morgan (eds.). *Length-based methods in fisheries research.* ICLARM Conference Proceedings 13, International Center for Living Aquatic Resources Management, Manila, Philippines. 468p.

Wetherall, J.A. 1986. A new method for estimating growth and mortality parameters from length-frequency data. *Fishbyte* 4(1): 12-14.