An Assessment of the Status of the Ivorian Purse Seine Fishery off Sierra Leone, 1970-78

MOHAMED B.D. SEISAY
Fisheries Department
P.O. Box 47
Mangochi, Malawi

Abstract

A time series of catch and effort data (1970-78) of the Ivorian purse seine fishery in Sierra Leone waters was analyzed using the Schaefer production model. The regression of C/f on effort was significant and the resulting estimates of MSY was 14,640 tonnes with f_{msy} = 1,734 boat-days.

Introduction

Sierra Leone lies on the West Coast of Africa (Fig. 1), and it has a coastline of about 330 km, with a shelf area of approximately 25,600 km^2. Population is estimated at around 3.7 million people and the per capita fish consumption is about 25 kg·year^{-1}.

The fisheries consist of the large industrial concerns and the small-scale or artisanal fishing enterprises. Most of the industrial fisheries are foreign-owned, the main countries involved being the USSR, the United Kingdom, Côte d'Ivoire, Spain and Greece; these operate trawlers, shrimpers, purse seiners, longliners, motherships and carriers.

Ivorians introduced purse seine fishing in Sierra Leone waters in the 1960s. This fishery exploited pelagic fish species: *Sardinella aurita*, *S. maderensis*, *Scomber japonicus* and others. The artisanal fishery, using traditional gears, also exploits the same stocks (within the 8-km limit of the coastline).

The purse seine fishery is very seasonal and mostly limited to the first five months of the year when the

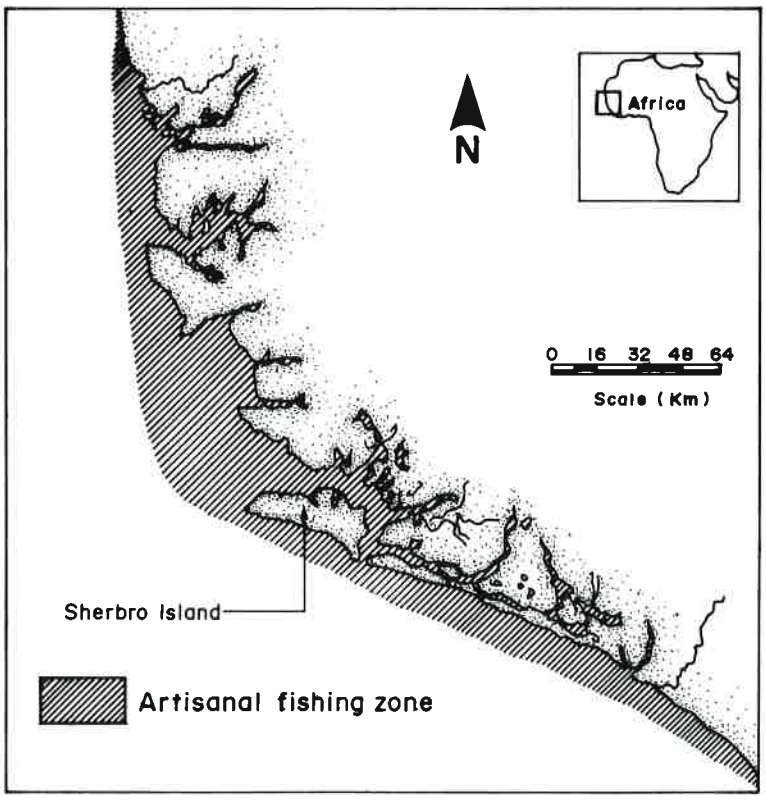

Fig. 1. Coast of Sierra Leone, showing separate artisanal and industrial fishing zones, and location of Sherbro Island.

Table 1. Catch and effort of Ivorian seiners in the Sierra Leone waters, 1970-78.[a]

Years	*Sardinella aurita*	*Sardinella maderensis*	*Priacanthus arenatus*	*Scomber japonicus*	Others[b]	Total catch (t)	Effort (boat-days)	C/f
1970	1,005	8,279	8	-	405	9,697	610	15.9
1971	2,264	9,310	5	7	206	11,792	935	12.6
1972	2,346	7,156	62	-	234	9,798	712	13.8
1973	4,269	8,306	44	6	987	13,612	1,500	9.1
1974	1,157	7,816	29	-	695	9,697	834	11.6
1975	126	10,640	59	-	700	11,525	834	13.8
1976	1,386	6,273	82	-	853	8,394	651	12.9
1977	512	3,023	9	-	59	3,603	247	14.6
1978	-	79	12	-	24	115	12	9.6
TOTAL	13,065	60,882	310	13	3,963	78,233	6,335	(12.3)

[a]Adapted from Anon. (1983).
[b]Species included: *Decapterus rhonchus, Decapterus punctatus, Auxis thazard, Euthynnus alletteratus, Selar crumenophthalmus, etc.*

catches from other fisheries in Côte d'Ivoire are low. After May, these seiners fish the *S. aurita* stock in Ivorian and Ghanaian waters during the main upwelling season.

Materials and Methods

The catch and effort data (Table 1) used in this study were obtained through the statistical monthly reporting system established by the Fisheries Department of Sierra Leone for the industrial fisheries. The captain or skipper of every commercial fishing vessel maintains on board a daily fishing log book containing catch by species, species weight in each haul, duration of haul, days spent fishing, number of trips, etc. These log books are submitted to the Fisheries Department on a monthly basis and the data therein are first compiled by Fisheries Assistants and later checked and summed by Fisheries Research Officers to obtain annual totals.

Thirty-nine (39) Ivorian purse seiners fished from 1970 to 1978 in the shallow waters around Sherbro Island (Anon. 1985). They had the following characteristics: length 16-38 m, engine power 100-1,760 hp. The mesh size of the 300-m long and 30-m deep purse seine net was 16 mm (stretched).

The surplus production model of Schaefer (1954) was used here to estimate maximum sustainable yield (MSY) and the corresponding fishing effort (f_{msy}) for the Ivorian fishery. The basic assumption of the model is that data on catch and effort are assumed to have come from the fishery in equilibrium and thus that the catch represents the "surplus" biomass generated by tissue growth and recruitment into the fish stocks (Pitcher and Hart 1982).

Results and Discussion

The estimated MSY from this study was 14,640 t and the f_{msy} needed to achieve this value was 1,734 boat-days (Fig. 2).

The Fox model (1970) was also tried using the same data and it proved to give a slightly better fit than the Schaefer model by comparison of the correlation coefficients (Fox, r =-0.86; Schaefer: r = -0.84). The Schaefer model was nevertheless adopted here because it predicts a more conservative MSY figure and a lower f_{msy} than the Fox model (MSY = 15,938 t and f_{msy} = 2,429 boat-days). This is simply because one would like to be cautious in the face of the usually unreliable data which come out of a fishery and also to ensure, in part, against the assumption that the fishery was in equilibrium while it was not. Such situation which can easily result in the overestimation of the management parameters of interest here (MSY and f_{msy}).

It should be noted that the Ivorian fishing effort increased in the Sherbro area, resulting in higher overall catches, following the collapse of the Ivorian-Ghanaian stocks in 1972-73 (Anon. 1983). As a result, in 1973, the fishery was operating close to MSY level. *S. maderensis* and *S. aurita* constituted over 90% of the total catch.

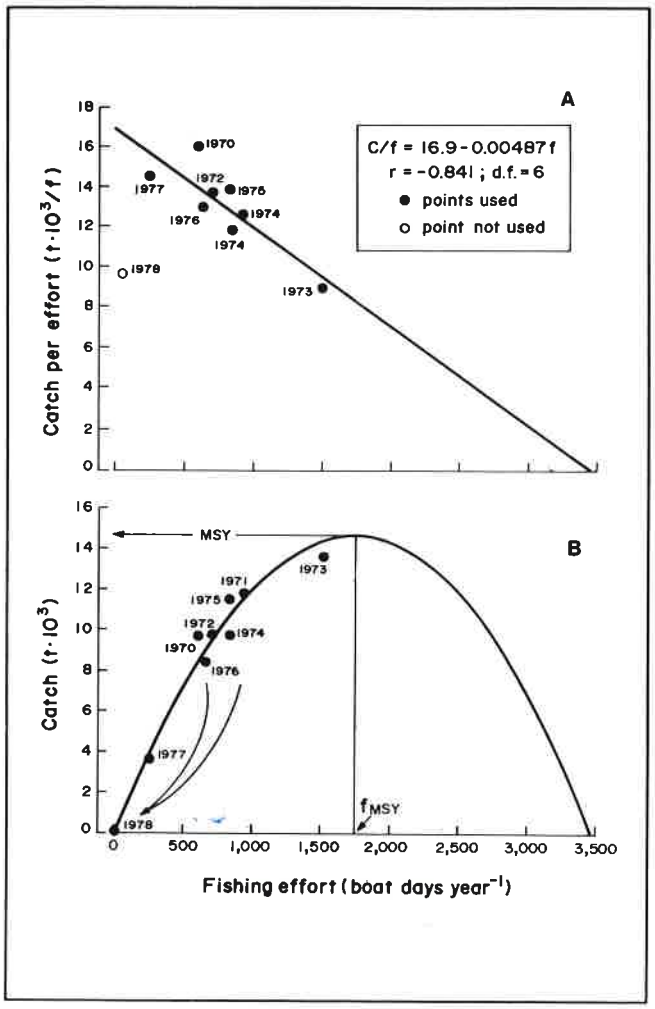

Fig. 2. Plots of catch per effort (C/f) and of catch *vs.* effort in the purse seine fishery off Sherbro Island, Sierra Leone, 1970-1978; note collapse of fishery in the late 1970s.

A close inspection of Table 1 reveals that maximum catches of the combined total of all species occurred in 1973, 1971 and 1975 (in decreasing order), when the total exceeded 11,000 t. During the later years (i.e., 1976, 1977 and 1978) of the Ivorian purse seine fishery in Sierra Leone waters, there were dramatic reductions in both total catch and fishing effort. The Ivorians may have deliberately reduced their fishing effort during these years during which the stock apparently collapsed (see arrow in Fig. 2B).[a]

Th USSR is currently the only nation engaged in purse seining for pelagic stocks off Sierra Leone. These purse seiners are equipped with highly sophisticated fish detection devices. The present fishery regulatory measure to place recorders for the purpose of collecting scientific data and carrying out management and enforcement activities on board all commercial fishing vessels and to forbid the use of any purse seine net with a mesh opening of less than 32 mm (Anon. 1988) could help not only in increasing the reliability of the data but also in conserving the pelagic fish stocks.

[a]Editor's note: I added an arrow to point at the possibility that this stock underwent a classic collapse involving a large increase in catchability as the residual stock contracted (see Csirke 1989).

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