AN ASSESSMENT OF THE EXPLOITATION OF THE SARDINE STOCK OFF VIZHINJAM, SOUTHWEST COAST OF INDIA*

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ABSTRACT

The sardine resources at Vizhinjam have been assessed based on bi-weekly observations and the present level of exploitation has been studied using the surplus production model. The average annual sardine catch has been estimated at 272 tonnes, constituted by seven species, *viz. Sardinella gibbosa* (40.0%), *S. longiceps* (23.1%), *S. sirm* (20.7%), *S. davi* (9.8%), *S. fimbriata* (4.8%), *S. sindensis* (1.2%) and *S. clupeoides* (0.4%). Gill net, boat seine, shore seine and hooks and line were the main gears employed for the fishery with contributions of 62%, 34%, 3% and 1% respectively.

The suitable model for the catch and effort data for sardine fishery at Vizhinjam during the period 1970-77 seems to be that of Fox (1970) using boat seine as the standard effort. The MSY (419 t) was higher than that of the average catch (272 t), but the effort to get the MSY was less (58000) when compared to the average standard effort (112000) during the period. The landings of the three important species of Sardines, viz; *S. gibbosa, S. longiceps* and *S. sirm*, were also assessed by using the Schaefer and Fox models separately with boat seine as the standard effort. This also showed a need for the reduction in the effort to get the MSY of individual species.

INTRODUCTION

FISHES of the genus *Sardinella*, popularly known as sardines, support a regional fishery of appreciable importance along the southern section of the west coast of India in between Cape Comorin and Thangaserry (Fig. 1). They form about 10.7% of the total marine fish catch of the area (Fig. 2). Vizhinjam, an important fish landing centre in the above area, is almost at the mid-point to study the sardine fishery. A variety of crafts and gears are intensively employed to exploit these resources and hence an attempt is made here to study the Maximum Sustainable Yield of sardines by the different gears. Among the earlier important studies on the sardine fishery of this centre are by Nayar (1958), Bennet (1971), Radhakrishnan (1973), Luther *et al.* (1982), Bennet *et al.* (1986) and Lazarus (1984, 1987).

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MATERIAL AND METHODS

The catch data, collected at Vizhinjam during 1970-77 on the basis of biweekly

observations, have been utilised for the study. Random samples consisting of about 50 sardines were used to assess the species composition. The method of raising the sample value to estimate the catch, as described by Sekharan (1965), was followed for obtaining the monthly estimates of total catch of each species and for the number of fish in each length group. Samples were collected separately from boat seine, shore seine, gill net and hooks and line, and the catch per unit effort (CPUE) was also calculated separately following Sekharan (1965).

The catch and effort data for gill nets, boat seines, shore seines and hooks and line were utilised for stock assessment by using the surplus production models (Ricker, 1975).
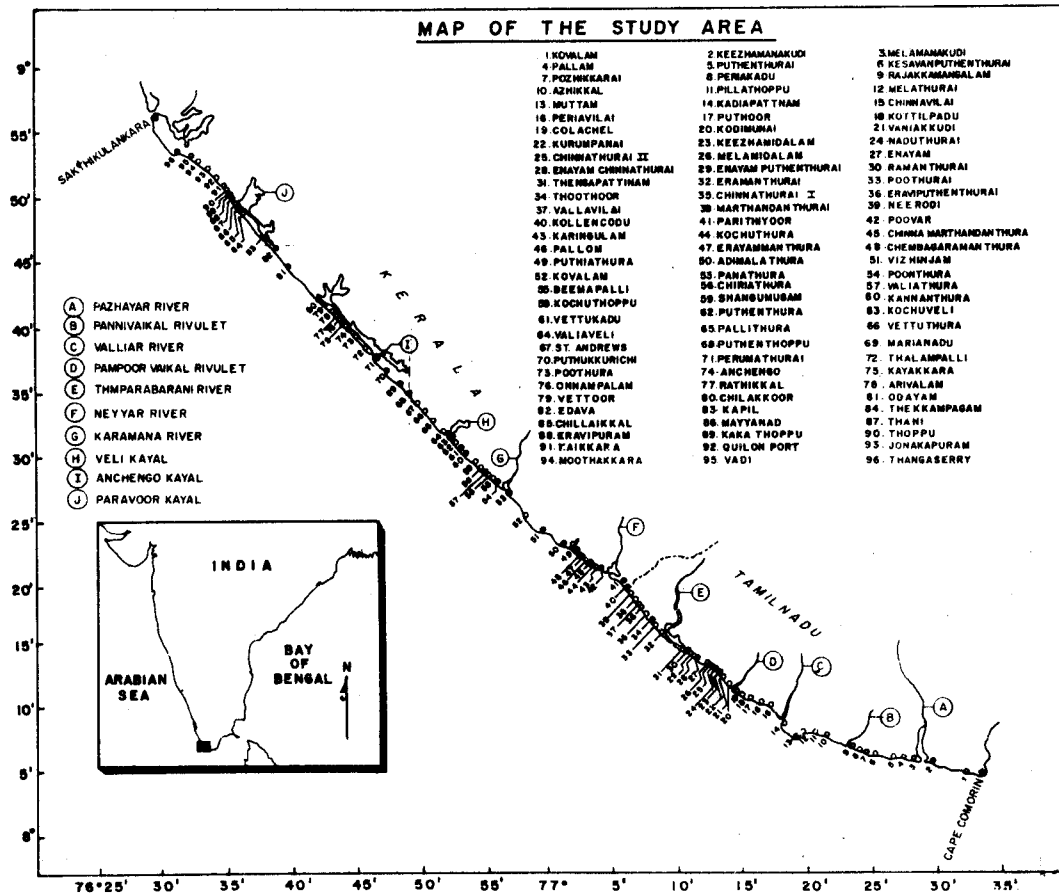

Fig. 1. The important fish landing centres between Cape Comorin and Thangaserry.

FISHERY

The average annual sardine landings at Vizhinjam has been estimated at 272.3 tonnes and it formed 6.5% of the local fish catch (Fig. 3). The fishery extends from January to December with three peaks, one in May, another in August and a third one in October, and the fishery is subject to wide fluctuations.

Seven species of sardines constituted the catch at Vizhinjam. According to their order of abundance they are *Sardinella gibbosa* (Bleeker), *S. longiceps* (Valenciennes) *S. sirm* (Walbaum), *S. dayi* (Regan) *S. fimbriata* (Valenciennes), *S. sindensis* (Day) and *S.*

seine, shore seine and hooks and line, their annual average contribution to the sardine fishery being 62%, 34%, 3% and 1% respectively (Fig. 4). The gill net is operated from October to June with two peaks, November-December and April-May. Boat seine
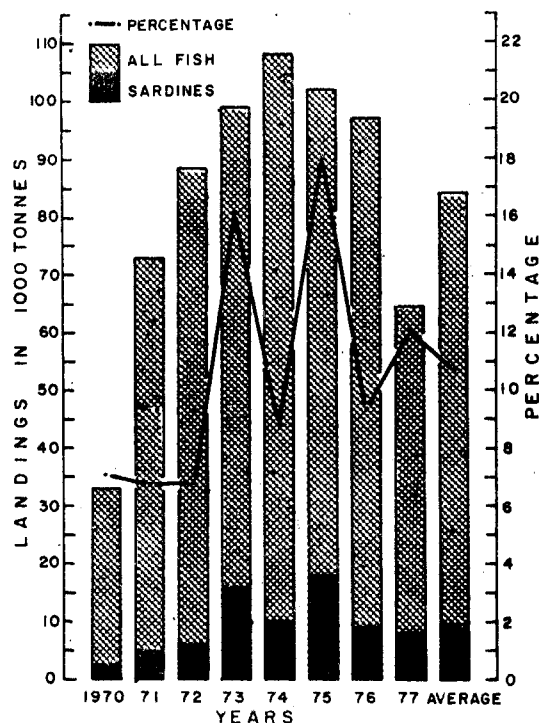

Fig. 2.   Annual landings of sardines with that of all fish in the area between Cape Comorin and Thangasserry during 1970-77.

Fig. 3.   Annual landings of sardines with that of all fish at Vizhinjam during 1970-77.

clupeoides (Bleeker). Table 1 gives the annual landings and percentage composition of the various species of sardines at Vizhinjam. The peak season was from April-June and August-December for *S. gibbosa* May-June and August for *S. longiceps*, November-March for *S. sirm*, June-July and December for *S. dayi*, October-November and April-May for *S. fimbriata*, February for *S. clupeoides*, and September-October for *S. sindensis*.

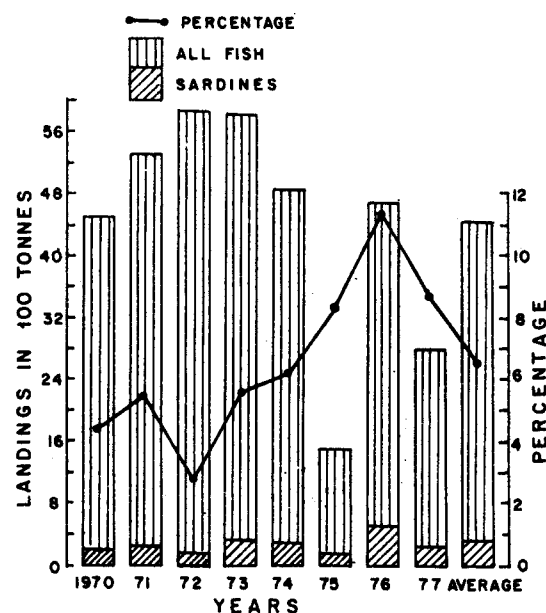The important gear which exploit this resource at Vizhinjam, are the gill net, boat

and shore seine are operated almost throughout the year with peaks at May-October and October-December respectively. The hooks and line operation extends from May to October with maximum operation during May.

RESULTS AND DISCUSSION

As seen already, about 60% of the sardine catch at Vizhinjam are netted by gill net, a selective gear used exclusively for sardines during the season. However, the maximum sustainable yield calculated for this gear as standard effort comes to 329 t according to Schaefer (1954) model and 409 t according to Fox (1970) model. The correlation coefficient (r) values (-0.38 and -0.28 respectively) were

also found to be poor for both the models (Table 2). Moreover this gear is operated only for nine months from October, with peak
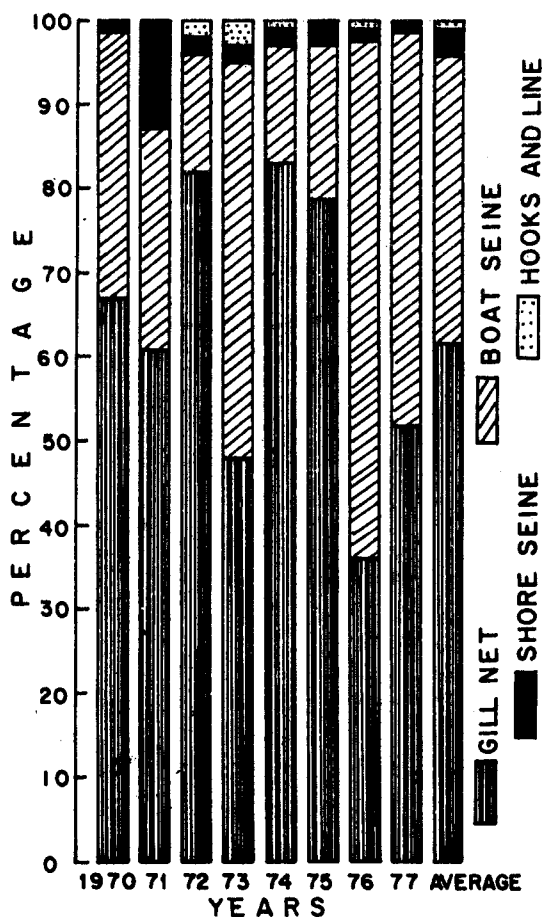

Fig. 4.   Gearwise contribution of sardines at Vizhinjam during 1970-77.

landings for about four months only. Next to the gill net, the boat seine, a non-selective gear contributes about 34% of the sardine catch at Vizhinjam. This gear is operated throughout the year with intensive operation for six months from May every year. By using the boat seine as standard effort the calculated MSY were 629 t and 419 t respectively for the Schaefer and Fox models. The correlation coefficient values were better (-0.89 and -0.97) than those obtained with the gill net as standard effort.

TABLE 1. *Annual landings (kg) of various species of sardines at Vizhinjam for the years 1970-77*

Species	1970	1971	1972	1973	1974	1975	1976	1977	Total	Average	Percentage Mean	Percentage Range
S. gibbosa	122947	169200	85528	146071	66296	79208	147131	54403	870784	108848	40.0	22.7-62.6
S. longiceps	1739	5152	15202	17874	33561	23020	286513	120723	503784	62973	23.1	0.6-53.3
S. sirm	10542	30353	47076	51641	157778	21735	78896	53482	451503	56438	20.7	5.3-53.0
S. dayi	62772	55619	5145	65669	12695	1290	5631	4134	212955	26619	9.8	1.0-31.6
S. fimbriata	533	23980	3207	42311	28369	1302	5322	2209	105433	13179	4.8	0.3-13.0
S. clupeoids	..	333	6210	850	..	..	1008	..	8401	1050	0.4	0.1-3.8
S. sindensis	..	..	..	..	..	..	13966	11539	25505	3188	1.2	1.0-5.0
TOTAL	198533	284637	162368	324416	298699	126555	536667	246490	2178365	272295	100.00	

Like boat seine the shore seine, also a non-selective gear, is operated throughout the year with maximum number of effort only for three months from October. The MSY calculated for this gear were 617 t and 367 t respectively fishery at Vizhinjam during the period 1970-77 seems to be the Fox model using boat seine as the standard effort. The maximum sustainable yield of 419 tonnes was higher than the average catch of 272 t but the effort to get the MSY

TABLE 2. *Maximum Sustainable Yield (MSY) and the effort to get MSY (f_{msy}) for sardines at Vizhinjam by using gill net, boat seine and shore seine as standard effort by the surplus production models.*

Standard effort	Total catch (t)	Std. Effort (X 1000)	Schaefer model			Fox model		
			MSY (t)	f_{msy} (X 1000)	correction coefficient (r)	MSY (t)	f_{msy} (X 1000)	correlation coefficient (r)
Gill net	272	19	329	29	-0.38	409	58	-0.28
Boat seine	272	112	629	87	-0.89	419	58	-0.97
Shore seine	272	84	617	107	-0.48	367	100	-0.82

TABLE 3. *MSY and the effort to get the MSY (fmsy) for 3 important species of sardines using boat seine as standard effort by the surplus production models.*

Species	Average catch (t)	Std. Effort (X 1000)	Schaefer model			Fox model		
			MSY (t)	fmsy (X 1000)	correlation coefficient (r)	MSY (t)	fmsy (X 1000)	correlation coefficient (r)
S. gibbosa	109	112	188	97	-0.93	143	74	-0.96
S. longiceps	63	112	267	79	-0.80	64	39	-0.72
S. sirm	56	112	115	91	-0.81	64	66	-0.072

for the Schaefer and Fox models with poor correlation coefficient (-0.48 and -0.82) when compared to the boat seine as the standard effort.

The catch and effort relationship was better with the boat seine for sardine than the other two gears described above. This may be due to the non-selective nature of boat seine and the maximum period of operation of the boat seine at Vizhinjam. Thus the suitable model for the catch and effort data for the sardine

is less (58 thousand) when compared to the average standard effort (112 thousand) during the year 1970-77.

Schaefer and models were used separately for the three important sardine species, *Sardinella gibbosa*, *S. longiceps* and *S. sirm*, using boat seine as the standard effort and the results are given in Table 3. The results also showed a need for the reduction in the effort to get the MSY of individual species.

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