

Wadge Bank Trawl Fishery Studies

PART II

The effect of trawling on the catch per hour from 1945 to 1960

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INTRODUCTION

THE object of this series of papers has been given in Part I which deals with the first known commercial fishery on the Wadge Bank from 1928 to 1935. There is no recorded trawling on the Bank between 1936 and 1944. This paper deals with the changes in the total catch (i.e. all species combined) per hour of trawling in relation to the changes in fishing intensity from 1945 when the present trawling activities started, to 1960. The effect of trawling on individual categories or varieties will be presented later.

RECORDS OF CATCH AND LANDINGS

Two sets of records were maintained during the period 1945-1960. The trawler records maintained by the skippers on board the trawlers and records of landings maintained by the shore staff. The details of the trawler records have been given earlier (Sivalingam and Medcof 1957). The format of the trawler record form referred to in the above paper has been given by Mendis (1965). When the trawler returns to port and the fish is landed, it is sorted out by categories for commercial purposes and the weights of each is recorded separately. The list of categories recognised for commercial purposes is given in Appendix I. Each commercial category is made up of one or more species.

In 1947 a private company the Lanka Deep Sea Fishing Company operated the coal burning steam trawler the "Aringa". The detailed records of its operations are not available, but the total landings and the number of days out of port for each trip are available. The data have been excluded from the general analysis due to lack of adequate details. But its operation is compared with that of "Raglan Castle" which operated about the same time.

Information has been received that during the later part of the period under review, other foreign trawlers operated on the Bank and landed the catch in Colombo. Details of these operations are not available for analysis. According to information received from the skippers of the vessels operating on the Wadge Bank, no trawlers from any other port operated on the Bank up to 1960.

The records are not complete in all respects. From 1957 the trawlers landed their catch direct in the fisheries harbour with the new cold rooms. Before this date cold storage space was limited in capacity and as a result it was not always possible to accommodate the entire catch brought in by the trawlers. For this reason on few occasions the trawlers were instructed to throw overboard low grade varieties like sharks and skates, catfish, etc. These were sometimes noted in the trawler records and sometimes not. The quantity thrown overboard could not be estimated.

In addition to the varieties regularly recorded, two species of the variety called "leather jackets" (*Balistes* sp.) were caught in varying quantities sometimes in enormous proportions of a ton or more per four hour haul. These were considered inedible and thrown overboard. The quantity caught were not recorded regularly.

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Further, during the later stages of the period under study the number of hours fished by trawlers were not recorded for certain trips. This has been estimated as follows. For the years during which the data on certain trips is not known, the proportion of trawling time to the total time spent on the fishing grounds is worked out for the trips for which the trawling time was recorded. On the assumption that this proportion would have been the same throughout the year, the trawling time for the trips for which it has not been recorded is calculated.

The shortcomings discussed above are of minor nature and not important enough to affect the conclusions.

CATCH PER UNIT OF FISHING EFFORT

For fishing effort it is possible to use the " number of fishing trips ". But in this case the number of days on the fishing grounds per fishing trip was not constant and varied from one to eleven days. As such, the catch per fishing trip is not a reliable standard for population study purposes. In this respect " the number of days on the fishing grounds " is preferable. But it has minor drawbacks. During the rough season (south-west monsoon months) on occasions the trawlers were forced to anchor for shelter with a loss in fishing time. On other occasions when on rough grounds the damage to the trawl net caused loss of fishing time. Also the duration for each trawl haul varied from skipper to skipper while the interval between hauls remained more or less constant. When the duration for each haul varies the proportion of actual fishing time to the time on the fishing grounds varies. Under these circumstances, if the " duration of each trawl haul " is available, this will give the most reliable information of the three. Data on the " duration of each trawl haul " is available and in this study this has been used for the fishing effort. The catch per unit of fishing effort is expressed in " pounds per hour of trawling ".

RELATIVE EFFICIENCIES OF TRAWLERS

Throughout this study, the catch per unit of fishing effort has been used as an indicator of changes in fish population density. In order to determine this factor it is necessary to standardize the relative efficiencies of the trawlers which had different specifications and operated during different periods.

The efficiency of operation or catching power of the trawler depends not only on the specifications of the trawler and net used but also on the skipper and his experience on the bank. While the specifications of the trawler and the nets remain the same, the second factor has been continuously changing. This fact is however, not serious enough to affect the conclusions arrived at.

In determining the relative efficiencies of the trawlers their catch rates for the same periods have been compared and relative efficiencies worked out.

" Raglan Castle " and " Aringa "

These two trawlers operated together on the Wadge Bank in 1947. Comparison of their catch per day is given in figure 1. It appears that there has been considerable fluctuations in the catch per day in the case of both the trawlers, but the average catch per day was very much the same. " Raglan Castle " fished for 71 days and landed 542,070 pounds with an average catch per day of 7,635 pounds, while " Aringa " excluding trips 1 and 13, fished for 128 days and landed 980,061 pounds with an average catch per day of 7,657 pounds. Trip number 1 was a trial trip and during trip number 13 the trawler was tied up for some time due to bad weather. It was not possible to estimate this time.

" Raglan Castle " and " Braconglen "

These two trawlers operated on the Wadge Bank simultaneously only for a short period. Also the former was by that time about to be discarded while the latter was new on the Bank. Table I gives the details of the catch rates by the two trawlers. On the average the catch rate of " Raglan Castle " which was the smaller of the two and also lesser powered (Sivalingam

and Medcof 1957) has been lower than that of the "Braconglen" and approximately 0.8 of that of "Braconglen". This ratio has been used throughout the analysis and the number of hours fished by "Raglan Castle" has been weighted accordingly.

"Braconglen" and "Maple Leaf"

Both these trawlers are more or less of same size and power and hence equally efficient. This is confirmed by the catch per hour analysis for the two years 1955 and 1957, selected at random (Table II). Fishing is seasonal and unless the fishing efforts during the good and off seasons are proportional for both the trawlers the comparison will not be accurate. It will be seen from Table II that the catch per hour has been changing from year to year for the two seasons for both trawlers, but on the overall average the catch per hour of trawling is more or less same for both trawlers.

WITHIN THE YEAR SEASONAL VARIATION IN CATCH RATES

From 1945 to 1950 fishing was not continuous and was interrupted during the south-west monsoon months. It was only from 1951 onwards till the end of the period under study when fishing was carried out during the full twelve months of the year. As was observed earlier (Sivalingam and Medcof 1957 and Sivalingam 1966) the catch per hour of trawling during the southwest monsoon months (May to October) was higher than that during the rest of the year (Fig. 2). During these months the catch was more than 600 lbs. per hour of trawling. During the months with the lowest catches the catch was less than 300 lbs. per hour. But the pattern of relative abundance on the Bank during the southwest monsoon months as indicated by the catch per hour of trawling was not the same for all the years (Fig. 2). During certain years (1951 to 1953, and 1959 to 1960) the catch was heaviest during the beginning of the season, i.e. in May and June and then gradually decreased towards the end of the season while during other years (1954 to 1958) the heaviest catches were during the mid season i.e. in July or August.

While the catches were generally lower during the northeast monsoon months, there was a slight increase during January and or December.

The increase in catch appears to be closely associated with rougher sea and atmospheric conditions on the Bank during southwest monsoon months. As was observed for the earlier commercial fishery (Sivalingam 1966) and will be seen in subsequent papers, the increase in catch was due to the appearance of varieties that normally do not appear in the catches during the northeast monsoon months (migrants stock) coupled with increased catches of those varieties that are present on the Bank throughout the twelve months of the year (resident stock). The almost complete absence of the former varieties from the Bank during the northeast monsoon months indicates they are migratory in nature.

YEAR TO YEAR VARIATION

Catch

The main objective of the management of any commercial fishery is to obtain the optimum sustained yield without diminishing returns. In an ideal fishery where the biological factors like age, rate of growth, population density, natural mortality, etc. can be estimated, it is possible to work out the theoretical annual catch for the optimum sustained yield. More often in such a fishery only one species is involved. The tropical marine fisheries on the other hand are greatly handicapped by the fact that it is not only difficult to determine the various biological factors but is further complicated by the fact that large number of species are involved. Under these circumstances the only means available for proper management of the fishery is to gradually expand the fishery until such a time when the catch rate, species composition and size composition indicate no further expansion is possible. Under normal conditions when a fish stock is under fished, the catch rate and size composition remain steady or increase. But with overfishing the catch rate is bound to fall steadily and also the size of the fish caught will be progressively smaller.

Figure 3 gives the changes in fishing intensity, catch rate and total catch for the period 1945 to 1960.

Until the end of 1950 when only one trawler was working the annual fishing effort was less than 1,250 hours of trawling and the total catch was around $\frac{1}{2}$ million pounds. With the introduction of a newer and more powerful trawler "Braconglen" in 1951 the fishing effort increased to over 2,000 hours of trawling per year with a corresponding increase in catch to a little more than a million pounds. Later in 1953 with the introduction of "Maple Leaf" the total catch closed up on 3 million pounds, and continued to be so till 1957. From 1957 onwards with a fall in fishing effort the annual catch came down to less than $2\frac{1}{2}$ million pounds. The number of hours trawled was highest in 1954 when both the trawlers were comparatively new and there was keen competition between the skippers to put in better sea time. Since then the effort declined to its lowest in 1960 when the fishing effort was only about 66% of that of 1954.

The catch per hour of trawling has been fluctuating but generally it has been on the ascend since 1951. This increase does not necessarily mean an increase in the population on the Bank. It has already been shown that the fishing on the Bank is seasonal and therefore the annual average catch per hour will depend on the proportion of the fishing time for that year for the good fishing season. An increase in the proportion of the fishing effort during the good fishing season in relation to the fishing effort during the off season as seen since 1951 (Fig. 4) will naturally contribute towards an increase in the average catch per hour. The increase in the average catch per hour for the year closely follows the increase in the percentage of fishing time during the good fishing season.

The catch per hour and the fishing effort for the two fishing seasons (good season and off season) for the years 1951 to 1960 is given in figure 5. It will be seen that there is a clear indication of a gradual falling off of the catch per unit of fishing effort during the off season, while that for the good season has been fluctuating and appear to improve. In both cases with a decrease in the fishing effort in 1960 (Fig. 5) the catch per hour has increased. The significance of the increase in catch per hour with the decrease in fishing effort can only be known with the data for the years after 1960.

The fishing during the off season is primarily for the resident stock (page 19) while that during the good season is for the migrant plus resident stock.

The gradual falling off of the catch per hour of trawling during the off season indicating a corresponding decrease in the fish population is not very encouraging, specially when it is known that the fishing effort is increasing from two trawlers to seven or eight trawlers at present (Mendis 1965).

Value of the catch per hour

The mode of disposal of the catch changed from time to time. There were also slight differences on the wholesale price, but on the average the price per pound has been as follows:— Grade I—Rs 1.00, Grade II .50 cts and Grade III .10 cts The varieties and their corresponding grades are given in Appendix I. Based on these prices the annual average value of the catch per hour is given in figure 3. It will be observed that the annual average value has remained more or less steady indicating that if there were any increases in the value of the catch per hour for certain varieties, as was observed for the good season, there was a corresponding decrease in the value of the catch per hour for the off season.

CONCLUSION

An analysis of the data indicates that the catch per hour during May to October was higher than that for the rest of the year as was observed for the earlier fishery. But the pattern of relative abundance of the fish population on the Bank during these months was not the same from year to year. The annual average catch per hour was on the increase from 1951 as a result of the proportional increase of fishing time during the good season and as a result of

increase in the relative abundance of the fish population during the same season. On the other hand there has been a gradual falling of the catch per hour during the off season indicating a decrease of the fish population during this season. As a result the annual average proceeds per hour of trawling has remained more or less the same.

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LITERATURE CITED

- MENDIS A. S. 1965. The Trawler fishery. *Bulletin Fisheries Research Station, Ceylon*. Vol. 17 No. 2 pp. 268-274
- SIVALINGAM S. 1964. Assessment and possible development of fishery resources of Pedro Bank. *Ibid.* Vol. 17 No. 1 pp. 133-150
1966. Wadge Bank trawl fishery studies. Part I. The effect of the 1928 to 1935 commercial trawling on the demersal stock. *Ibid.* Vol. 19 No. 1 & 2 pp. 11-16
- SIVALINGAM, S. AND J. C. MEDCOF .. 1957. General features and productivity of the Wadge Bank trawl fishery. *Ibid.*, No. 6, pp. 1-23

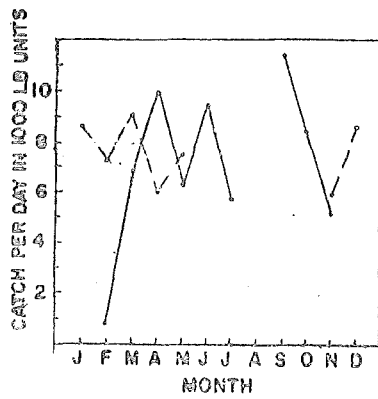


Fig. 1

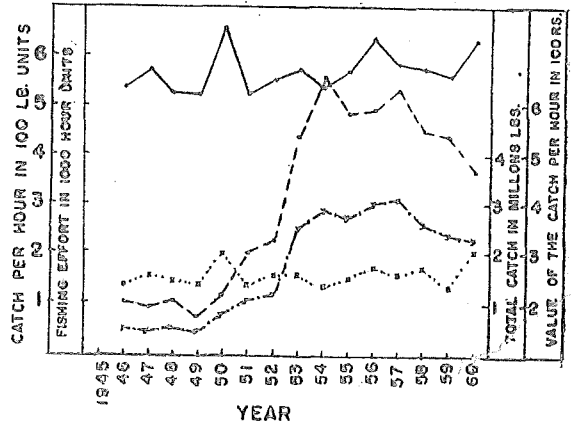


Fig. 3

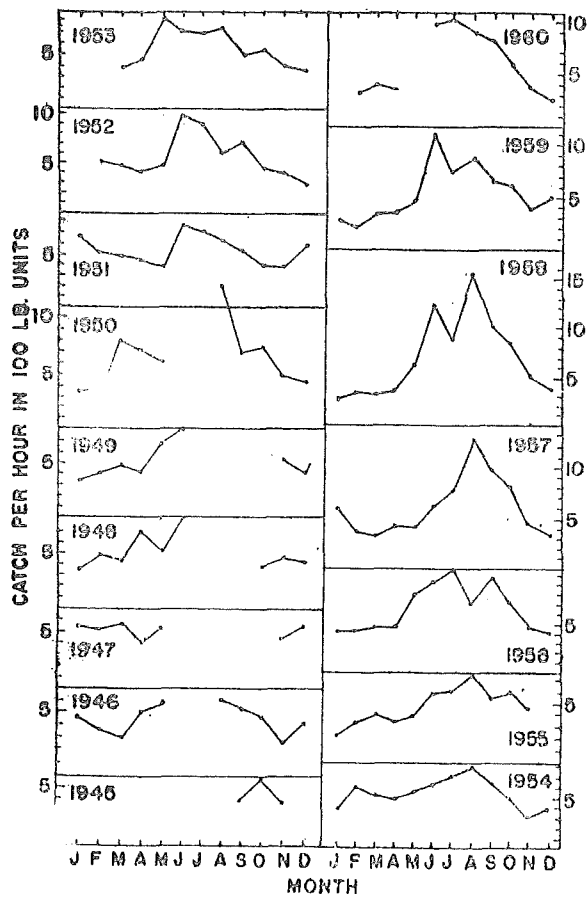


Fig. 2

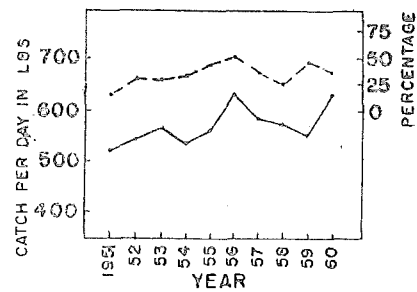


Fig. 4

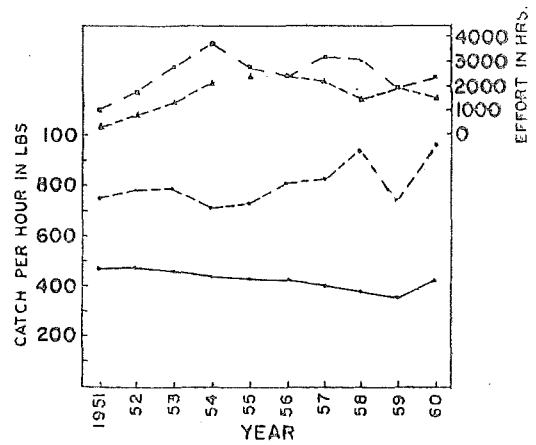


Fig. 5

Fig. 1.—Comparison of the catch per day's trawling by "Raglan Castle" (dotted line) and "Aringa" (solid line).

Fig. 2.—Variation in the monthly catch per hour from 1945 to 1960.

Fig. 3.—Annual fishing effort (dash) annual catch (Y), annual catch per hour of trawling (solid line) and the value of the catch per hour of trawling (dotted line) for the period 1945 to 1960.

Fig. 4.—Relationship between annual average catch per hour of trawling (solid line) and the annual percentage of fishing time during the good season (dotted line) for the period 1951 to 1960.

Fig. 5.—Changes in the catch per hour of trawling during the good season (dash) and off season (solid line) in relation to the changes in the fishing effort during the good season (triangles) and off season (squares) for the period 1951 to 1960.

TABLE I

Comparison of the efficiencies of the trawlers "Raglan Castle" and "Braconglen"

| RAGLAN CASTLE (1951) | | | | | BRACONGLEN (1951) | | | | |
|----------------------|-------------|----------------------|---------------------|----------------|-------------------|-------------|-------------------|---------------------|----------------|
| Trip No. | Date | No. of hours trawled | Total catch in lbs. | Catch per hour | Trip No. | Date | No. hours trawled | Total catch in lbs. | Catch per hour |
| 121 | 18/9—23/9 | 96 | 23 942 | 249.4 | 7 | 22/9—30/9 | 110.5 | 51513 | 466.2 |
| 123 | 17/10—21/10 | 86.5 | 30 415 | 351.6 | 8 | 15/10—25/10 | 170.5 | 51484 | 302.0 |
| 124 | 26/10—30/10 | 66 | 17 960 | 272.1 | 9 | 30/10—9/11 | 165.5 | 59638 | 360.4 |
| Total .. | | 248.5 | 72 317 | 291.0 | | | 446.5 | 162635 | 364.2 |

$$\frac{\text{Catch per hour by "Raglan Castle" } = 291.0}{\text{Catch per hour by "Braconglen" } = 364.2} = 0.8$$

TABLE II

Comparison of efficiencies of the trawlers "Braconglen" and "Maple Leaf"

| Year | Name of trawler | January to May and November to December | | | June to October | | | January to December | | |
|-------------|-----------------|---|---------------------|----------------|-----------------|---------------------|----------------|---------------------|---------------------|----------------|
| | | Total Catch | No. of hrs. trawled | Catch per hour | Total Catch | No. of hrs. trawled | Catch per hour | Total Catch | No. of hrs. trawled | Catch per hour |
| 1955 | "Braconglen" | 355,844 | 817 | 436 | 805,152 | 1,016 | 792 | 1,160,996 | 1,833 | 633 |
| | "Maple Leaf" | 451,418 | 1,167 | 387 | 858,980 | 1,239 | 693 | 1,310,398 | 2,406 | 545 |
| 1957 | "Braconglen" | 464,759 | 1,136 | 409 | 649,816 | 931 | 698 | 1,114,575 | 2,067 | 539 |
| | "Maple Leaf" | 546,121 | 1,304 | 419 | 882,596 | 1,077 | 819 | 1,428,717 | 2,381 | 600 |
| 1955 & 1957 | "Braconglen" | | | | | | | 2,275,571 | 3,900 | 583 |
| | "Maple Leaf" | | | | | | | 2,739,115 | 4,787 | 572 |

APPENDIX I

| Commercial categories as recorded by shore staff | Grade | Scientific names of main varieties included in each category |
|--|-----------|---|
| Bigfish | .. II .. | Specimens of the following species which are more than 30 cm. long <i>Lethrinus nebulosus</i> (Forsk.) <i>Epinephelus undulosus</i> (Quoy and Gaimard) <i>Lutianus dodecanthus</i> (Bleeker) <i>Lutianus rivulatus</i> (Cuvier) <i>Plectorhynchus pictus</i> (Tanaka) |
| Paiyinthe | .. II .. | <i>Ephippus Orbis</i> (Bloch) <i>Platax teira</i> (Forsk.) |
| Small fish | .. III .. | All specimens of the varieties listed above which are 30 cm or less and the following <i>Priacanthus humrur</i> (Forsk.) <i>Scolopsis dubiosus</i> <i>Lutianus vaigensis</i> (Quoy and Gaimard) <i>Parupeneus malabaricus</i> (Cuv. et Val.) <i>Lutianus rangus</i> (Cuvier and Valenciennes) and various other species of minor importance |
| Detta } Orawa } | .. III .. | <i>Acanthurus matoides</i> (Valenciennes) |
| Pothupara | .. III .. | <i>Balistes stellatus</i> (Bl. Sch.) |
| Paratti | .. I .. | Various small sized carangids less than 2 lbs. each |
| Paraw | .. I .. | Various big sized carangids more than 2 lbs each |
| Giralawa | .. I .. | <i>Megalaspis cordyla</i> (Linnaeus) |
| Jeela | .. I .. | <i>Sphyræna sp.</i> |
| Seer } Anjila } | .. I .. | Scomberomorids |
| Savalaya | .. III .. | <i>Trichirurus savala</i> (Day) |
| Catfish | .. III .. | <i>Arius thalassinus</i> (Bleeker) |
| Shark | .. III .. | Elasmobranchs |
| Shark liver | | liver from all Elasmobranchs |
| Fins | | fins from all Elasmobranchs |
| Cuttlefish | | Decapods |
| Prawns | | Penaeids |
| Fish Roe | | mixed ovaries of various species of the category called "Bigfish". |