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The effect of fishing on catch per effort, size and
sex-ratio of the Norway lobster (*Nephrops norvegicus* L.)
in Icelandic waters during the years 1962 to 1967.

by

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Introduction

Papers on the Norway lobster fishery in Icelandic waters during the period 1960 to 1965 have been published before by Sigurdsson (1965) and Skúladóttir (1965).

Regular sampling of Norway lobster from the various fishing grounds was initiated in 1962. Two years previously the filling out of reports for Nephrops boats had started, giving information about the catch and the number of trawling hours etc. In view of the intensive fishery in recent years, the material on the effect of fishing, as reflected in the average mean size of males, catch per trawling hour, and proportion of females in the catch, has been gathered in this paper. Apart from the continuation of these investigations, work on various aspects of the biology of the Norway lobster, is either being carried out or planned at the Marine Research Institute. At present work is mainly being done on size at maturity, spawning and hatching seasons, and fecundity of Nephrops in Icelandic waters.

Material and methods

Because of the known variation in the availability of female Norway lobster to capture by trawls size comparisons have been based

on measurements of males. All samples were taken from unsorted Nephrops on either commercial or research vessels.

Catch data are based on reports filled out by skippers of Nephrops boats for each trip undertaken, the neglect of which can mean a loss of licence for Norway lobster fishing rights for the boat or boats in question.

The investigation is confined to certain areas off the southwest, south and southeast coasts of Iceland as designated in Fig. 1. These areas comprise annually approximately 90% of the total fishery.

With the fishing season being limited to the summer months from the middle of May to the end of August or September (depending on area and year), only this part of the year has been included in the paper. However data from other seasons have been obtained on research vessels and are widening our knowledge of the biology of Nephrops in Icelandic waters.

Size composition

The mean and maximum carapace length of Norway lobster taken in area 146 during the period May-August over the years 1962 to 1967, is shown in Table 1a. Mean size of males has decreased considerably and is especially low in the last two years (1966 and 1967). Similar trend is seen for maximum size which often gives a useful comparison, particularly in case of any variations in fishing gear employed. Thus a large proportion of larger males has disappeared from the catch, presumably as a result of fishing. Results from other areas at the southwest coast are similar but more scanty.

Table 1b shows the mean and maximum carapace length of males taken off the southeast coast of Iceland (areas 152-154) during the period May-September over the years 1963 to 1967. From 1963 to 1965 no change in mean size is observed. There is, however, a considerable decline in 1966 and again in 1967, although the size is still comparable to the one observed in 1962 off the southwest coast (area 146). A likely explanation for this is that the fishery off Southeast Iceland was relatively light until 1963, whereas the exploitation of the southwestern areas, particularly area 146, dates back to the year 1958. However the possibility of a different size composition, owing to environmental factors, cannot be ruled out.

Table 1c shows the mean and maximum carapace length of males taken

off the south coast of Iceland (area 169) during the period May-August over the years 1963 to 1967. A pronounced decline is seen in both mean and maximum size over this period, but this area has been heavily exploited since 1958 when Norway lobster fishery first became commercially important in this country.

Thomas (1965) gives the progressive decrease in size composition of male Norway lobster during the years 1958 to 1962 throughout the main commercially exploited areas in Scotland and attributes it to the considerable increase in fishing. O'Riordan (1964) accounts for the small mean size of the Irish Sea Nephrops by the great increase in exploitation over the past 10 years which has reduced, by fishing mortality, most of the large individuals.

Annual catch/effort and sex-ratio

With the male population constituting at any time the major proportion of the catch, the partial disappearance of large individuals and diminishing mean size due to fishing mortality, would be expected to affect the catch per effort. At the same time the proportion of females, being better represented in a sample of smaller animals and partially protected by their smaller size and burrowing habit when berried, would be expected to increase.

Fig. 2a shows annual fluctuations in average catch per trawling hour and the proportion of females in the catch during the period May-August over the years 1962 to 1967 at Southwest Iceland (areas 106-148). A decrease in catch per trawling hour is seen over the period of years mentioned, accompanied by an appreciable increase in proportion of females. The value for 1962 is 80 kgs/hour decreasing to 40 kgs/hour in 1967 during which period the female percentage has increased from 11% to 32%. The relationship between catch/effort and female percentage appears to be good. The increase in catch/effort seen in 1963 and to a lesser extent in 1965 may be partly explained by the discovery of new important Norway lobster grounds in those years. The accompanying decrease in proportion of females could be associated with the exploitation of these virgin grounds.

Annual fluctuations in average catch per trawling hour and proportion of females in the catch during the period May-September over the years 1963 to 1967 off southeast Iceland (areas 152-154) are shown

in Fig. 2b. Changes in catch per trawling hour are seen to be rather small until 1966-1967 when there is a drop from 78 to 53 kgs/hour. The value for 1963 is rather low and hardly comparable to the others as no Norway lobster was caught here in May that year, but catches are generally highest in May, as will be discussed later. The increase in the proportion of females in the catch at Southeast Iceland is much less than the one encountered off the southwest coast, or 9% to 17%.

The data from South Iceland, although rather limited, show a decrease in average catch per trawling hour from 56 kgs/hour in 1964 to 33 kgs/hour in 1967, accompanied by an increase in the proportion of females in the catch from 20% to 32% over the same period.

The year to year decrease in size of males, accompanied by a lesser catch per trawling hour and an increase in the proportion of females is thus attributed to the intensive fishery in recent years. Moreover these changes are seen to be most prominent in the areas off the southwest and south coasts of Iceland, where a commercial fishery on a large scale commenced in 1958. In southeast Icelandic waters where the fishery was relatively light until 1963, these effects of fishing have, however, only started to appear in the last two years, i.e. 1966 and 1967.

Monthly catch/effort and sex-ratio

Apart from annual fluctuations in catch per trawling hour and sex-ratio, changes are observed from month to month each year.

Fig. 3a shows monthly fluctuations in average catch per trawling hour and proportion of females in the catch at Southwest Iceland (areas 106-148) over the months May to August during the years 1962-1967. The average catch per effort is seen to be highest in May, 89 kgs/hour, declining progressively to 56 kgs/hour in August. The percentage of females in the catch is seen to rise from 6% to 27% over the same period.

Monthly fluctuations in catch per trawling hour and proportion of females in the catch off the southeast coast of Iceland (areas 152-154) over the months May to August during the years 1963-1967 are shown in Fig. 3b. In these areas the catch is also highest at the beginning of the season in May or 115 kgs/hour, decreasing progressively to 57 kgs/hour in August. This is accompanied by an increase in percentage of females from 5% to 14% over the same period.

Data from South Iceland are rather unsatisfactory, but indicate the same sort of phenomena regarding monthly changes in catch/effort and sex-ratio.

All the years here assembled show the same trend as regards the diminution of catch/effort and the increase in percentage of females in the catch over the months May to August. There are, however, changes in average values obtained for each year as discussed previously.

The catches at the start of the season in May can be expected to be good, as the stocks have had the opportunity to recuperate during the winter when there is no fishery for Norway lobster in Iceland. However with increasing effort, mainly in June and July (see Fig. 4), there is a progressive decrease in catch per trawling hour resulting in minimal catches in August. This indicates a great susceptibility of the Icelandic Norway lobster stocks to fishing. The fact that the mean size of males is generally seen to decrease somewhat from May to August as seen in Table 2, would account for some of the increase observed in the proportion of females in the catch over this period. However, the effect on the sex-ratio by seasonal variations in availability of females, owing to the burrowing habit of berried individuals, must be considered. A marked increase in percentage of females caught from June to September after the peak of hatching in May is shown by Thomas and Figueiredo (1965) and O'Riordan (1964) for the Norway lobster stocks around Scotland and Ireland respectively. Icelandic observations on ovary maturity and external egg development, planktonic larvae, filamentous remains of egg masses and soft condition of females indicate a period of hatching in the spring and early summer, thus coinciding with the increase seen in proportion of females in the catch. This is, however, being investigated further and will not be dealt with here.

The decrease in catch per trawling hour over the period May to August can be attributed to the high fishing intensity, particularly in June and July, resulting in the lowly catch towards the end of the season. With the evidence available, the increase in the proportion of females in the catch over the same period can be partly attributed to fishing intensity. There is, however, evidence as to the sex-ratio being affected by an increasing amount of females coming into the catch after the occurrence of hatching in spring or early summer.

S U M M A R Y

1. Information is given regarding the effect of fishing on size, catch/effort and sex-ratio of the Norway lobster in Icelandic waters over the years 1962 to 1967. The catch/effort data were obtained from reports for Nephrops boats, whereas information on size composition and sex-ratio was mainly obtained by regular sampling of both commercial and research vessel catches.

2. The mean and maximum carapace length of males has decreased considerably with the sustained high intensity of fishing in recent years. This is most noticeable off the southwest and south coasts of Iceland where important commercial exploitation dates back to the year 1958. In southeast Icelandic waters, where the fishery was relatively light until 1963, no decrease in mean size is observed until the last two years (1966 and 1967).

3. Over the period 1962 to 1967 there has been a decline in annual catch/effort and an increase in proportion of females in the catch at Southwest Iceland. This, however, does not apply to the years 1963 and 1965 and can be explained by the utilization of new important Norway lobster grounds in those years. At Southeast Iceland these changes in catch/effort and female percentage are less apparent, probably due to lesser exploitation. There is, however, a considerable drop in catch/effort in 1967.

4. Monthly decrease in catch/effort and increase in female proportion over the months May to August is seen in all areas investigated. The lessening catch/effort can be attributed to the high fishing intensity during a relatively short Norway lobster fishery season. With the evidence available, the increase in the proportion of females in the catch appears to be affected by fishing as well as by the breeding cycle of the female Norway lobster.

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TABLE 1

The mean and maximum size (mm carapace length) of male Norway lobster, by years, for stated months and areas.

Year	1962	1963	1964	1965	1966	1967	
No. in sample	4666	3286	1359	1757	1438	595	A
Mean carapace length (mm)	46.5	44.4	44.5	44.0	41.9	41.6	Area 146
Max. carapace length (mm)	79	72	69	70	67	66	May-August

Year		1963	1964	1965	1966	1967	
No. in sample		3239	2581	2079	4324	2218	B
Mean carapace length (mm)		52.6	52.6	52.8	48.3	46.3	Area 152-154
Max. carapace length (mm)		76	80	79	81	75	May-September

Year		1963	1964	1965	1966	1967	
No. in sample		335	668	490	1237	906	C
Mean carapace length (mm)		52.9	49.3	48.9	45.0	42.3	Area 169
Max. carapace length (mm)		75	78	72	72	66	May-August

TABLE 2

The mean size (mm carapace length) of male Norway lobster and the proportion of females in the catch, by months, during the period 1962-1967 off Southwest Iceland (areas 106-148).

Month	May	June	July	August
No. in sample	3117	7366	11802	10392
Mean carapace length of males (mm)	46.4	46.0	44.1	44.4
Percentage females	6.1	10.8	17.3	27.1

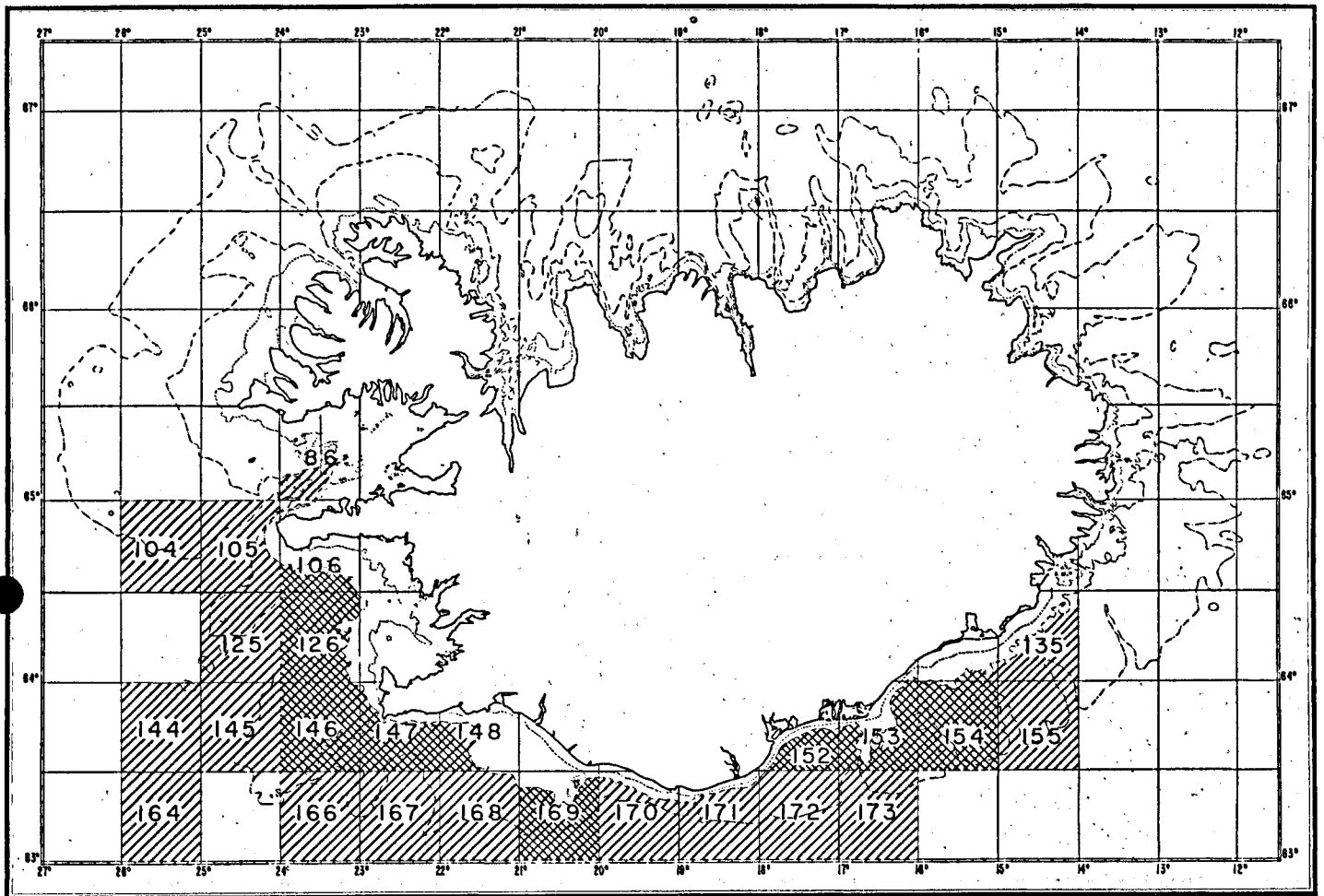


FIGURE 1. The statistical areas for the Norway lobster fisheries in Icelandic waters. Crossed are the areas discussed in the paper. Areas 106-148, 169 and 152-154 are here referred to as southwest, south and southeast Icelandic waters respectively.

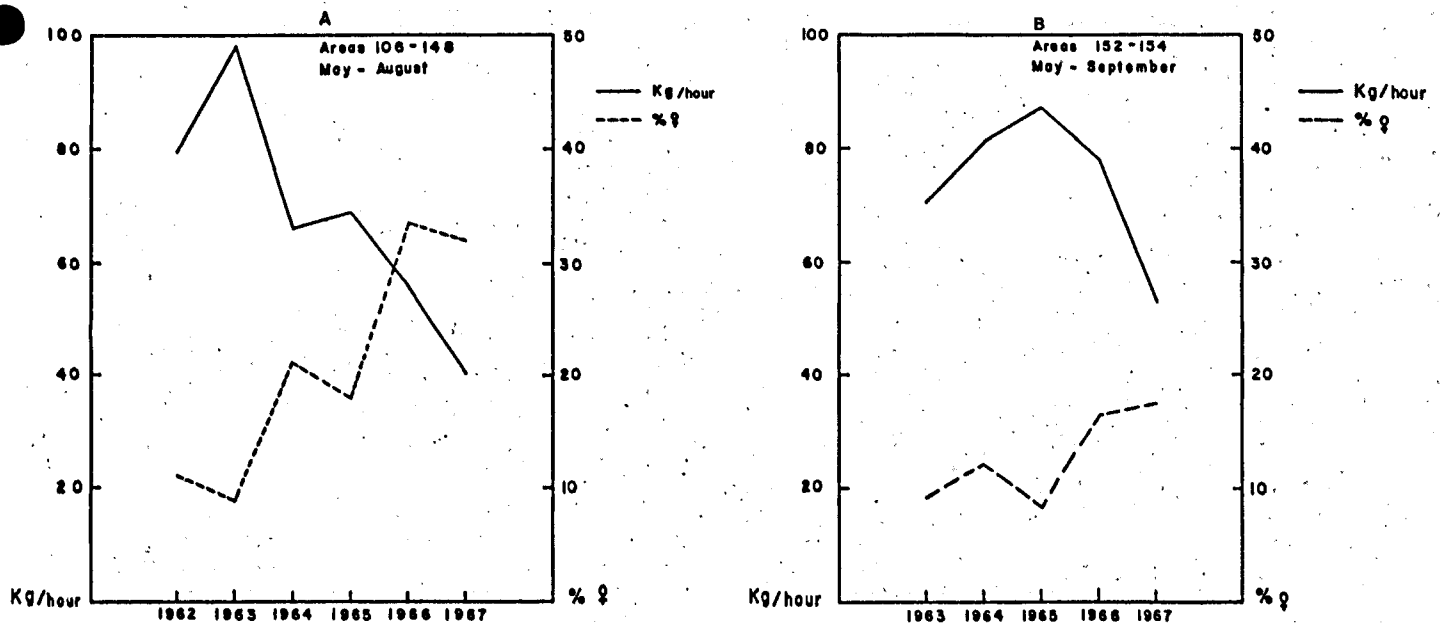


FIGURE 2. Annual fluctuations in catch per trawling hour and proportion of females in the catch, for stated months and areas.

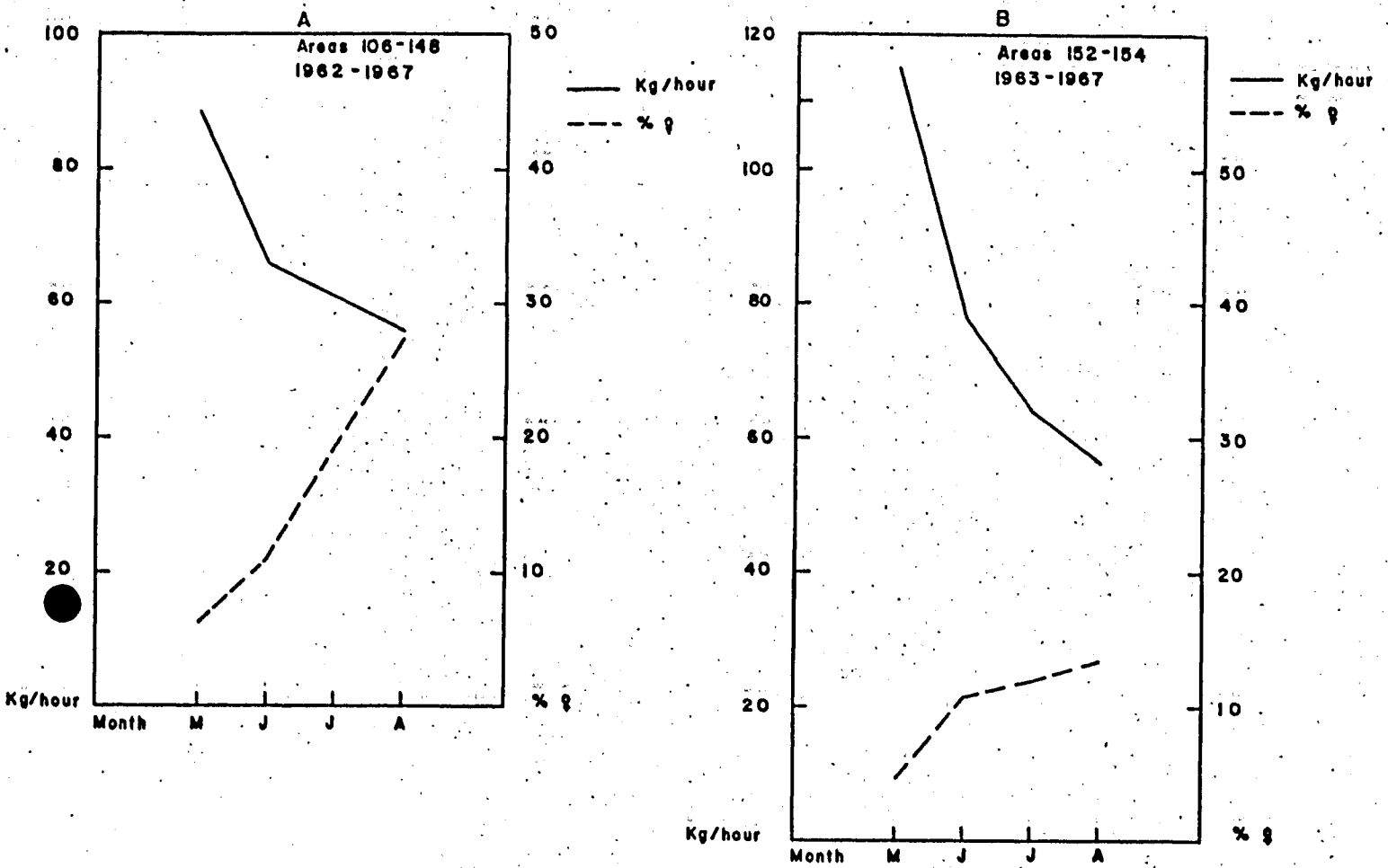


FIGURE 3. Monthly fluctuations in catch per trawling hour and proportion of females in the catch, for stated years and areas.

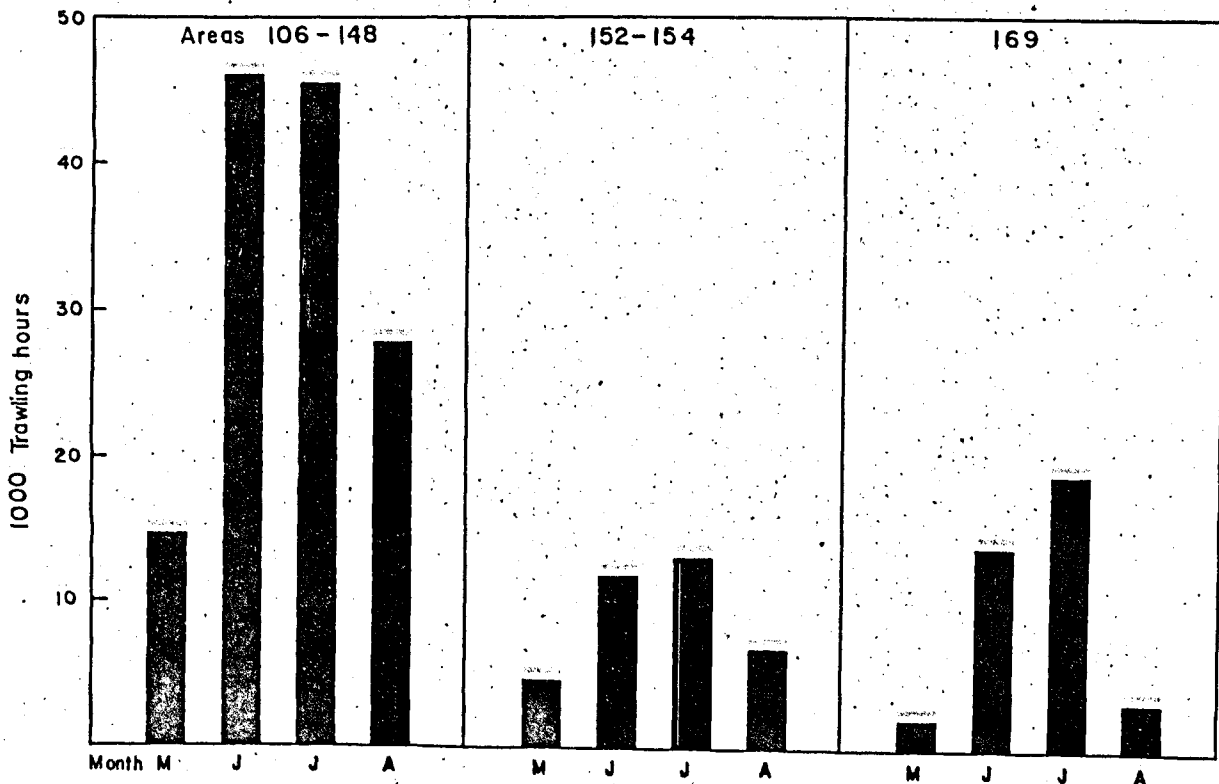


FIGURE 4. Monthly fishing effort (number of trawling hours) during the period 1962-1967, for stated areas.