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Unfavourable prospects for the Belgian shrimp fishery in 1975.

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Introduction.

Shrimp fishery is subject to strong yearly fluctuations. The life span and life cycle of Crangon crangon are relatively short (2 or 3 years) so that fluctuations in the strength of the different successive recruits have an immediate influence on the fishery.

In 1971 and 1972 the thinning out of the shrimp stock by the cod year-classes 1969 and 1970 strongly affected the Belgian shrimp fishery (DE CLERCK and REDANT, 1974). In these years the landings of commercial shrimps only amounted respectively to 905 and 865 tons. On the contrary 1973 was a very successful year : 1615 tons of shrimps were landed and in October 1973 a record yield of 51.3 kg/hour fishing was recorded.

1974 was forecasted as a good year for the shrimp fishery, due to the presence of strong brood classes of shrimps in 1973 and the absence of intensive predation during autumn and winter 1973-1974. In the course of the year however a clearly unfavourable trend in the evolution of the yield of the shrimp fleet was noted.

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In this contribution the evolution of the shrimp stock along the Belgian coast in 1974 is described and an analysis is made of the factors causing the unfavourable trend in the landings and the yield in 1974.

Material and methods.

This study is based partially on statistical data supplied by the Fisheries Division and partially on the results of experimental fishing on the shrimp stock and fish stocks along the Belgian coast.

The statistical data include the monthly landings of shrimps (C. crangon) from the Belgian coastal waters (statistical rectangle G 1) and the monthly fishing effort of the shrimp fleet. The yearly and half-yearly landings and yields of the shrimp fishery for the period 1970-1974 are summarized in table 1. Figure 1 shows the monthly yields (in kg commercial catch/hour fishing) of the shrimp fishery for the period 1970-1974.

The experimental part of the study consisted of monthly samplings on fourteen fixed stations in the Westdiep, the Vlakte van de Raan and the Thornton Bank. The positions of these stations are given in figure 2. Experimental fishing was performed with an otter trawl. The mesh size of the net was 18 mm. On each station the catch of a 15 minutes haul was analysed on its qualitative and quantitative composition. In the context of the present study special attention was paid to the fish species which play an important role as shrimp-predators. The yearly average densities of Raja species, Anguilla anguilla, Gadus morhua, G. merlangus, G. luscus, Trigla species, Scophthalmus maximus and Limanda limanda for the three investigated areas are summarized in table 2. The results concerning the densities of the so-called non-commercial shrimp-predators (Ciliata mustela, Cottus scorpius, Callionymus lyra, Pomatoschistus minutus, Agonus cataphractus and Liparis liparis) are given in ICES, 1975 C. M./K:44. The monthly average densities of G. merlangus in the Westdiep (period 1971-1974), the Vlakte van de Raan (period 1973-1974) and the Thornton

Bank (period 1973-1974) are represented respectively in the figures 3, 4 and 5. The monthly average densities of L. limanda in the Westdiep (period 1971-1974) are given in figure 6. Figure 7 shows the monthly average densities of undersized shrimps (smaller than 54 mm) in the Westdiep (period 1972-1974).

Results and discussion.

During the first half year of 1974 the landings of commercial shrimps from the Belgian coastal waters reached 642 tons. The average yield for this period was 17.2 kg/hour fishing (table 1). The high landings and yield of the shrimp fishery were in complete harmony with the expectations since at the end of 1973 very large concentrations of undersized shrimps (smaller than 54 mm) were recorded along the Belgian coast (figure 6 and DE CLERCK, CLOET and REDANT, 1974). The evolution of the shrimp landings was very promising and at that time it seemed as if the record landings of 1973, namely 1615 tons, at least would be equalled.

In 1974 the evolution of the yield showed the same pattern as in the previous years : a minimum in March - May and a maximum in September - October (figure 1). This maximum however was in 1974 only 23.5 kg/hour fishing, thus being clearly much lower than in the previous years (figure 1). During the second half of 1974 another 622 tons of shrimps were landed (i. e. only 49 % of the total 1974 catch). In this period the average yield was only 19.6 kg/hour fishing (table 1). Contrary to what was observed in the previous years there was in 1974 nearly no difference between the average yields for the first and the second half year (table 1).

The main reason for this phenomenon was the lack of a dense stock of undersized shrimps in the spring of 1974 (figure 7). Juvenile shrimps, which in winter and spring are still undersized, grow to a commercial

size in the course of spring and summer (TIEWS, 1954 ; SCHOCKAERT, 1968 and REDANT, 1972). It is very unlikely that the low densities of the undersized shrimps in the spring of 1974 were due to an unsuccessful brood. In 1973 a large stock of mature shrimps was present in the Belgian coastal waters. This is proved by the high landings recorded in 1973. Consequently at least a relatively large stock of young shrimps could be expected for the spring of 1974.

Some hypothetical explanations for the low densities of the undersized shrimps during spring 1974 can be postulated. These low densities might be the consequence of a mass mortality of the shrimp-larvae during winter 1973-1974. The reason for such a mass mortality might be predation, starvation as a consequence of depletion of the food-sources or unfavourable or lethal physico-chemical or climatological conditions. Unfortunately no data are available on this subject. Another possibility is mass mortality of the juvenile shrimps due to predation. Taking into account that in autumn 1973 large concentrations of undersized shrimps were still observed along the coast, it may be accepted that this predation occurred, at the earliest, in winter 1973-1974.

From the yearly average densities of different fish species, which according to bibliographical data are known to be shrimp-predators (REDEKE, 1906 ; TODD, 1907 ; BLEGVAD, 1917 ; GILLIS, 1952 ; JONES, 1954 ; KUHL, 1961 ; TIEWS, 1961 and 1965 ; BRABER and DE GROOT, 1973 ; DAAN, 1973 ; DE CLERCK, 1973 and REDANT, 1975a and 1975b), clearly appears that in 1974 the stocks of G. merlangus and L. limanda were considerably larger than in the previous years (table 2). The whiting stock, respectively dab stock, was in 1974, according to the area, 2.5 to 4.5 times, respectively 1.5 to 2.5 times, larger than in 1973. The stocks of the other shrimp-predators were in 1974 either of the same size as in 1973 or smaller than in 1973 (table 2 and REDANT, 1975c).

During the first half year of 1974 the stock of G. merlangus mainly consisted of individuals larger than 22 cm (2 or more years old). In summer and autumn the stock almost exclusively consisted of juveniles, smaller than 22 cm (0 and 1 year old). Young as well as adult whiting largely feed on Caridea, especially on C. crangon (GILIS, 1952 and REDANT, 1975a). The food contains mostly undersized shrimps but older whiting also feed on shrimps with a commercial size (REDANT, 1975a).

The stock of L. limanda mainly consisted of individuals smaller than 15 cm (0 and 1 year old) (table 2 and DE CLERCK, 1975). Older dabs (2 years and older) were found in large concentrations only in the West-diep (table 2 and figure 6). Dabs smaller than 15 cm are negligible as shrimppredators since they only sporadically feed on Caridea (BRABER and DE GROOT, 1973).

A synthesis of all these data leads to the following picture.

During the first half of 1974 an immigration of mainly 2 years old whiting (year-class 1972) took place in the Belgian waters (figures 3, 4 and 5). This immigration and especially its attendant predation on the juvenile shrimp stock, caused a reduction of the stock of these undersized shrimps. The maximum density of the undersized shrimps, already observed in the previous years in March-May, also occurred in 1974 but was strongly reduced (figure 7). The commercial shrimp stock was hardly attacked by this predation so that in spring and early summer 1974 very good catches (namely 642 tons) were recorded (figure 1 and table 1).

At the time the older whiting left the coastal waters, namely in July 1974, enormous numbers of 0 and 1 year old whiting (year-classes 1973 and 1974) were observed along the Belgian coast (figures 3, 4 and 5). This evolution was rather unexpected since neither the 1973 year-class, nor the 1974 year-class of North Sea whiting were described as strong year-classes (ANONYMUS, 1974 and HISLOP, HOLDEN and DAAN, 1974).

These young whiting largely fed on undersized shrimps but did not prey upon the spring-shrimps, which meanwhile grew to a commercial size. These spring-shrimps yielded 622 tons of consumption shrimps but, because of their relatively low density, the maximum in the yield was restricted to 23.5 kg/hour fishing. The predation by the 0 and 1 year old whiting caused a renewed and substantial reduction of the undersized shrimp stock. It is possible that this reduction, especially in the Westdiep, was intensified by the predation by 2 and 3 years old dab. Just like in the previous years a maximum density of undersized shrimps was observed in autumn 1974, but this maximum was apparently much lower than in the previous years (10,500 individuals/15 minutes fishing in 1974 versus 16,500 and 23,500 individuals/15 minutes fishing in 1972 and 1973 respectively). Consequently the landings of shrimp will be rather low during the first six months of 1975. As far as statistical data already are available a total of 410 tons may be expected for this period.

Analogous cases in which G. merlangus caused a crisis in the shrimp fishery have already been described in the past for the Belgian and German coast (GILIS, 1962 and TIEWS, 1961).

Conclusions.

During the first half of 1974 very good catches of shrimps (C. crangon) were recorded along the Belgian coast. The high landings and yield of the shrimp fleet in this period were a consequence of the very strong concentrations of undersized shrimps observed along the coast in autumn 1973.

The immigration, during the first half year of 1974, of, mainly 2 years old G. merlangus caused a first reduction of the undersized shrimp stock. In consequence of this predation-mortality the yield of the shrimp fishery was considerably lower in autumn 1974 than in the previous years.

The abundance of 0 and 1 year old whiting in the coastal waters from July 1974 onwards, caused a severe reduction of the undersized shrimp stock during summer and autumn 1974. This substantial reduction of the shrimp stock undoubtedly will have a strong repercussion on the landings and the yield of the shrimp fishery in the first six months of 1975.

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Table 1.

Yearly and half-yearly landings and yields of the Belgian commercial shrimp fishery in 1970-1974.

Year ----	Period -----	Landing (*) -----	Yield (**) -----
1970	Jan-June	607.4	15.7
	July-Dec	791.2	22.9
	Jan - Dec	1398.6	19.1
1971	Jan -June	165.6	7.5
	July-Dec	770.0	20.2
	Jan- Dec	935.6	15.6
1972	Jan-June	223.5	9.6
	July-Dec	641.8	18.1
	Jan - Dec	865.3	14.7
1973	Jan-June	465.1	14.3
	July-Dec	1150.1	32.1
	Jan-Dec	1615.2	23.6
1974	Jan-June	642.0	17.2
	July-Dec	622.4	19.6
	Jan-Dec	1264.4	18.3

(*) in tons

(**) in kg commercial catch/hour fishing

Table 2.

Yearly average densities of the commercial shrimp-predators (in numbers/15 minutes fishing) in the Westdiep (WD), Vlakte van de Raan (VR) and Thornton Bank (TB)(period 1971 - 1974).

Species	Length class	Year	WD	VR	TB
Raja species	All	1973	0.4	0.1	0.2
		1974	0.1	0.1	0.2
Anguilla anguilla (L.)	All	1973	0.4	0.3	0.1
		1974	0.3	0.1	0.0
Gadus morhua L.	All	1971	13.7	-	-
		1972	1.6	-	-
		1973	1.5	1.5	0.9
		1974	0.2	0.4	0.2
Gadus merlangus L.	All	1971	17.8	-	-
		1972	11.9	-	-
		1973	11.9	17.3	20.5
		1974	34.6	74.6	55.6
	Smaller than 22 cm	1971	9.1	-	-
		1972	8.0	-	-
		1973	3.8	11.7	14.6
		1974	28.5	65.0	41.0
	22-30 cm	1971	5.6	-	-
		1972	3.5	-	-
		1973	6.4	4.4	4.2
		1974	5.4	9.0	13.0
	Larger than 30 cm	1971	3.1	-	-
		1972	0.4	-	-
		1973	1.8	1.2	1.7
		1974	0.6	0.6	1.6
Gadus luscus L.	All	1973	8.4	11.1	26.9
		1974	2.8	9.4	19.0
Trigla species	All	1971	1.1	-	-
		1972	2.2	-	-
		1973	4.9	4.6	3.1
		1974	3.4	0.4	0.8
Scophthalmus maximus (L.)	All	1973	0.1	0.0	0.0
		1974	0.1	0.1	0.0
Limanda limanda (L.)	All	1971	49.3	-	-
		1972	25.2	-	-
		1973	37.3	20.9	11.4
		1974	92.4	34.2	21.9

Limanda limanda (L.) (continued)	Smaller than 11 cm	1971	27.8	-	-
		1972	9.7	-	-
		1973	21.7	15.1	9.9
		1974	50.8	27.4	14.2
	11 - 14 cm	1971	2.4	-	-
		1972	3.5	-	-
		1973	3.8	1.0	0.2
		1974	11.8	2.0	2.0
	15 - 19 cm	1971	13.3	-	-
		1972	7.4	-	-
		1973	7.8	3.6	1.0
		1974	26.8	3.4	4.1
	Larger than 19 cm	1971	5.8	-	-
		1972	4.6	-	-
		1973	4.0	1.2	0.2
		1974	2.9	1.4	1.6

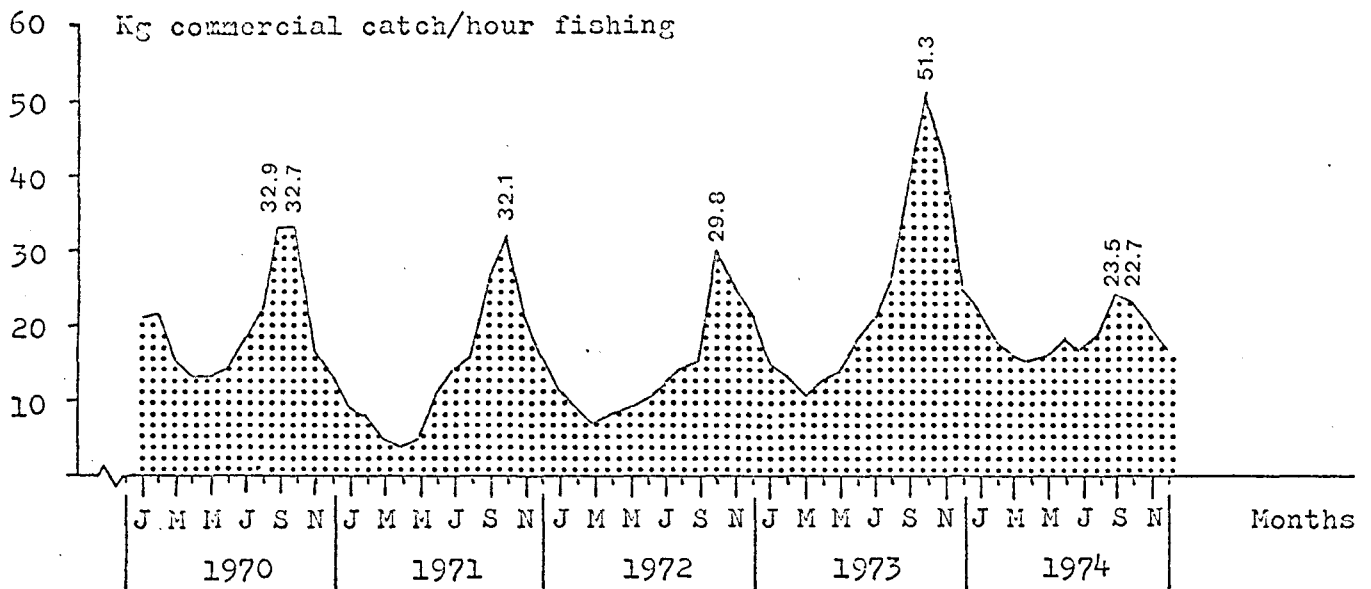


Figure 1.
Monthly yields of the Belgian shrimp fishery. Period 1970 - 1974.

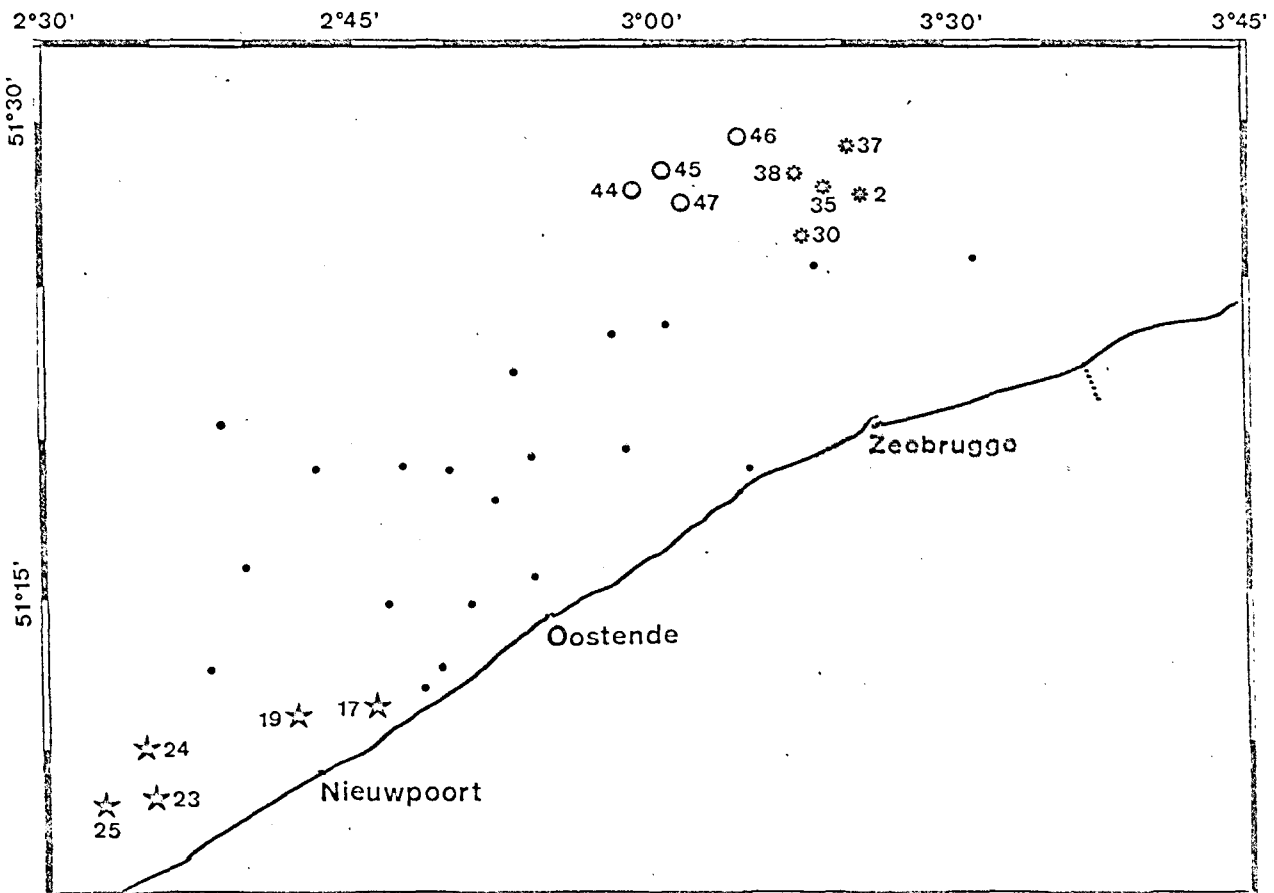


Figure 2.
Positions of the sampling stations in the Westdiep (☆), Vlakte van de Raan (*) and Thornton Bank (○).

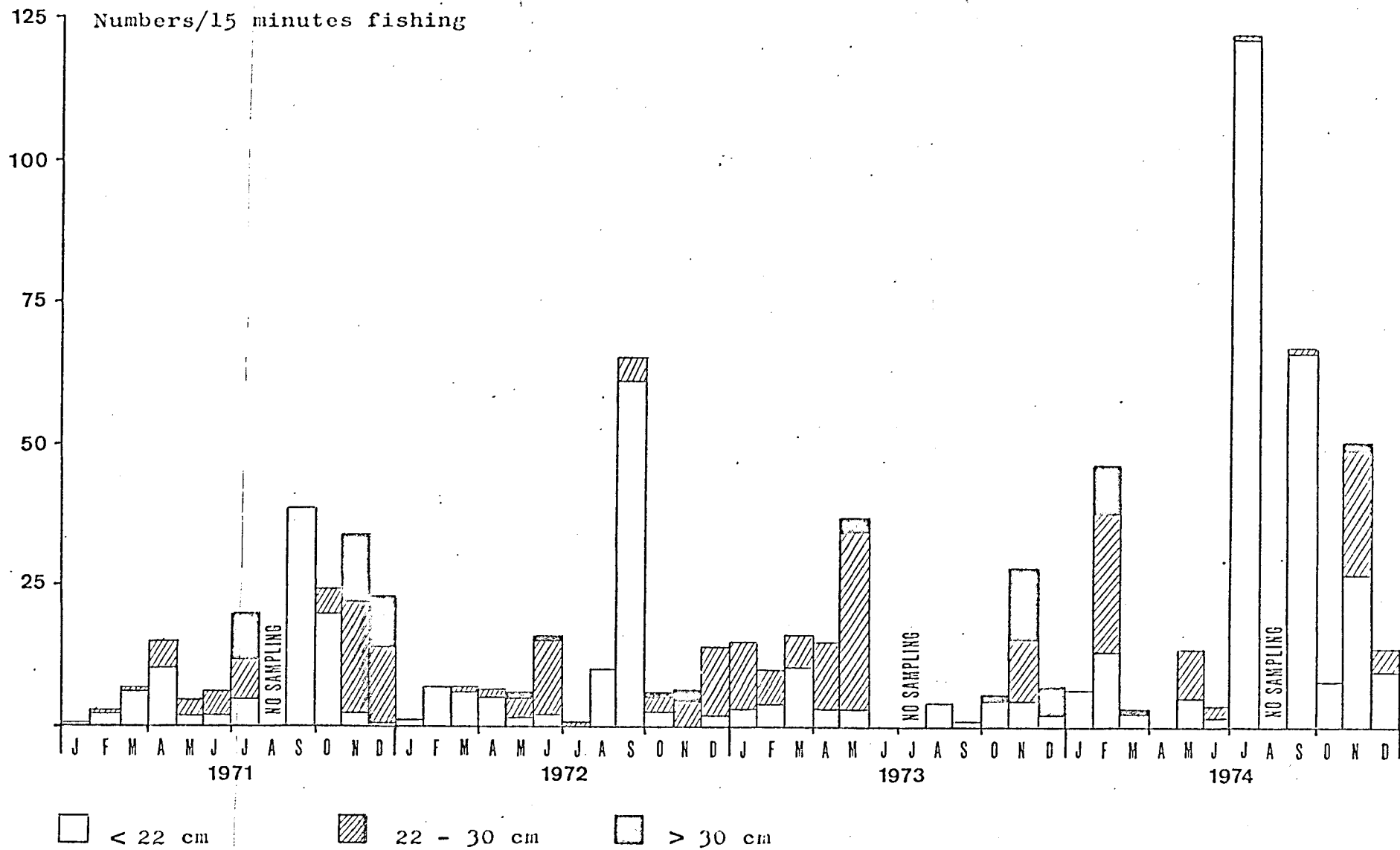


Figure 3.

Monthly average densities of whiting (*G. merlangus*) in the Westdiep (period 1971 - 1974).

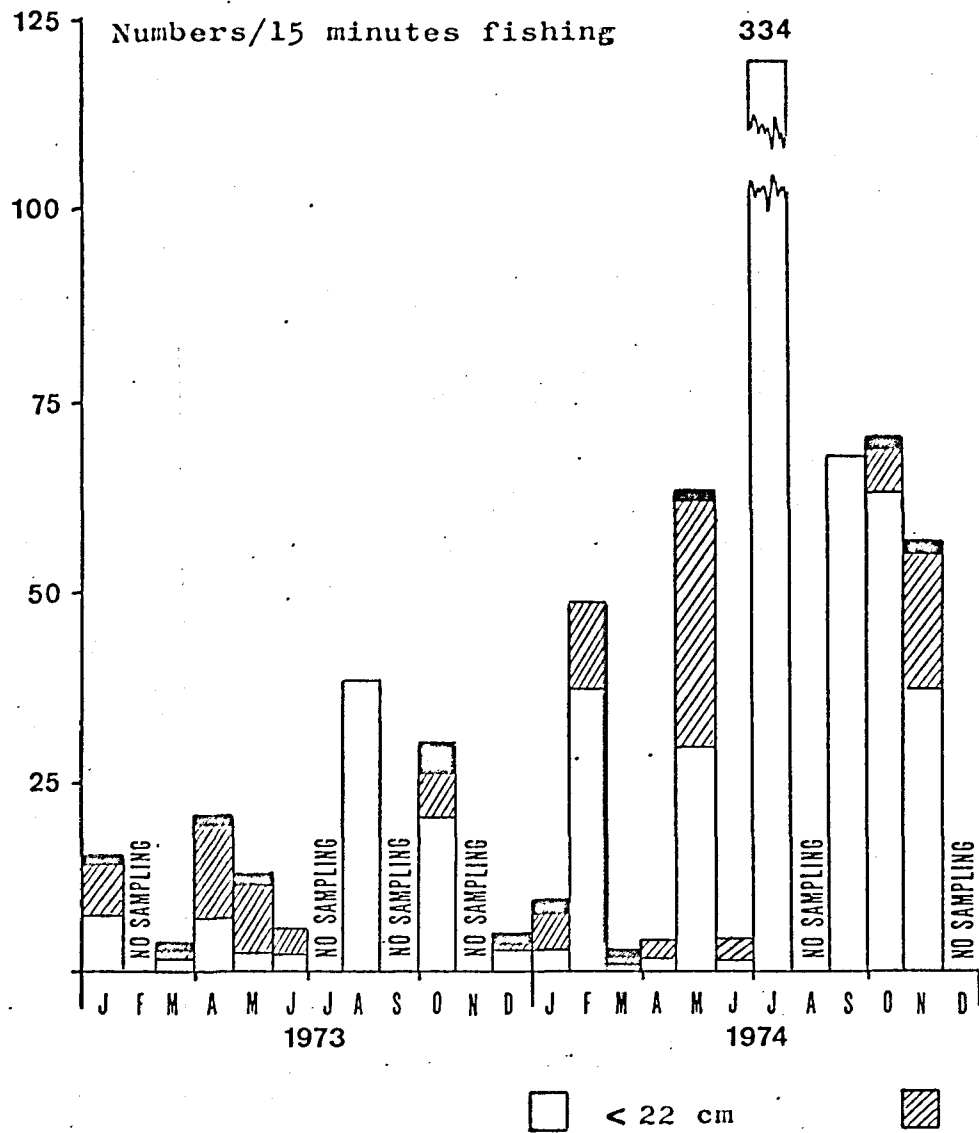


Figure 4.

Monthly average densities of whiting (G. merlangus) on the Vlake van de Raan .

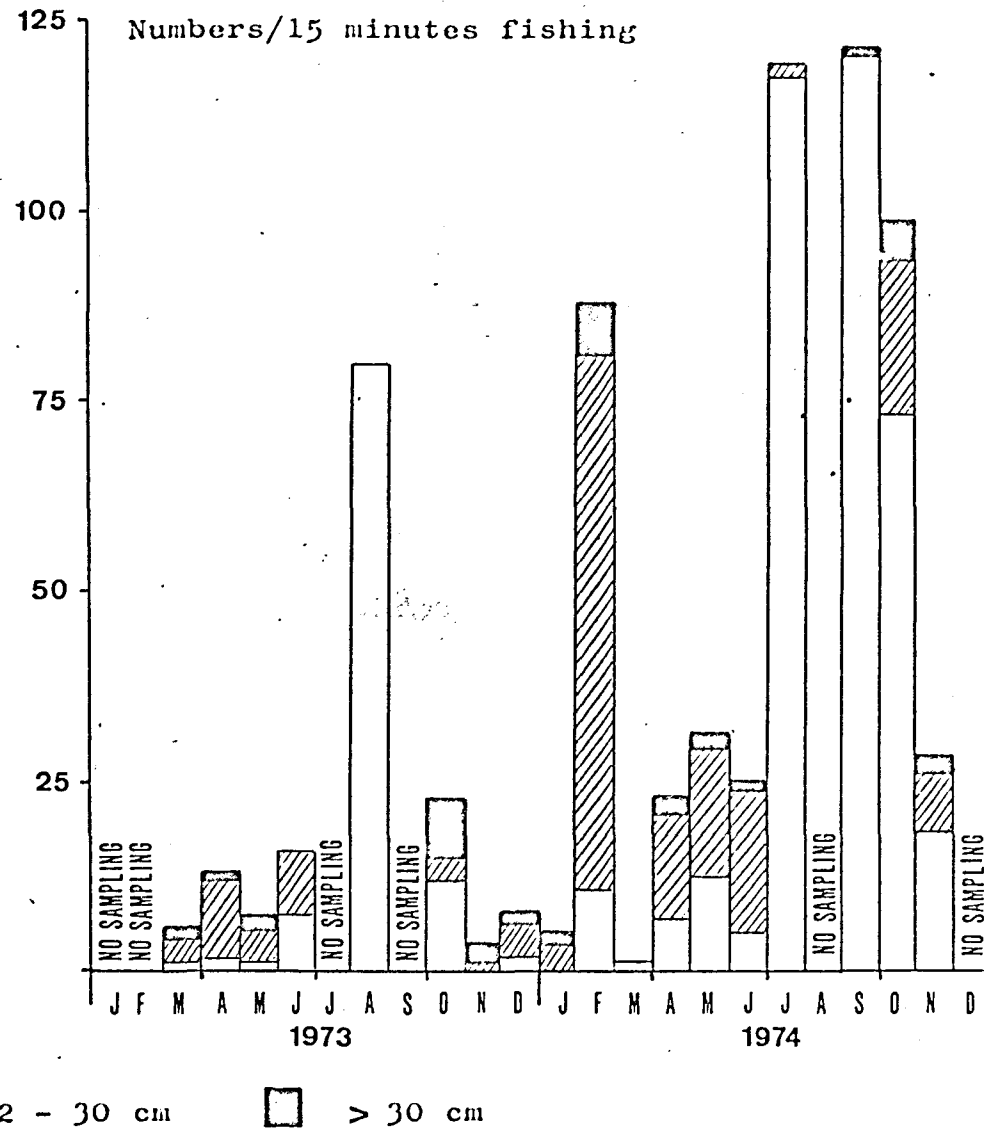


Figure 5.

Monthly average densities of whiting (G. merlangus) on the Thornton Bank.

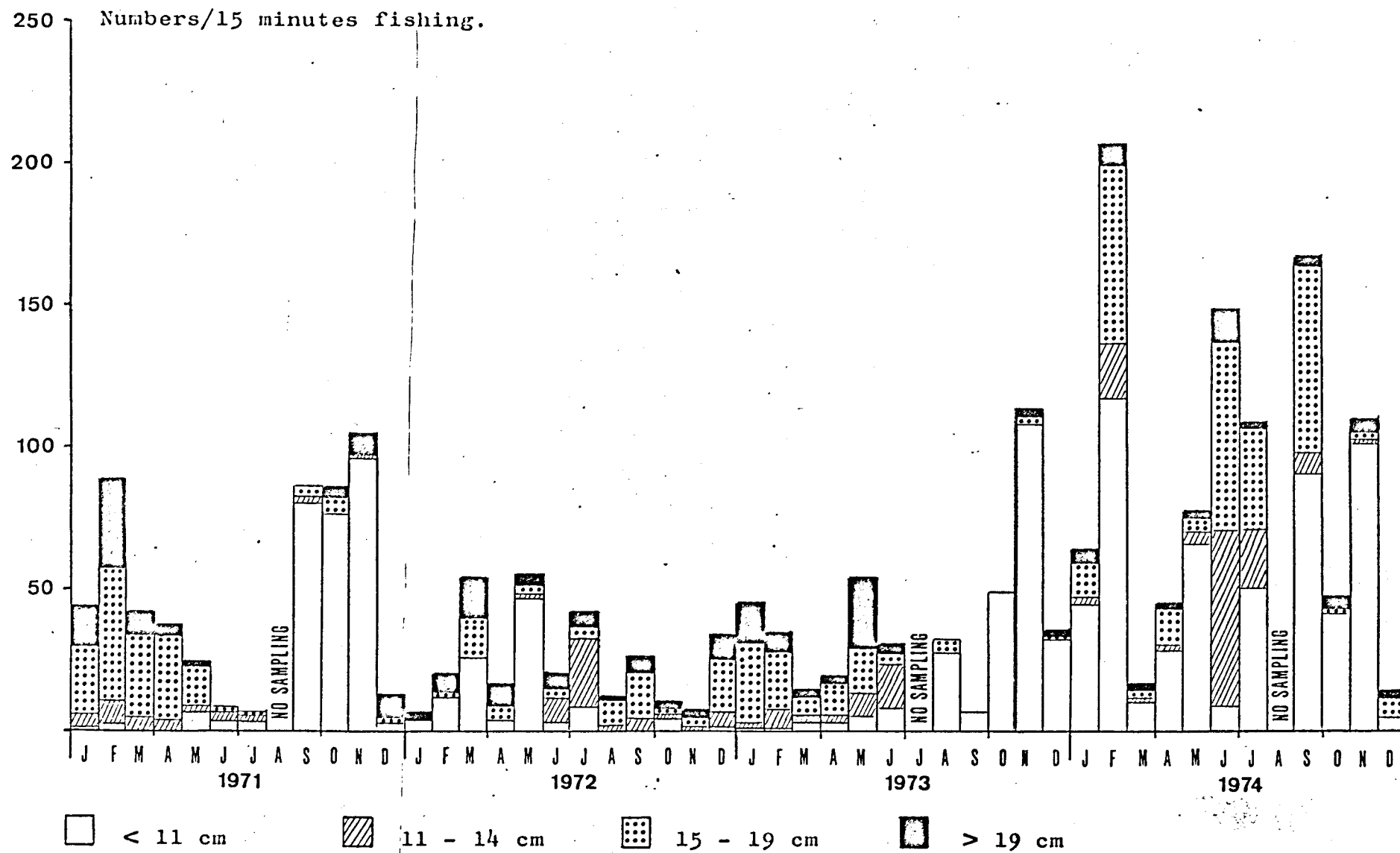


Figure 6.

Monthly average densities of dab (*L. limanda*) in the Westdiep (period 1971 - 1974).

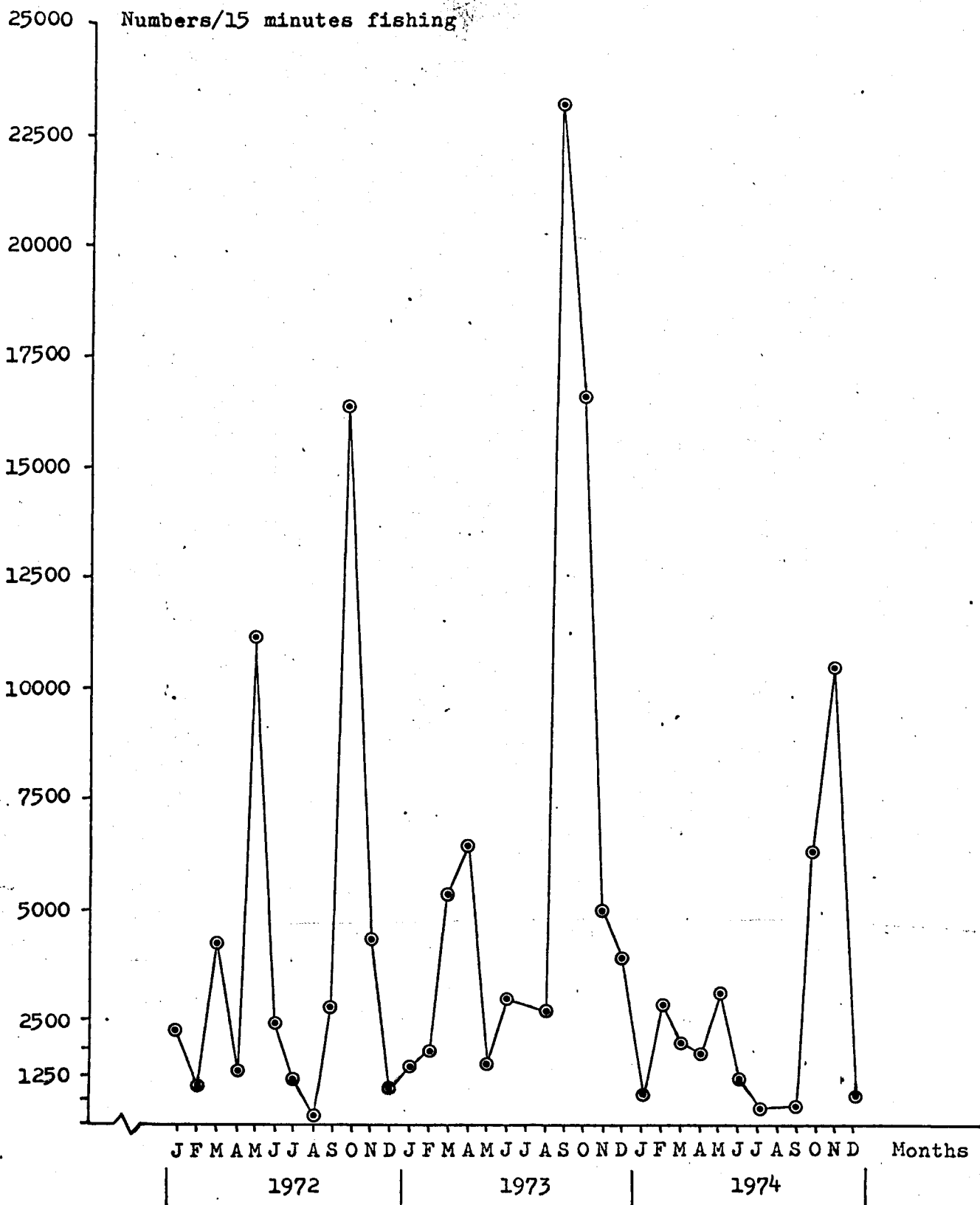


Figure 7.
 Monthly average densities (in numbers/15 minutes fishing) of undersized shrimps C. crangon in the Westdiep. Period 1972 - 1974.