

ACTA ADRIATICA

INSTITUT ZA OCEANOGRFIJU I RIBARSTVO - SPLIT
SFR JUGOSLAVIJA

Vol. XV, No. 8

THE YUGOSLAV NEPHROPS FISHERY

JUGOSLAVENSKI ULOV ŠKAMPA

STJEPAN JUKIĆ

SPLIT 1974

THE YUGOSLAV NEPHROPS FISHERY

JUGOSLAVENSKI ULOV ŠKAMPA

Stjepan Jukić

*Institute of Oceanography and Fisheries
Split, Yugoslavia*

ABSTRACT

Statistical data of the yearly Nephrops catch in the Yugoslav waters for the period 1960 /70. and the fishing effort data, the number of effective fishing days in a year, have been pointed that the average Nephrops population abundance in the Central Adriatic is considerably higher (53 kg/fishing day/year) — region A, then in the Northern Adriatic (22 kg/fishing day/year) — region B. Calculated values of the yield regression lines, between the catch per unit effort against the total yearly effort for the eleven years period for the both Nephrops fishing regions do not show that there is a direct relationship between them. Obtained values of the correlation coefficients (r) were: in the central open Adriatic (region A) $r = -0.06$, and northern channel region B, $r = 0.09$. It seems that behaviour of the Nephrops population inside of the clay-lomay bioceonose »*Nephrops norvegicus* — *Thenaea muricata*« along the Yugoslav coast, more directly, determines the index of abundance of the population.

In the selectivity Nephrops experiments with the synthetic bottom trawl, whose stretched mesh-sizes of the cod-end were: 41.6 mm, 52.8 mm, 62.6 mm, the following 50% retention lengths of Nephrops were obtained (1c) 4.3; 5.2; 9.2 cm. The selection factors of the synthetic cod-end with the knots (210/48 Den) were: 0.9, 1.5.

INTRODUCTION

Due to its high market price trawling of Nephrops in the Adriatic has an exceedingly great importance. In the eleven years period, from 1960 to 1970, the yearly catch of Nephrops in the Adriatic ranged from 770 to 1,258 tons. In this period Yugoslavia's share in the catch was 13.3. percent of the total Adriatic catch, within the Yugoslav waters exclusively, while the greater share was by the Italian trawlers, who were fishing mainly on the continental shelf.

Although the yearly Nephrops catch of the Yugoslav trawlers was considerably lower in the Adriatic Sea than that of the Italian ones, the mean percentage of Nephrops in relation to other edible benthic groups was considerably higher (12.4%) in the Yugoslav fishery than in the Italian (2.0%).

Yugoslav trawlers catch Nephrops on the continental shelf exclusively, only within the Yugoslav territorial and internal waters (Fig. 1). The

fishing grounds cover an area of approximately 800 square miles within which, in addition to Nephrops, trawling normally includes also other benthic groups of fishes like: *Chondrichthyes*, *Osteichthyes* among which the following families in the Central Adriatic stand out: *Scylliidae*, *Rajidae*, *Gadidae* and *Carangidae*.

With regard to geo-morphological and hydrographical conditions, size and number of trawlers and duration of the fishing season, the trawling area of Nephrops within the Yugoslav waters can be divided into two geographically quite separate regions:

- A — trawling region in the open Central Adriatic approx. 200 square miles
- B — trawling region of the Northern Adriatic channels approx. 600 square miles

The Yugoslav trawlers fishing in those regions are made of wood with the following characteristics: A — *Central Adriatic*: length 18—25 m, width 4.6—6.5 m, 38—123 BRT, engine power from 220 to 400 HP. The total number of commercial trawlers fishing in this region is 6—10 vessels during a year. The mentioned vessels belong to the combined type trawler-sciner, which, most frequently by mid-spring, abandon the trawling in the Central Adriatic, and in summer months they begin fishing small (sardine, anchovy) and large (tuna) pelagic fish. In autumn, September, trawl season begin again.

B — *Channel region of the Northern Adriatic*: length 14—18 m, width 4.0—4.9 m, 20—30 BRT, 80—150 HP. The number of trawlers during a year is from 65 to 116. As different from the vessels in the Central Adriatic the cruises of these vessels are more frequent, thanks to the enclosed area.

Table 1 — Total yearly catch of demersal species and Nephrops catch (tons) in the Adriatic Sea for the period 1961/69 year

Y e a r		1961	1962	1963	1964	1965	1966	1967	1968	1969
Total demersal catch	I	39 107	36 352	36 141	39 644	45 027	50 622	56 368	54 937	54 694
Total demersal catch	Y	1 590	1 150	1 116	1 458	1 366	1 188	1 147	1 050	946
Together		40 697	37 502	37 257	41 102	46 393	51 810	57 515	55 987	55 640
Nephrops catch	I	—	—	687	660	1 021	1 030	1 136	1 077	932
Nephrops catch	Y	182	120	93	119	161	141	122	137	153
Nephrops together		—	—	770	779	1 182	1 171	1 258	1 214	1 085
% Nephrops catch of the total demersal	I	—	—	1.9	1.7	2.3	2.0	2.0	2.0	1.7
% Nephrops catch of the total demersal	Y	11.4	10.4	7.4	8.2	11.8	11.9	10.6	13.0	16.2
I — Italy										
Y — Yugoslavia										

Within the mentioned regions the Nephrops population is closely connected with the clayey-loamy bottoms (Morović, 1951; O. Karlovac, 1953; Crnković, 1965 — in manuscript) making characteristic biocenosis »*Nephrops norvegicus Thenea muricata*« — (Gamulin-Brida, 1962). In the Central Adriatic Nephrops fishery is conducted at the depth of 180 to 220 m, and in the channels of the Northern Adriatic at the depth of 40 to 100 m. From the hydro-

Table 2 — Yugoslav yearly Nephrops catch (tons) and effort data for the fishing grounds in the Central open Adriatic and Northern channel region for the period 1960/70 year

Y e a r	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Central Adriatic (region A)	48	33	10	11	23	17	34	43	50	30	12
Effort (fishing days/year)	697	694	416	590	794	375	499	589	525	417	264
% of the total demersal catch	—	18.1	8.3	13.3	19.3	10.6	24.1	35.2	36.5	19.6	9.9
Northern channels (region B)	—	149	110	72	96	144	107	79	87	123	109
Effort (fishing days/year)	—	5674	4512	4742	4951	5267	5230	4581	5167	4358	5093
% of the total demersal catch	—	81.9	91.7	86.7	80.7	89.4	75.9	64.8	63.5	80.4	90.1
Yugoslav total Nephrops catch	—	182	120	83	119	161	141	122	137	153	121

graphical viewpoint both areas are characterized by small annual temperature amplitudes in the bottom layer, so that in the Northern Adriatic channel region these oscillate from 8.5°C to 12.0°C (Crnković, 1965). In the open Central Adriatic, the temperatures in the bottom layer are within the limits of 9.0°C to 13.6°C (O. Karlovac, 1956; Županović, 1969).

In these trawling regions fishing is done in the daytime, mostly from early dawn to twilight, so that the effective trawling day lasts from 8 to 10 hours.

Yearly catch and catch effort data

The statistical data on the total yearly catch of Nephrops in the Yugoslav territorial waters and the data on the total fishing effort (number of fishing days per year) for the period 1960/70 are shown in Table 2.

The data in Table 2 show that the yearly Nephrops catch in the Yugoslav waters oscillates considerably and in the mentioned period it is from 83 to 182 tons. An average of 20.0 percent of the yearly Nephrops catch belongs

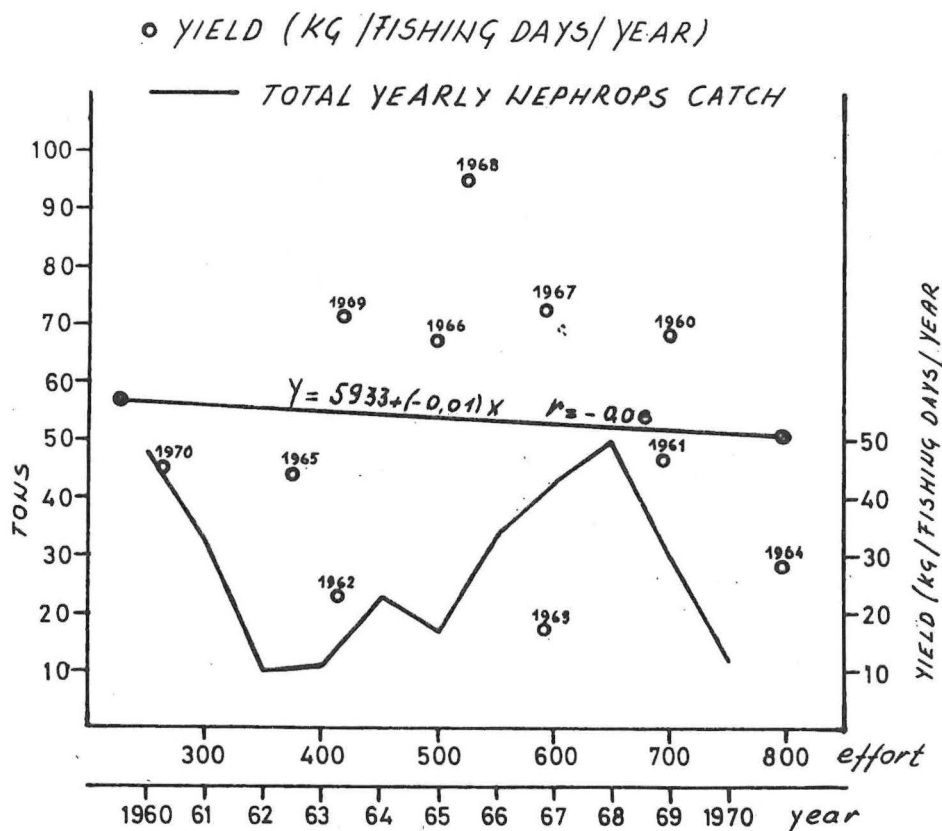


Fig. 2 — Yearly catch(—) and yield(o) of the Nephrops in the Central Open Adriatic as related to the effective fishing days; o—o yield regression line, r = correlation coefficient

to the Central Adriatic, and 80.0 percent to the channel region of the Northern Adriatic.

To estimate the settlement density of this population in the Central and the channel regions of the Adriatic, and to estimate the degree of the over-fishing of this population Figures 2 and 3 give the data on the catch per each region separately. According to the data in Figures 2 and 3 it can be stated that the catch per effort unit is considerably higher in the open Central Adriatic, region A, than the catch per effort unit in the region B. which means that the index of the Nephrops population density in this region is higher. These statistically stated differences in the index of Nephrops abundance withing two geographically separated regions, probably, due from the differences in the engine power of the fleet. For the central Adriatic calculated slope of the yield regression line [$y = 59.33 + (-0.01)x$], between the total fishing effort and catch per unit effort, points out negative value ($b = -0.01$), while the slope of regression line ($y = 16.00 + 0.01x$) of the fishing region B has a positive value ($b = 0.01$).

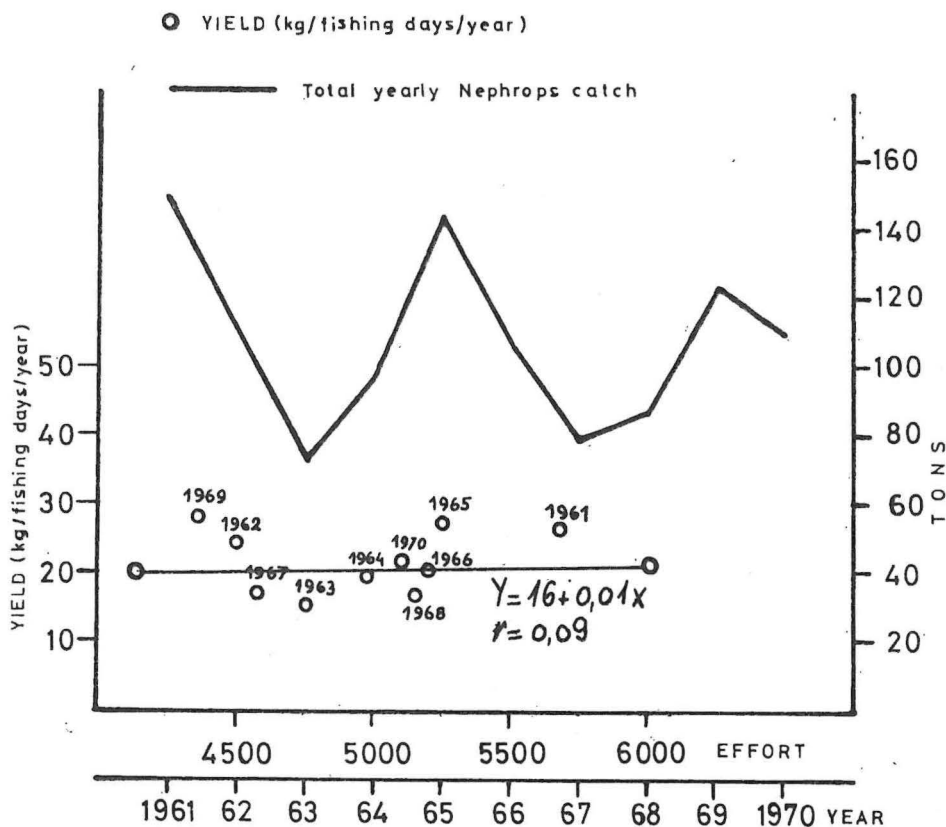


Fig. 3 — Yearly catch(—)and yield(o)of the Nephrops in the Northern Channel region as related to the effective fishing days; o—o yield regression line, r = correlation coefficient

Since the two calculated values of the slopes do not differ very much from each other, i. e. it could not be said that by further encreasing of fishing effort encrease of catch per unit effort could be expected, we tried to establish relationship between those two variables by means of correlation coefficient (r). Obtained values for correaltion coefficients for the central Adriatic ($r = -0.06$) and for channel region ($r = 0.09$) do not show any relationship between catch per unit effort and total fishing effort in the case of *Nephrops* population. It seems that biological factors, like yearly spawning cyclus of the *Nephrops* individuals, i.e. behavior of the population O. Karlovac, 1953; Jukić, 1971) plays more important part in the catchability of the species.

Nephrops selectivity experiments

In his ecological study on *Nephrops* in the Adriatic O. Karlovac (1953) states that the mean length of the *Nephrops* population in the Central Adriatic is 10.7 cm, i. e. less than the mean length of the *Nephrops* in the channel region of the Northern Adriatic, 11.5 cm. Realizing that it is of greatest importance to protect the *Nephrops* population from overfishing, the author suggests, by basing it on the biological and biometrical observations, that it would be necessary to protect the female samples of 9 cm (the first sexual maturity of the female occurs at 6.5 cm) by regulating the fishing gear, which would make it possible to preserve 30 percent females of the total population.

Having in mind such a statement and the fact that, in the Yugoslav trawling, no measures of mesh-size regulations of the bottom trawl have been put into effect, by basing it on scientific experiments, we were induced to examine for the first time to what extent the size of the cod-end affects the selection catch of *Nephrops* in the Adriatic. To understand the importance of the preliminary experiments on the cod-end selectivity Figure 4 and 5 bring the length composition of the *Nephrops* population in the Central Adriatic on the basis of scientific and marketing data. The data show that 80.0 percent of the whole *Nephrops* population in the region A consists of samples smaller than 12 cm. The unfavorable composition of the commercial catches, in addition to the biological characteristics of the population, lies in the unsolved problem of the right usage — the mesh-size regulation of the cod-end.

The experiments on selection by trawl nets were conducted during August 1971 (region A) with a synthetic trawl with knots, from the research vessel m/m »Bios« (300 HP). The system of covered cod-end was used. During the experiment the ship's rate was 3 miles an hour. All the time the same trawl used (Fig. 6) only the size of the cod-end was changed in the course of the experiments (41.6 mm, 52.8 mm, 62.6 mm, stretched mesh-size). The I.C.E.S. mesh gauge (pressure 5 kg) was applied in gauging the mesh-size of the wet cod-end after its being used several times. The values for the mesh-size of the cod-end in Table 3 represent the mean values of the stretched mesh-size of the cod-end. The total length of the *Nephrops* samples from the top of the rostrum to the end of the telson is given in the centimetres. The obtained results are given in Table 3 and Figures 7 a, b, c.

According to the data from Table 3 and Figures 7 it follows that in spite of the selection factor of the synthetic trawl net from 0.9 to 1.50 the values

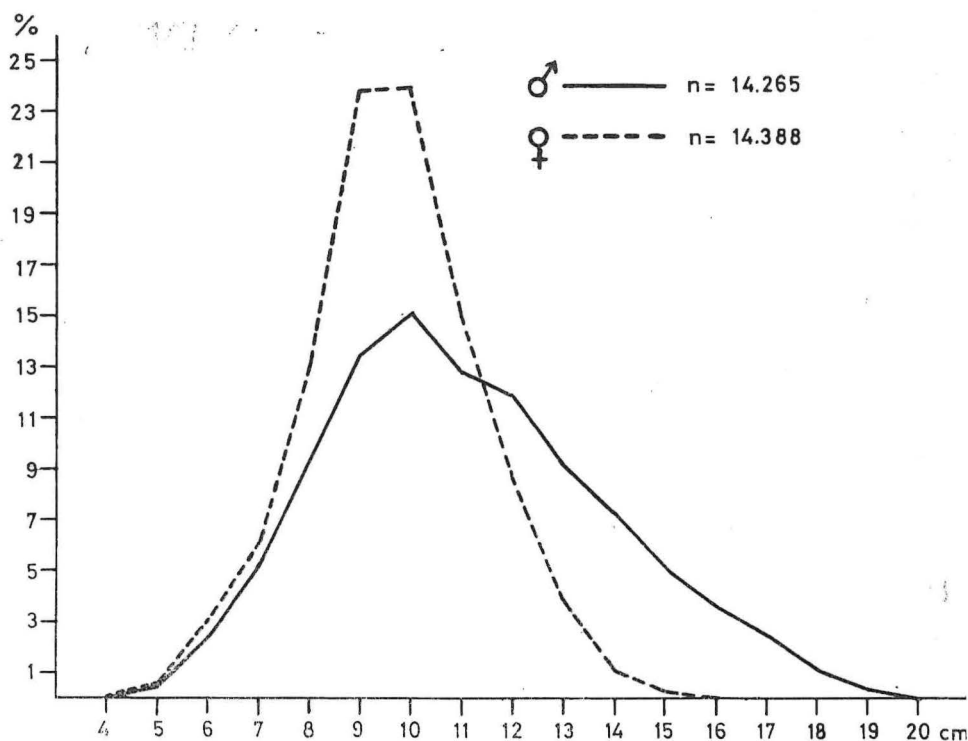


Fig. 4 — Percentage length distribution of *Nephrops* in the Central Adriatic. Research data for 1967/69 year.

of 50% retention length, the values (l_c), are very low, especially for the size of the cod-end of 41.6 mm ($l_c = 4.3$ cm), 52.8 mm ($l_c = 5.2$ cm) and 62.6 mm ($l_c = 9.2$ cm).

If we know the facts about the trawling conditions in Yugoslavia, where the problem of mesh-size regulation of the cod-end has not yet been treated, and that current fishing regulation allow the trawlers to use the cod-end of 40 mm, stretched mesh-size (it was often found that fishermen in Adriatic use even smaller meshes of the cod-end from 32 to 36 mm), and the fact that most trawlers use cotton trawl nets, one may conclude that *Nephrops* population in the waters of Yugoslavia is exposed to a high level of exploitation.

Discussion

As this species in the Adriatic is very interesting from its biological and economic point of view it has been studied since early times. The first biological studies of this species are found in the works by Lorenz (1863), who believes that this species in the Adriatic is a glacial relict. The works by Gauss-Garody (1912, 1913); Pesta (1914, 1918); Santucci (1926) deal mostly with the problems of biology, ecology and distribution of this species in the channels of the Northern Adriatic. The recent studies on the *Nephrops* popu-

lation (O. Karlovac, 1953; Crnković, 1965 — in manuscript; Županović, 1969; Jukić, 1971) deal with the problems of the ecology and catchability of this species in the Central and Northern Adriatic. According to O. Karlovac (1953) the *Nephrops* population density in the Central Adriatic is greater than in the other regions of the open Adriatic. The author has registered greater density only in the Northern Adriatic channels. He believes that this species in the Adriatic is closely connected with the habitat of the clayey-loamy sediments, so that he rejects Lorenz's hypothesis that *Nephrops* in the Adriatic is a glacial relict, which is exclusively connected with the sea bottoms of colder waters. Crnković (1965) has studied the biology and ecology of *Nephrops* in the channels of the Northern Adriatic and has stated that the size characteristics of the samples in this region (Fig. 8) do not differ much from the samples in the northern seas of Europe. The problem of the changes within the settlements, especially regarding the size of the samples, the author explains as the relationship of the height of exploitation and by basing it on scientific data, he explains and finds the changes in the composition of the

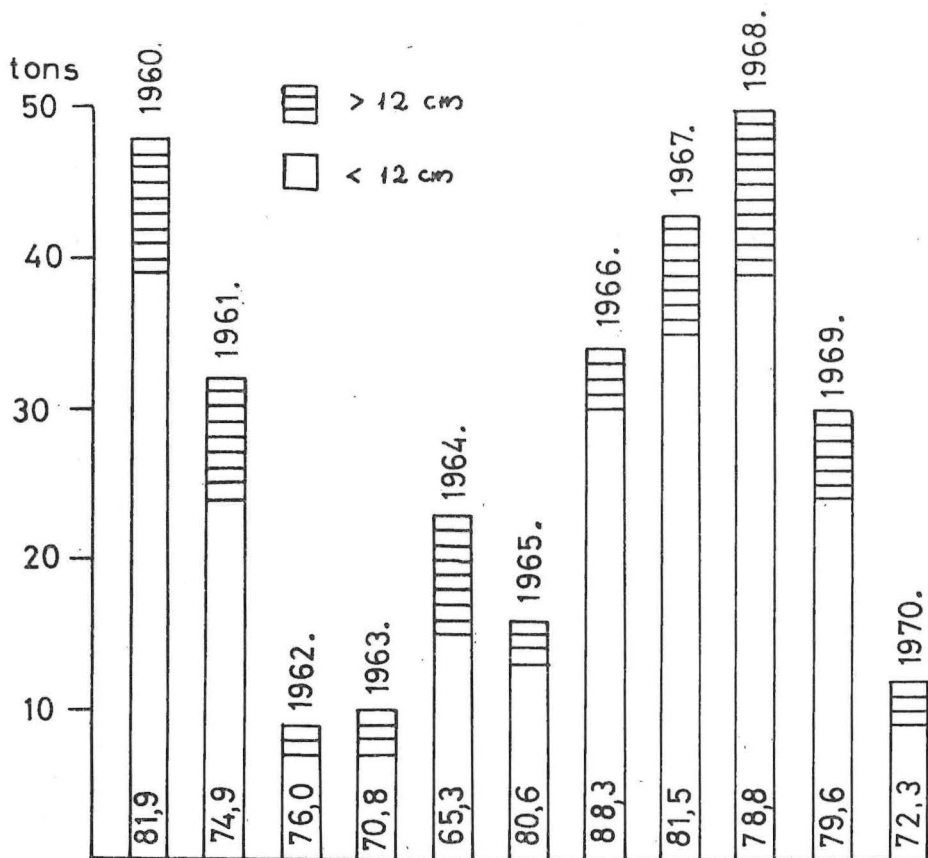


Fig. 5 — Composition of the *Nephrops* stock in the Central Adriatic for the period 1960/70 year (Commercial data).

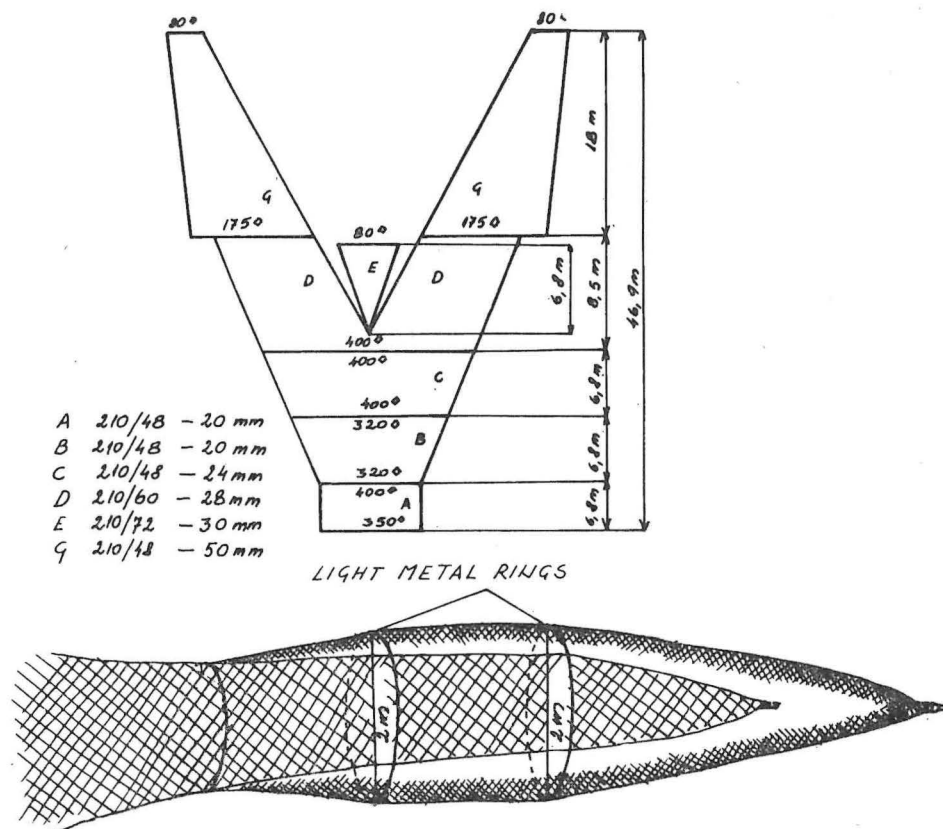


Fig. 6 — Description of the trawl, with a knots, that has been used in cover cod-end experiments in the Central Adriatic. August, 1971.

Nephrops settlements in the channels of the Northern Adriatic as the predatory relationship *Selachii-Nephrops*.

Županović (1969) believes that the yearly fluctuation in the *Nephrops* catch of commercial trawlers in the Central Adriatic are closely connected with the mean annual changes of temperature in the bottom layer. At higher temperatures he found higher yearly catches, and vice versa. Jukić (1971), studying the influence of the abiotic factor of light on the daily catch of *Nephrops* in the Central Adriatic, has found that the catches early in the morning and early in the evening are much higher than those during strong daylight. The same author says that the quantity of and the changes in the monthly catches of *Nephrops* in the Central Adriatic are probably influenced by the composition of the *Nephrops* population, i.e. by the relation between males and females, because it is known that the sexually mature females with external eggs bury themselves into the bottom sediments (O. Karlovac, 1953), and in these months (Jan. Aug. Nov. in the Central Adriatic, when the number of males examples in the trawl catches is greater than that of the females, the average weight of the catches are also greater.

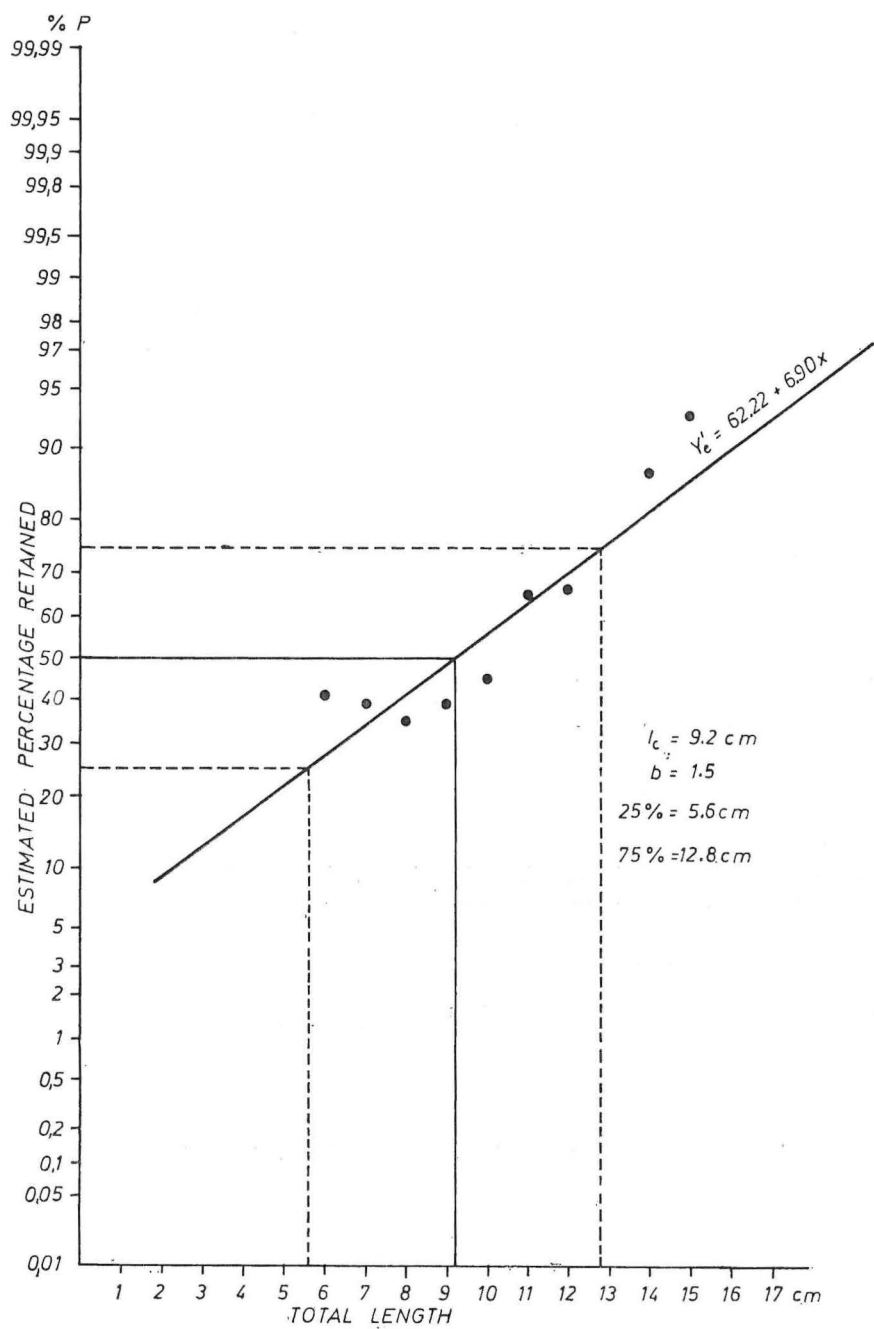


Fig. 7a — *Nephrops* selectivity data for synthetic twine (polyamid) cod-end of 41.56 mm; 210/48 Den in the central omen Adriatic (August, 1971)

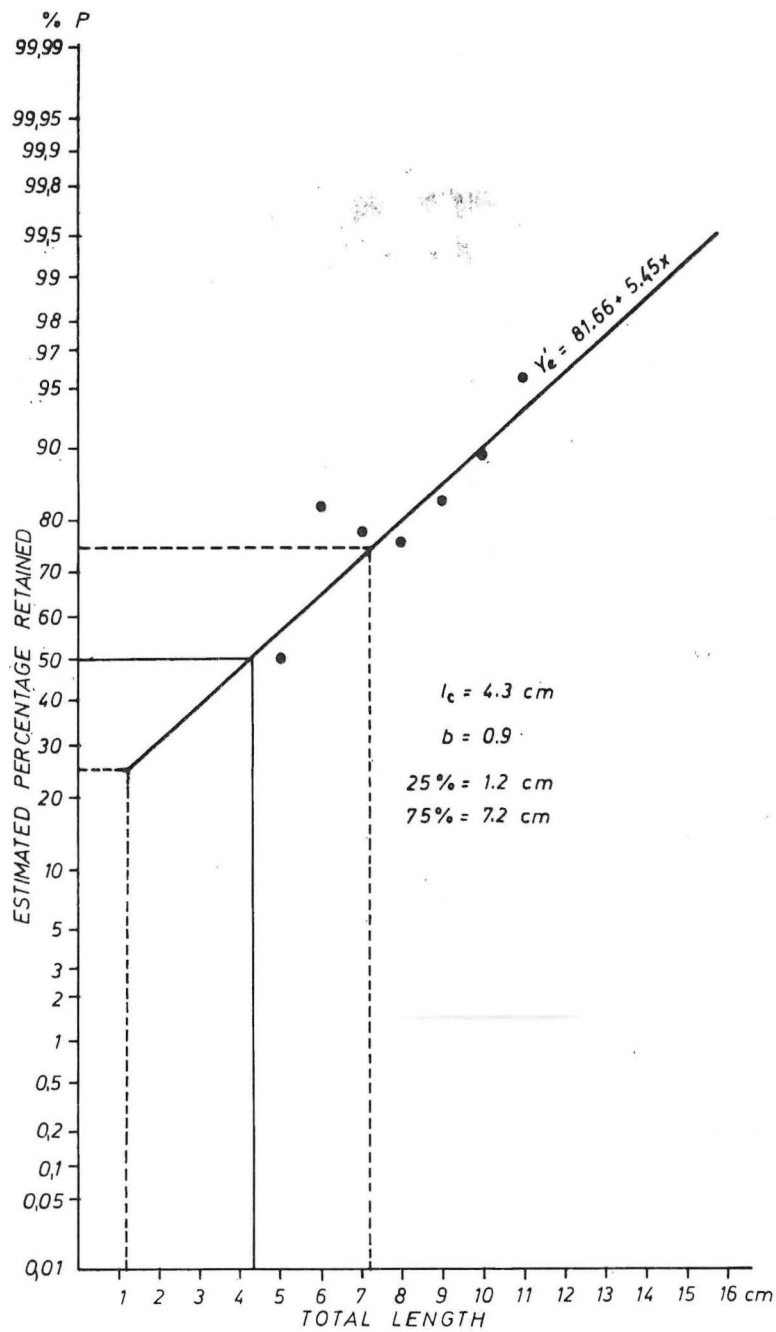


Fig. 7b — *Nephrops* selectivity data for synthetic twine (polyamid) cod-end of 52.83 mm; 210/48 Den in the central open Adriatic (August, 1971)

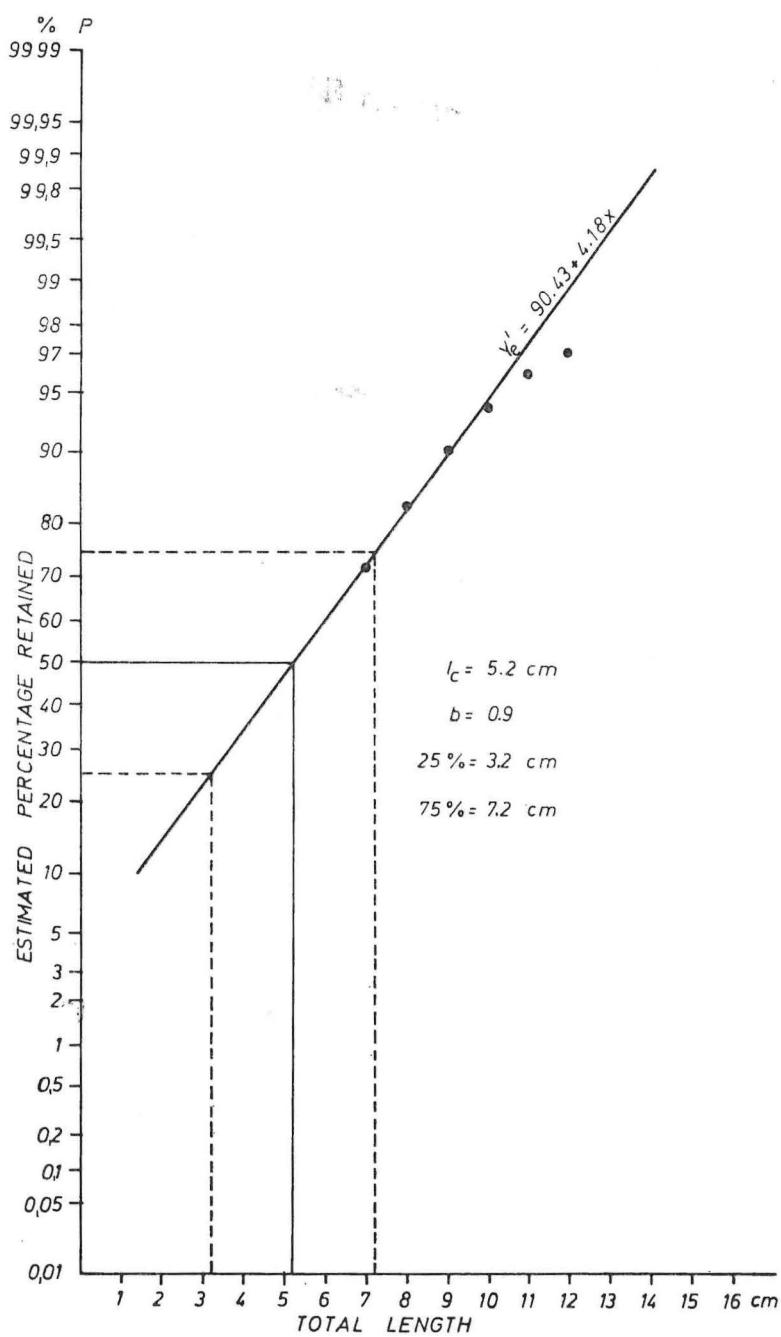


Fig. 7c — *Nephrops* selectivity data for synthetic twine (polyamid) cod-end of 62.60 mm; 210/48 Den in the central open Adriatic (August, 1971)

Table 3 — Selectivity data for Norway lobster (*Nephrops norvegicus* L.) in the central open Adriatic — region A, with covered cod-end (August, 1971)

Length (cm)	A cod-end 41.56 mm	210/48 Den	B cover 18.0 mm	210/18 Den	A+B total	% A/A+B	A cod-end 52.83 mm	210/48 Den	B cover 18.0 mm	210/18 Den	A+B total	% A/A+B	A cod-end 62.60 mm	210/48 Den	B cover 18.0 mm	210/18 Den	A+B total	% A/A+B
5	2	2	4	50.0	4	—	4	—	—	—	—	—	—	2	2	—	—	—
6	23	5	28	82.1	9	—	9	—	—	—	—	—	7	10	17	41.2	—	—
7	82	23	105	78.1	26	10	36	72.2	26	41	67	38.8	26	41	67	38.8	—	—
8	207	67	274	75.5	65	13	78	83.3	72	134	206	35.0	72	134	206	35.0	—	—
9	311	65	376	82.7	75	8	83	90.4	113	179	292	38.7	113	179	292	38.7	—	—
10	339	40	379	89.4	77	5	82	93.9	139	168	307	45.3	139	168	307	45.3	—	—
11	294	24	318	95.5	70	3	73	95.9	165	91	256	64.5	165	91	256	64.5	—	—
12	188	—	188	100.0	36	1	37	97.3	88	45	133	66.2	88	45	133	66.2	—	—
13	99	—	99	—	29	—	29	100.0	57	19	76	75.0	57	19	76	75.0	—	—
14	64	—	64	—	13	—	13	—	40	6	46	87.0	40	6	46	87.0	—	—
15	44	—	44	—	14	—	14	—	38	3	41	92.7	38	3	41	92.7	—	—
16	29	—	29	—	5	—	5	—	15	—	15	100.0	15	—	15	100.0	—	—
17	23	—	23	—	2	—	2	—	6	1	7	—	6	1	7	—	—	—
18	10	—	10	—	2	—	2	—	3	—	3	—	3	—	3	—	—	—
19	2	—	2	—	2	—	2	—	1	—	1	—	1	—	1	—	—	—
20	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1718	289	2007		429	40	469		780	699	1479							

In the experiments with trawl selection with regard to population Jensen (1865) has found that the cotton net whose cod-end is 69 mm (12) 18 cotton twine in the regions of Skagerak and Kattegat has the 50% retention length of *Nephrops* at the total length of 93 mm ($l_c = 93$ mm) and selection factor from 1.30 to 1.37 Ancellin (1965) working in the gulf of Gascogne with the cod-end 63.9 mm on the experiments with trawl selection regarding *Nephrops* has obtained the selection factor of 1.41.

Pope and Thomas (1965) working on the experiments on the *Nephrops* selection in the First of Clyde region have stated that the level of escape of *Nephrops* (l_c) through the cotton mesh of the cod-end is between that of double manila and simple nylon, at equal mesh-sizes of the cod-end.

Data based on the catch per unit effort show that the *Nephrops* population density is higher in the open Central Adriatic than in the channels of the Northern Adriatic, and in the former region it is from 18 to 95 kg/fishing day/year, with the mean value of 53 kg/fishing day/year. In the channel region of the Northern Adriatic the density is from 15 to 28 kg/fishing day/year, with the mean value of 21 kg/fishing day/year. In spite of the various sizes and engine power of the trawlers, which in the Yugoslav trawling conditions does not mean also a proportionate increase in the trawling effectiveness, (Županović, 1953), our findings do not agree with those by O. Karlovac (1953) who has established that the density of the *Nephrops* population is higher in the channels of the Northern Adriatic. We are of the opinion that the data by O. Karlovac, collected by the research vessel during

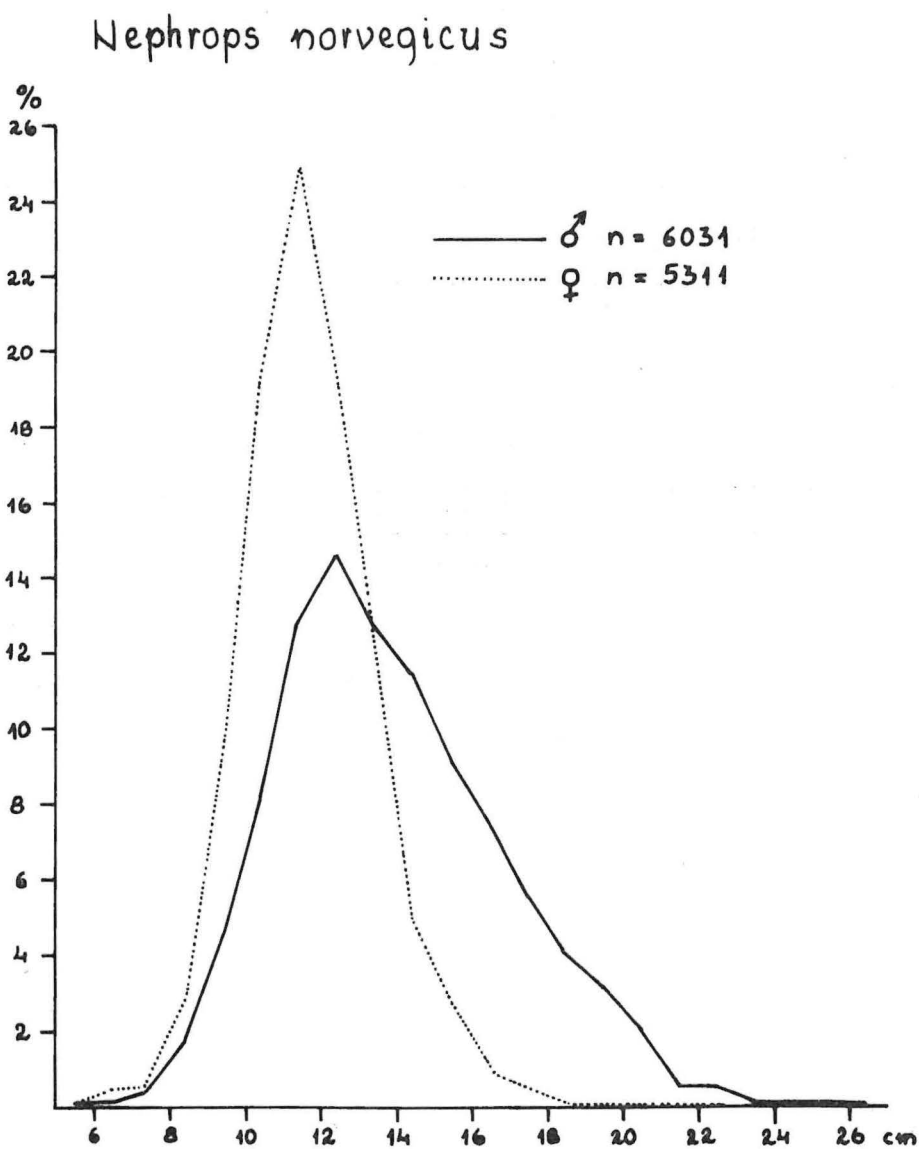


Fig. 8 — Percentage length distribution of *Nephrops* in the Northern Channel region (after Crnković). Research data for 1956/57 year.

1951/52 only in April, May and June, can not be a true evaluation of the Nephrops abundance that might be compared with the other regions in the Adriatic, because it was later found (Crnković, 1965), by basing it on the scientific and commercial data during the whole year, that months (April, May, June) are the maxima of occurrence and catch of Nephrops in the channels of the Northern Adriatic, owing to behaviour of population.

The low values of the catch per unit effort in the Central Adriatic which were registered in the years 1962, 1963 could be explained by an earlier statement by Županović (1969) that the mean annual temperatures affect the Nephrops catch, because a lower bottom temperature of only 9°C was registered in those years. The predatory relationship that Crnković (1965), has stated in the channels of the Northern Adriatic between the groups Selachii and Nephrops, could not be stated in the Central Adriatic (Jukić, 1971; Jardas, 1971). Jardas (1971) claims that Selachii group have no predatory relation at all toward Nephrops because in the nourishment of these fishes predominate crabs with their dominant species *Alpheus glaber*, *Squilla desmarestia*, *Gastrosaccus labatus*, *Lophogaster typicus*, *Solenocera membranacea*.

From the data on the yearly catch per unit effort specially for the Central Adriatic, as the evaluation of the density and state of the Nephrops population, negative value of the slope of yield regression line points out possibility of overfishing of the population. This statement for the Nephrops population in the Central Adriatic coincides with the findings by Jukić (1971) who, on the basis of the mean length analysis of the males and females between the periods 1948/49 and 1968, noticed a decrease in the mean lengths. In the preliminary selectivity studies by mean of synthetic trawl the obtained selection factors from 0.9 to 1.5 do not differ much from the values stated by Jensen (1965) and Ancellin (1965) for Nephrops in the regions of Skagerrak-Kategat and the Gulf of Gascogne where cotton nets were used.

Conclusion

On the basis of the statistical data of the yearly Nephrops catch in the Yugoslav waters for the period 1960/70 and data of the total effective yearly effort for the same period for the two main Nephrops fishing areas along the Yugoslav coast we could conclude the following:

1. the index of the Nephrops population density is much higher in the open central Adriatic than in the channel northern regions;
2. under present trawl fishing conditions inside the two main Nephrops fishing grounds, direct relationship between the total fishing effort and catch per unit effort has not been stated. Calculated and obtained values of yield regression line slopes as well as correlation coefficient do not show evidently that Nephrops population in the both areas has been significantly under or over-exploited.

Experimental data of the Nephrops selectivity, in order to protect the Nephrops population within the Yugoslav waters, pointed out necessity for increasing the mesh-sizes of the existing cod-ends of the trawl for protection of the immature Nephrops individuals.

REFERENCES

- Aker, E. and Tiews, K., The German Nephrops fishery. *Rapp. P. — v. Réun.* 1965
Con. perm. int. Explor. Mer. 156, 147—149.
- Ancellin, J., Selectivité des chaluts á langoustine (*Nephrops norvegicus* L.) *Rapp.* 1965
P. — v. Réun. Cons. perm. int. Explor. Mer. 156, 202.
- Crnković, D., Ispitivanje ekologije i mogućnosti racionalnog unapređenja eksploatacije raka *Nephrops norvegicus* (L.) u kanalskom području sjeveroistočnog Jadrana. Prirodoslovno-matematički fakultet, Sveučilišta, Zagreb (disertacija).
- Gamulin-Grida, H., Riocenoza muljevitog dna otvorenog srednjeg Jadrana. 1965
Acta Adriatic. 10 (10): 27 p.
- Cole, H. A. and Simpson, A. C., Selection by trawl nets in the *Nephrops* fishery. *Rapp. P. — v. Réun. Cons. perm. int. Explor. Mer.* 156, 203—205.
- Gauss-Garady, V., Über die Lebensgeschichte der Adriatischen scampi (*Nephrops norvegicus*) *Üst. Fisch Ztg*, 9, 42—44, 44, 61—63 and 77—79.
- Gauss-Garady, V., Lo scampo del Quarnero e la pesca del medesimo. *Atti*, V. 1913
Congr. int. Pesca Roma, 177—192.
- Jardas, I., Prilog poznavanju ekologije nekih jadranskih hrskavičnjača (*Chondrichthyes*) s posebnim obzirom na ishranu, *Acta Adriatica*, Vol. XIV, No. 3.
- Jansen, A. J. C., *Nephrops* in the Skagerak and Kattegat (length, growth, tagging experiments and changes in stock and fishery yield). *Rapp. P. — v. Réun. Cons. perm. int. Explor. Mer.* 156, 150—154.
- Jukić, S., Studies on the population and catchability of Norway lobster in the Central Adriatic. *Studies and Reviews*, 48, 27—53.
- Karlovac, O., An ecological study of *Nephrops norvegicus* (L.) of the High Adriatic. *Izv. Inst. Oceanogr., Split*, 5 (20) : 50 p.
- Kurian, C. V., Larvae of decapod Crustacea from the Adriatic Sea. *Acta Adriatica*, 6 (3) 1—108.
- Lorenz, J. R., Physikalische Verhältnisse und Verteilung der Organismen in Quarnerischen Golfe. Wien. 1863
- Morović, D., Composition mécanique des sédiments au large de l'Adriatique. 1951
 »Hvar-Rapports« Vol. III, No. 1.
- O'Riordan, C., *Nephrops norvegicus* in Irish waters. *Rapp. P. — v. Réun. Cons. perm. int. Explor. Mer.* 156, 183—185.
- Pesta, O., Die Decapodenfauna der Adria. *Leipzig und Wien.* 1918
- Pope, J. A. and Thomas, H. J., A summary of Scottish comparative fishing experiments on *Nephrops norvegicus* (L.) *Rapp. P. — v. Réun. Cons. perm. int. Explor. Mer.* 156, 190—201.
- Santucci, R., Lo sviluppo post-embrionale dello Scampo (*Nephrops norvegicus* L.) del Quarnero. Nota preliminare, *Boll. Musei Lab. Zool. Anat. comp. R. Univ. Genova*, 6 (2), 7—10.
- Županović, Š., Contribution a l'étude de la faune bentonique de la dépression Jabuka. *Thalassia jugosl.*, 5 : 477—493.
- Županović, Š., Statistical analysis of catches by trawling in the fishing regions of the eastern Adriatic in 1951. *Acta Adriatica*, 5 (8) : 3—55.

JUGOSLAVENSKI ULOV ŠKAMPA

Stjepan Jukić

Institut za oceanografiju i ribarstvo, Split

KRATAK SADRŽAJ

Na temelju statističkih podataka o godišnjem ulovu škampa u jugoslavenskim vodama za period 1960—1970. i podacima totalnog efektivnog godišnjeg napora za isti period i to za dva glavna područja uzduž jugoslavenske obale, možemo zaključiti slijedeće:

Indeks gustoće populacije raka *Nephrops norvegicus* mnogo je veći u otvorenom središnjem dijelu Jadrana nego u kanalima sjevernog područja;

u prisutnim uvjetima ribarenja koćom na dvjema glavnim ribolovnim područjima gdje se ovaj rak lovi, direktni odnos između totalnog ribolovnog napora i lova po jedinici napora nije iznesen.

Izračunate i dobivene vrijednosti regresione krivulje kao i korelacioni koeficijent ne pokazuju da je populacija ovog raka na oba područja znatnije ispod ili iznad eksploatiranog.

Eksperimentalni podaci za selektivnost raka škampa, u svrhu zaštite nezrelih primjeraka, ukazuju da treba svakako takova konstrukcija mreža, koja bi imala koristan učinak.

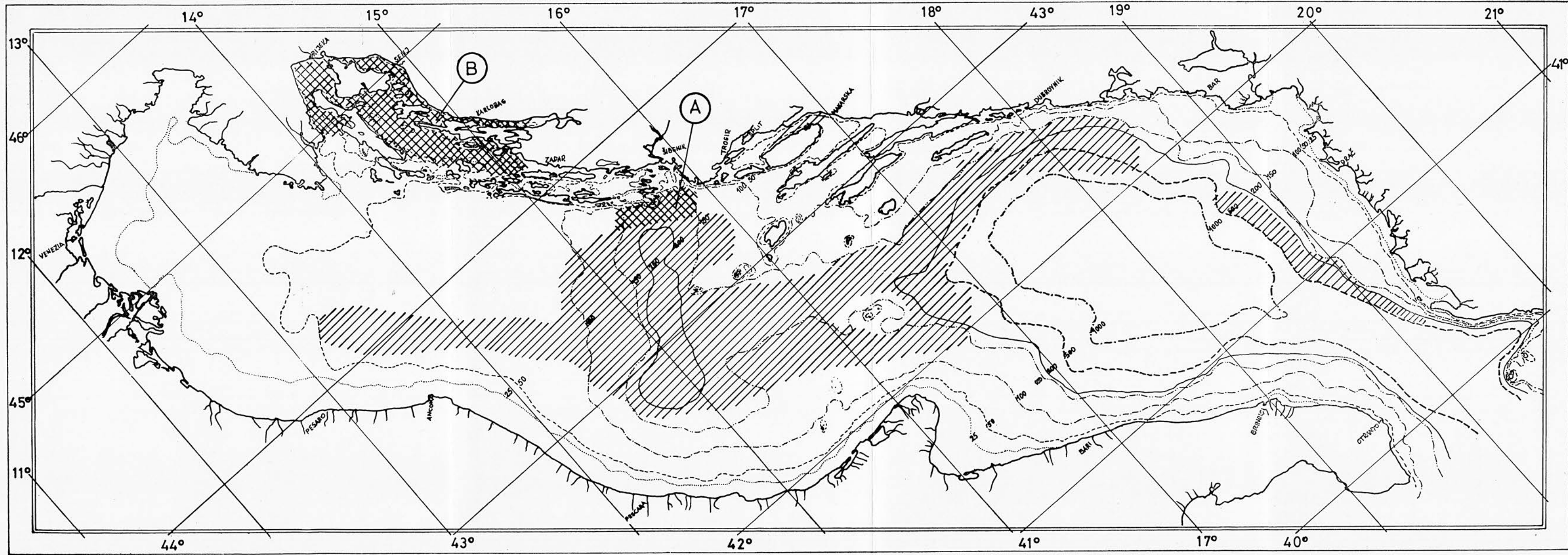


FIG. 1.- MAIN YUGOSLAV NEPHROPS FISHING GROUNDS AND DISTRIBUTION OF THE SPECIES IN THE ADRIATIC SEA

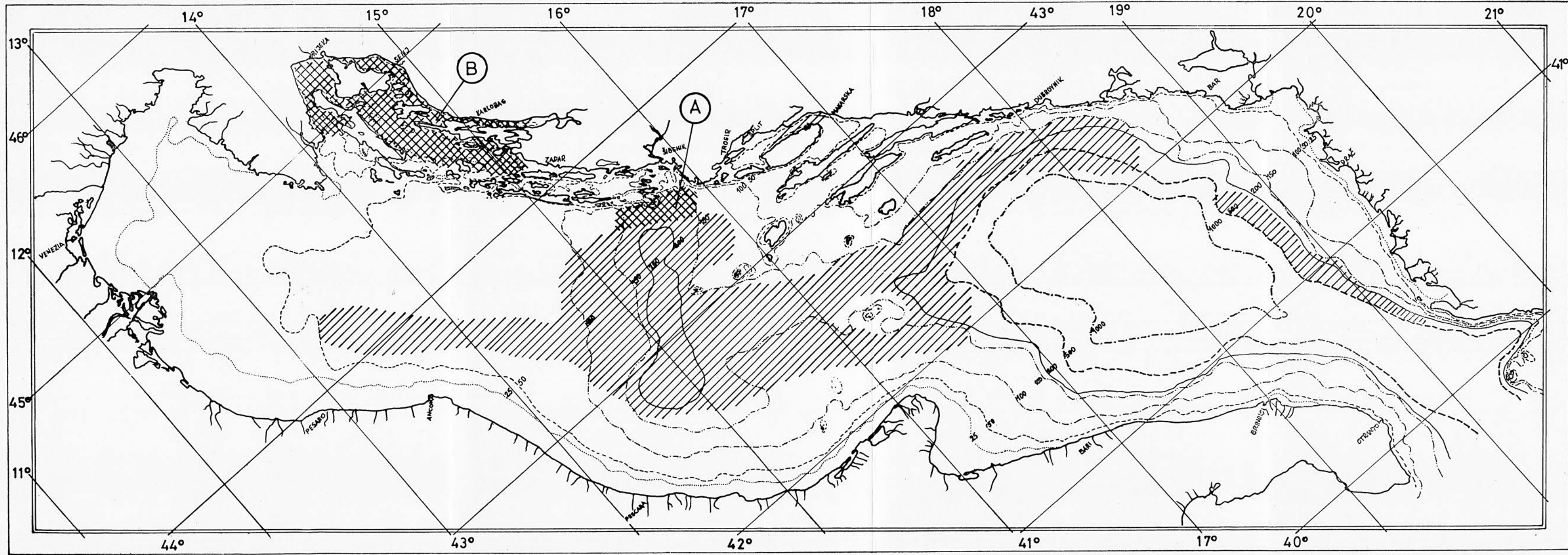


FIG. 1.- MAIN YUGOSLAV NEPHROPS FISHING GROUNDS AND DISTRIBUTION OF THE SPECIES IN THE ADRIATIC SEA