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Non-Target Species

SOME ASPECTS OF BIOLOGY OF NON-TARGET FISH SPECIES IN THE BARENTS SEA

by

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ABSTRACT

The paper deals with distribution, habitat conditions, length-weight relations, fecundity and its dependence on length and weight of the body, reproduction and feeding of 21 non-target fish species in the Barents Sea. On some species we have obtained new biological data. The necessity of their further studying was noted.

INTRODUCTION

Despite more than 200 species dwell in the Barents Sea (Andriyashev, 1954), their biology, excluding species of commercial importance, have been studied poorly and usually only fragmentary data on some aspects of biology are available. The majority of papers on biology of non-target species were prepared in pre-war years (they are summarized in classic report by A.P. Andriyashev (1954). In recent years non-target species became of more interest in relation with ecosystem approach to research of the Barents Sea biocenosis (Chernova, 1987, 1989; Falk-Petersen et al., 1988). The monography on snailfishes by N.V. Chernova should be noted especially (1991).

During PINRO sea expeditions for commercial fishes data on non-target fish species have been also collected. New data on different aspects of biology of some species were obtained. Results from the above research are presented in the paper.

MATERIALS AND METHODS

Materials have been collected during PINRO research cruises in 1987-1994 as well as in the cruise by Norwegian vessel T-33-T "Rossvik" in autumn 1993. Fish were usually fixed in formalin or frozen in some cases or processed in the sea. Fish analysis included determination of species, measuring of absolute length (L), weighing, determination of sex, stage of maturity and weight of gonads (similar to commercial species from *Gadidae* family because scales of maturuty were not developed for the majority of non-target species), fecundity, examination of stomach content and collection of otoliths. However, data on age are not used in

this paper because age determination has not completed yet. Determination of prey species when analysing fish stomach content was connected with certain difficulties what was noted as early as in 1939 by M.M. Briskina. Maturity rate expressed as gonads weight devided by total weight of the body in per cent was taken as an index of maturation. When analysing feeding the mean index of stomach fullness (food weight - body weight ratio, °/...), % of empty stomachs, as well as weight (% m) and frequency of occurrence (% f) were used.

When drawing maps of some species occurrence data from Russian trawl-acoustic surveys as well as materials from the Russian/Norwegian data base on commercial fish feeding were used. However, in the see an exact determination of caught fish to species sometimes were not performed, therefore in those cases distribution maps were drawn for species from the same genus.

RESULTS AND DISSCUSSION

Spotted snake blenny *Leptoclinus maculatus maculatus (Fries)*

This species occurred in 90-527 m depth that exceeded maximum dwelling depth of 240 m noted by A.P. Andriyashev (1954) when bottom temperature was -0.05 - +2.1°C. Locations of catches correspond to the previously known distribution of the species (Fig.1, a).

Fish from size groups 7-10 cm and 14-16 cm constituted the bulk of catches in the Western Spitsbergen area in November 1993 (Fig. 3).

Parameters of the regression equation of "weight-length" relation are given in Table 1.

In July-August on the Goose Bank slopes two females (L=117 and 128 mm) were observed to have 792 and 920 yellowish-orange eggs with nearly 1 mm diameter. In October fecundity of two females (L=90 mm and 100 mm) caught on the Murman Shoal constituted 650 and 713 eggs with 1.5 mm diameter. Our data fully correspond to the Collett's information about fecundity of 970 eggs (1902, quoted from Andriyashev, 1954). Spawning in the southern Barents Sea probably takes place in late summer-early autumn.

The diet of the above species was dominated by *Polychaeta* and various crustaceans mainly by *Gammaridea* (Table 4), that proves the information by A.P. Andriyashev (1954).

Snakeblenny *(Lumpenus lampretaeformis (Walbaum)*

Fish 20-30 cm long were predominant in catches in the Western Spitsbergen area in November 1993 (Fig. 3).

Fecundity of three females of standard length 193-258 cm over the Goose Bank in April was estimated to be 400-700 yellowish-brown eggs with 0.5-0.8 mm diameter which corresponds to the data on fecundity of 600-1100 eggs (Andriyashev, 1954).

Eelpout *Licodes rossi Malmgren*

This species occurred in 233-527 m depth which exceeded maximal depth of 365 m known earlier (Andriyashev, 1954) at -0.05 - +1.6°C bottom temperature range.

Parameters of the regression equation of "weight-length" relation are presented in Table 1.

Fecundity of four females 204-280 cm long with gonads at maturity stage III constituted 235-387 yellowish-orange eggs with 1-2.5 mm diameter on the Central Plateau and adjacent areas in January. Literature data on this species fecundity are not available.

Mean maturation rate of females increased from 0.52 % in September to 1.12% in January. Apparently, spawning was in winter and spring.

Shrimp *Pandalus borealis* dominated their food, besides *Polychaeta* and *Gammaridea* occurred in stomachs (Table 4). This corresponds to data from A.P. Andriyashev (1954), however, shrimp were observed in this species diet for the first time.

Eelpout *Lycodes reticulatus Reinhardt*

The species occurred in 253-300 m depth at negative bottom water temperature.

Parameters of regression equation of "weight-length" relation are shown in Table 1.

In female of standard 260 mm length on the Central Plateu 242 yellowish-orange eggs with 1.5-2.5 mm diameter were found. Literature data on this species fecundity are not available.

Mean maturation rate in January constituted 0.95%. Spawning was apparently in winter - in January on the Northwestern slope of the Murmansk Bank females with gonads on the stage of extrusion were observed.

Cuttlefish from *Sepiidae* family as well as *Gammaridea* and *Bivalvia* occurred in the diet of *Lycodes reticulatus* (Table 4). Lierature data on feeding of this species are not available.

Pale eelpout *Lycodes pallidus pallidus Collett*

Fecundity of two females (L=170 and 179 mm) in November off the Western Spitsbergen constituted 35-42 amber-yellow-coloured eggs with 3-4 mm diameter. Besides, large amounts of smaller eggs were observed in ovaries. Maturation rates in those individuals constituted 2.40-6.21%. Our data correspond to the data on fecundity of this species in the Kara Sea - 35 eggs with 6.1 mm diameter in females 163 mm long (Andriyashev, 1954). The species probably spawns in autumn-winter time, which was noted by A.P. Andriyashev (1954).

"Patterned eelpout" *Lycodes esmarki Collett*

This species occurred at 90-480 m depth, most frequently at 200-400m depth with positive temperature of bottom waters (0.4-3.4°C).

In November 1993 fish 24-31 cm long were predominant in catches (Fig. 3).

Parameters of the regression equation of "weight-length" relation are presented in Table 1.

Fecundity of 6 individuals was examined. In May on the Western slope of the Bear Island Bank in female (L=560 mm) in ovaries on the maturuty stage III 1888 orange eggs with 2-4.5 mm diameter were found. Maturation rate of that individual was estimated at 4.65%. In December off the Western Spitsbergen in 5 females 270-318 mm long with gonads on maturity stage IV fecundity was estimated to be 101-175 yellowish eggs with 5-5.5 mm diameter. Data from Collett (1903, quoted from Andriyashev, 1954) on 1200 eggs are within the frames of this species fecundity.

Good correletion between fecundity and body length and weight was observed, equally strong in both cases (Table 3). These relations are equally well presented by all kinds of correlations.

Maturation rates in females in December in the Western Spitsbergen area constituted 9.49-11.33%. Probably, spawning in this area occurrs in winter.

Stomachs of fish examined were empty.

Lycodes vahlii gracilis M.Sars

This species occurred in 169-352 m depth, mainly at 200-300 m with positive bottom temperatures (2.3 - 3.4°C). Apparently, this species does not form dense concentrations, usually catches do not exceed 1-4 fish per 1-hour haul. Locations of catches of this species (Fig.1,b) overstep the limits of area of distribution known from literature according to which this species is distributed mainly in the southwestern Barents Sea and do not occur north of the Southern slope of the Bear Island Bank (Andriyashev, 1954). It could be explained by two reasons. First, all the locations of this species dwelling north of 74°N were determined from cod stomachs which could be connected with inexact species identification. From the other side the area of distribution of this species could has expanded. This aspect requires further research.

In December 1993 - January 1994 on the Murmansk Tongue, Central Plateau, Demidov Bank and adjacent areas fish 19-30 cm long occurred in catches (Fig. 3).

Parameters of regression equation of "weight-length" relation are given in Table 1, separately by sex - in Table 2.

On the Murmansk Tongue in December in two females (L=191 mm and

249 mm) with gonads on the maturity stage III 58 and 290 eggs with 1-3 mm diameter were found. In January in the same area fecundity of four females 201-254 mm long fluctuated from 52 to 100 eggs with diameter of 1.5-5.0 mm. Fecundity observed by us exceeded fecundity of 27-48 eggs noted by Collett (1902), however corresponded to information from Jensen (1904, quoted from Andriyashev, 1954) according to whom fecundity of a female 210 mm long at the Greenland shores constituted not less than 93 eggs with 4.5 mm diameter. High fecundity (290 eggs) observed by us can be explained by the fact that not all the eggs are ripe to the spawning and large amount of them are exposed to resorption. Females reach maturation at length 19-20 cm.

Relation between fecundity and body length or weight is weak and no one kind of dependence is able to reflect this relation satisfactorily (Table 3). This is probably connected with small amount of material.

Mean maturation rates in December-January were low - 1.07% and 1.70%, respectively. Maximum values of maturation rate in females in December reached 3.39%, in January - 9.05%. Spawning apparently takes place in winter-autumn period.

All the individuals examined had empty stomachs.

"Spotted wolf-pout" *Lycenchelys kolthoffi Jensen*

The new location of this species dwelling was registered. Three individuals were caught in the Western Spitsbergen area (80°04'N, 09°25'E) at 527 m depth. Fish length - from 10.3 to 18.2 cm. Stomachs were empty.

Sculpin *Triglops pingeli Reinhardt*

When analysing locations and conditions of catches of individuals of this species it was revealed that in some cases this species intermingled with other species from the same genus, therefore map of distribution is given for all *Triglops* in general and only locations with reliable identification of species are indicated (Fig.1, c).

Length structure of population varied by areas (Fig. 5). So, in the Western Spitsbergen area fish from two size groups 6-7 cm and 11-14 cm dominated in catches; in the Hopen area and on the Eastern slope of the Bear Island Bank - fish from one length group (7-10 cm and 9-12 cm, respectively).

Parameters of regression equation of "weight-length" relation are presented in Table 1, separately by sex - in Table 2.

Fecundity of 7 females (L=90 mm-148 mm) in September in the Hopen area and on the Persey Elevation fluctuated from 260 to 730 eggs with 1.5-2.0 mm diameter. In November in the western Spitsbergen area in female 140 mm long 430 eggs with 2.0-2.5 mm diameter were found. Our data correspond to data on fecundity of this species in the Kara Sea - 287 eggs (Andriyashev, 1954) and at the

Greenland Shores - nearly 400 eggs (Jensen, quated from Andriyashev, 1954). Females reach maturation at 7-9 cm length.

The relation between fecundity and body length and weight is weak and no one kind of dependence can not describe this relation satiafactorily (Table 3). This is probably connected with small amount of material available.

Mean maturation rates decreased from September to November and January and constituted 7.50%, 5.78% and 2.48%, respectively. Maximum values of maturation rate in females were registered in September - up to 16.57%, however, in November females in which eggs weight constituted up to 10.30% of body weight occurred too. This species probably spawns in Autumn.

The diet of this species was dominated by crustaceans, mainly by *Hyperiidae* and *Euphausiacea* (Table 5).

Mailed sculpin *Triglops murrayi Gunther*

Locations of catches are shown in Fig.1,c.

In female (L=122 mm) in August on the Western slope of the Goose Bank 450 light-yellow coloured eggs of 1.5-2.0 mm diameter and nearly 500 eggs with diameter below 0.5 mm were found. This much higher than fecundity of a female of similar size reported by Andriyashev (1954) - nearly 120 eggs with 2.2 mm diameter and small amount of smaller eggs in one ovary. Maturation rate in that female was estimated to be 13.78%.

In the stomach of that individual (mean index of stomach fullness is 85.5°/...) *Parathemisto libellula* and digested food remnants were observed.

Spatulate sculpin *Icelus spatula Gilbert et Burke*

Locations of catches (Fig.1, d) are within the limits of area indicated earlier (Andriyashev, 1954).

Fecundity of female (L=149 mm) in August on the Western slope of the Goose Bank constituted 840 yellow-orange with 1-2 mm diameter and large amount of smaller eggs with 0.2-0.3 mm diameter. In two females (L=75 and 90 mm) on the eastern slope of the Bear Island Bank 180 and 190 brown eggs with 1.5-2 mm were found, respectively. From data by A.P. Andriyashev (1954) fecundity of this species is a little higher - 1100-1300 eggs and eggs diameter - a little lower (1.4 mm).

Hetairus polaris and *Parathemisto libellula* (Table 5), which corresponds to data published earlier (Andriyashev, 1954).

Twohorn sculpin *Icelus bicornis (Reinhardt)*

Location of catching (Fig.1, d) were within the limits of area indicated earlier.

In the stomach of the only one specimen (mean index of stomach fullness 192.0) only *Parathemisto libellula* were found.

Staghorn sculpin *Gymnacanthus tricuspis (Reinhardt)*

Locations of catches (Fig.1, e) were within the limits of area of distribution indicated earlier (Andriyashev, 1954).

This species occurred in 55-505 depth range that exceeded maximum depth of dwelling of 240 m indicated by A.P. Andriyashev (1954), mainly at 50-150 m depth with positive bottom temperatures (0.5-1.96°C).

Parameters of regression equation of "weight-length" dependence are shown in Table 1, separately by sex - in Table 2.

Fecundity of 6 females (L=117-137 mm) in August in the Western slope of the Goose Bank fluctuated from 2240 to 4710 yellowish-brown eggs with diameter nearly 1 mm. This corresponds to fecundity of this species in the Kara Sea - 2060-3512 eggs (Andriyashev, 1954).

A good correlation between fecundity and length and weight of the body were found being a little stronger in the latter case (Table 3). These relations are well displayed by all the kinds of correlations, but most satisfactorily - by multiplicative and exponential ones.

Mean maturation increased from 1.92% in July to 4.48% in August. In August maximum values of maturation rate in females reached 9.18%. Spawning apparently takes place in autumn.

Polychaeta and *Gammaridea* (Table 5) were predominant in the diet which completely correspond to the data published earlier (Briskina, 1939). It is interesting to note the presence of young cods in stomachs of this species (unfortunately, we have not managed to identify remnants more precisely).

Sea scorpion *Myoxocephalus scorpius (L.)*

Locations of catches (Fig.1, f) are within the bounds of area indicated earlier (Andriyashev, 1954).

The species occurred at 30-250 m depth, usually down to 100 m with positive bottom temperatures (1.5-3.3°). In some cases it can occur in large amounts. In the coastal areas catches reached 22-25 individuals per one-hour haul.

On the Kanin-Kolguev Shoal fish 9-28 cm long occurred in catches. Analysis of length structure of spawning and postspawning

concentrations in January 1994 in the Eastern Coastal are showed that catches constituted of fish 20-32 cm in length and more than 90% of them were females.

Parameters of the regression equation of "weight-length" relation are presented in Table 1, separately by sex - Table 2.

Fecundity of two females (L=264 mm and 290 mm) in January in the Eastern-Coastal area constituted 9317 and 11717 red-orange eggs with 2-2.5 mm diameter. This is more than three times higher than values from A.P.Andriyashev's data (1954). Females reach maturation being 20-21 cm long, males - 17 cm long, which correspond to data from literature (Andriyashev, 1954). In January in the Eastern-Coastal area and on the Kanin Bank spawning was registered - more than 95% of females had gonads at the stage of extrusion and females with ripe eggs were observed at the same time too.

Large bottom crustaceans - shrimp, crab, hermit crab (Table 5) were the most important in the sea scorpion feeding what was indicated earlier (Andriyashev, 1954). Juvenile cod 9-12 cm long also occurred in sea scorpion stomachs. This could be a reason for studying this species predation on juvenile commercial species in details.

Hookear sculpin *Artediellus europeus Knipowitsch*

Locations of catches (Fig.2, a) exceeded the bounds of area indicated earlier (Andriyashev, 1954) - the species was registered in the southeastern Barents Sea at depth and temperatures which were not typical of *A.scaber* dwelling in the same area.

The species occurred at 77-527 m depth which exceeded maximum dwelling depth of 410 m indicated by A.P. Andriyashev (1954). Most frequently it occurred at 200-300 m depth. Values of botom temperatures varied from -0.8° to +6.4°C, usually to +2°C, which also exceeded the value to 3°C indicated earlier (Andriyashev, 1954). In some cases the species can occur in large numbers. Catches up to 22 and even 72 specimens per one hour-haul were registered.

Fish 9-12 cm long constituted the bulk of catches in the Western Spitsbergen area and fish 5-9 cm were predominant on the Eastern slope of the Bear Island Bank (Fig.4).

Parameters of regression equation of "weight-length" relation are given in Table 1, and in Table 2 - separately by sex.

In ovaries of two females (L=66 mm and 80 mm) in August on the Western slope of the Goose Bank 115 eggs with 1 mm diameter and nearly 150 smaller ones were found in first female and 60 reddish eggs with 3 mm diameter in the second one. Fecundity of 11 females (L=64-93 mm) with gonads on the maturity stage III in January on the Central Plateau and adjacent waters constituted 43-90 yellowish eggs with 1-2 mm diameter. Our data are consistent with literature data on fecundity of this species (57-

120 eggs)(Andriyashev, 1954). Females reach maturation being 6.4-6.6 cm in length.

Strong correlation between fecundity and body weight were found, the relation between fecundity and length were observed to be extremely week (Table 3). The best description of these relations are given by multiplicative and exponential ones.

Maturation rates from August (1.43% in average for males and females) decreased to 0.45% by October and then increased again till November (1.30%). The mean maximum value in females was observed in January - 3.77% with maturation rate reaching 6.71% in some specimens. Spawning in the southern Barents Sea probably was in winter-spring period but not in August-September as indicated by A.P. Andriyashev (1954).

Mollusca (mainly *Bivalvia*) and *Gammaridea* dominated this species diet. (Table 5). It is interesting to note the presence of eggs and unidentified fish remnants in the stomachs which were not observed in this species diet earlier (Briskina, 1939).

Cottunculus microps Collett

Locations of catches (Fig. 2, b) expanded the area indicated earlier (Andriyashev, 1954) - it was observed off the Spitsbergen.

This species occurred at 150-666 m depth, most frequently at 200-350 m depth with bottom water temperature from -0.05 to +4.5°C. Maximum values of depth and temperatures of dwelling also exceeded those indicated earlier (Andriyashev, 1954) - down to 400 m and up to +3°C, respectively. The species did not occur in large amounts and catches did not usually exceed 1-3 specimens per one-hour trawling.

Parameters of the regression equation of "weight-length" relation are presented in Table 1 and in Table 2 - separately by sex.

Fecundity of 9 females (L=128-175 mm) in December-January on the Central Plateau and adjacent areas fluctuated from 85 to 145 orange eggs with 3-5 mm diameter. This a little lower than fecundity of 124-220 eggs indicated by Collett (1902, quoted from Andriyashev, 1954).

Strong correlation between fecundity and body length and weight was found being equally strong in both cases (Table 3). These relations are equally well described by all kinds of correlations.

Mean maturation rates in December-January constituted 3.71-6.11%. Maximum values of maturation rate in those months reached 10.21 and 13.39%. The species spawns probably in winter-spring period.

Gammaridea and *Polychaeta* (Table 5) were predominant in the diet which complied with data from M.M. Briskina (1939).

Leptagonus decagonus

Locations of catches (Fig.2, c) are within the limits of area indicated earlier (Andriyashev, 1954).

The species occurred in 76-527 m depth range, most often at 100-300 m with positive bottom water temperatures (0.2-3.5°C). The species did not occur in large amounts, catches usually constituted not more than 10 specimens per one-hour trawling.

Fish 9-16 cm long constituted the bulk of catches in November 1993 in the Western Spitsbergen area (Fig.5).

Parameters of the regression equation of "weight-length" relation are given in Table 1, and separately by sex - in Table 2.

Fecundity of 6 females 117-165 mm long in January on the Central Plateau amounted to 406-627 bright orange eggs with diameter nearly 1.5 mm. This is considerably lower than fecundity indicated by A.P. Andriyashev (1954) - 1750 eggs with dimeter nearly 2 mm but agreed with data on 480-694 eggs from Collett (1902, quoted from Andriyashev, 1954). Females reach maturation being 11-12 cm long.

Relation between fecundity and body length and weight were weak and no one kind of relations did not describe it satisfactorily (Table 3). This is probably connected with little data available.

Mean maturation rates for males and females in November constituted 2.56%, in January 6.71% with values reaching 10-12% in some females in January. The species spawns probably in spring that is a little earlier than reported in literature (Andriyashev, 1954).

Gammaridea and *Parathemisto libellula* (Table 5) occurred in the food of this species which corresponded to data published earlier (Briskina, 1939).

Atlantic spiny lumpsucker *Eumicrotremus spinosus (Fabricius)*

Locations of catches (Fig.2, d) are within the limits of area indicated earlier (Andriyashev, 1954).

The species occurred at 55-228 m depth, usually at 100-200 m with bottom water temperatures from -1.1 to +2.6°C. In some cases can occur in large amounts. So, in the Western Spitsbergen area and on the Spitsbergen Bank catches reached 10-20 and in some cases even 57 individuals per one-hour haul.

Fecundity of prespawning female (L=102 mm) in July on the Kanin Bank was estimated at 1187 reddish-yellowish eggs of 2-4 mm diameter. Maturation rate of that female constituted 33.21%. In September in female of 124 mm total length with ovaries at maturity stage III-IV 550 eggs of 2-3 mm diameter and nearly 1000-1220 and more smaller eggs were found; maturation rate constituted 4.51%. Data on fecundity of this species are not

available in literature. The species spawns in the southern Barents Sea probably in summer, in the Spitsbergen area in autumn. This is proved by information from Johansen (1912) (quoted from Andriyashev, 1954) about observation of egg laying of this species in August.

Stomach of fish examined were empty.

Liparis fabricii Kroyer

A map of locations of *Liparis* fish catches (Fig.2, e) does not allow to identify fish to species, because areas of some species coincide (Chernova, 1991).

The species occurred in 110-244 m depth at negative bottom water temperatures (from -1.29 to -0.05°C).

Fecundity of a female (L=90 mm) in September on the Spitsbergen Bank constituted 300 brownish eggs of 0.8-0.9 mm diameter. This is much lower than the fecundity of this species in the White Sea (1949 large and 2204 small eggs in female of 171 mm in length) (Mukhomediyarov, 1963), however our data are close to data from Andriyashev (1954) on fishes from the Kara Sea (485-735 large and middle-sized eggs). Mean maturation rate in September was estimated to be 1.60%). Maximum values of maturation rate in females reached 6.23%. Females, apparantely, reach maturity at length of 9 cm.

Crustaceans (*Gammaridea, Euphausiidae* and *Hyperiidae*) were predominant in the diet (Table 4), which corresponded to data from literature (Briskina, 1939).

Liparis gibbus Bean

Crustaceans (*Euphausiidae* and *Gammaridea*) as well as fish dominated in the diet of this species (Table 4), which corresponded to data from previous research (Falk-Petersen et al., 1988; Chernova, 1989).

"Northern snailfish" *Careproctus reinhardti (Kroyer)*

Locations of catches (Fig.2, f) are within the bounds of the area indicated earlier (Andriyashev, 1954; Chernova, 1991).

The species occurred at 110-365 m depth, most often at 150-300 m with bottom water temperatures from -1.1 to +2.7°C, mainly at negative temperatures. The species did not occur in great amounts and catch usually did not exceed 1-2 specimen per one-hour haul.

Parameters of the regression equation of "weight-length" relation are presented in Table 1, separately by sex in Table 2.

In two females (L=176 and 217 mm) in September on the Persey Elevation 30 and 130 large (4-4.5 mm diameter) eggs and 117 and 65 smaller (2-2.5 mm diameter) eggs were found, respectively. In December-January on the Central Plateau and adjacent waters

fecundity of 8 females 112-170 mm long varied from 94 to 154 eggs of 3-4.5 mm diameter, besides large amounts of small eggs were observed in ovaries. This is coprresponded to data from N.V.Chernova (1987) on intermittent spawning of this species and on quantity of eggs in every batch, but such fecundity is lower than that of 300 eggs indicated by Collett (1905, quoted from Andriyashev, 1954). Females become mature at length of 9-10 cm, which is lower than 12 cm according to data from literature (Chernova, 1991).

An equal relation between fecundity, length and weight of body was revealed, thought it was not strong enough (Table 3). The most satisfactorily this relation is described by linear dependence.

Mean maturation rates were high during long-time period - 5.88% in September, 9.08% and 5.41% in December and January, respectively with values reaching 13-15% in females in September. However, maximum values of maturation rate were observed in January - up to 16.60%. This is apparently explained by intermittent spawning (Chernova, 1987). In the southern Barents Sea the species spawns probably in winter.

Crustaceans, mainly *Gammaridea* and in a lesser extent *Hyperiidae* and *Euphausiidae* (Table 4) constituted the bulk of the diet, which corresponded to data from literature (Briskina, 1939; Falk-Petersen et al., 1988; Chernova, 1991).

CONCLUSIONS

Analysis of data obtained on biology of non-target fish species in the Barents Sea allow to be sure enough to speak about their essential role in the Barents Sea ecosystem because of both high abundance of some of them and high similarity of their food and food of commercial fish species or their juveniles. Therefore, further thorough studies of biology and especially of trophic links of non-target species are necessary.

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Table 1

Coefficients of regression equations of "weight-length" relation for some non-target fish species

Fish species	Parameters of multiplicative relation $Y = a X^b$			
	a	b	r	N
Leptoclinus maculatus	0.0015	3.2032	0.99	84
Lycodes rossi	0.0051	2.9575	0.99	13
L.reticulatus	0.0009	3.5161	0.99	5
L.esmarki	0.0010	3.4112	0.99	12
L.vahlii gracilis	0.0069	2.8046	0.95	34
Triglops pingeli	0.0117	2.8318	0.95	38
Gymnacanthus tricuspis	0.0128	3.0237	0.98	33
Myoxocephalus scorpius	0.0048	3.3420	0.98	85
Artediellus europeus	0.0673	2.1842	0.92	67
Cottunculus microps	0.0141	3.0630	0.96	21
Leptagonus decagonus	0.0048	2.8406	0.96	28
Careproctus reinhardti	0.0102	3.0273	0.94	30

Table 2

Coefficients of regression equations of "weight-length" relation in males and females of some non-target fish species

Fish species	Parameters of multiplicative relation $Y = a X^b$			
	a	b	r	N
Lycodes vahlii gracilis				
males	0.0055	2.8737	0.96	16
females	0.0083	2.7474	0.93	18
Triglops pingeli				
males	0.0059	3.1172	0.99	11
females	0.0199	2.6077	0.95	21
Gymnacanthus tricuspis				
males	0.0004	4.5028	0.97	4
females	0.0007	4.1923	0.96	13
Myoxocephalus scorpius				
males	0.0028	3.5082	0.95	16
females	0.0075	3.2007	0.98	52
Artediellus europaeus				
males	0.0554	2.2898	0.92	32
females	0.0763	2.1066	0.92	32
Cottunculus microps				
males	0.0120	3.1248	0.96	8
females	0.0192	2.9486	0.96	13
Leptagonus decagonus				
males	0.0014	3.2738	0.98	11
females	1.5797	0.7527	0.52	16
Careproctus reinhardti				
males	0.1198	2.1357	0.96	6
females	0.0114	2.9769	0.98	23

Table 3

Coefficients of regression equations of fecundity dependence on length (L) and weight (W) in some non-target fish species

Fish species		Dependence									N
		linear $Y = a + bX$			multiplicative $Y = a X^b$			exponential $Y = \exp(a + bX)$			
		a	b	r	a	b	r	a	b	r	
Lycodes vahli	L	-231.1	15.04	0.43	0.063	2.329	0.43	2.065	0.107	0.44	6
gracilis	W	-80.3	4.49	0.51	3.956	0.839	0.34	3.391	0.026	0.42	6
Lycodes	L	-1785.9	65.20	0.99	0.0001	4.136	0.99	1.857	0.101	0.99	5
esmarki	W	- 115.6	2.05	0.99	0.311	1.262	0.99	4.466	0.003	0.99	5
Tryglops	L	205.9	14.94	0.19	9.778	1.460	0.44	4.494	0.114	0.38	10
pingeli	W	320.7	4.06	0.15	85.686	0.548	0.41	5.371	0.031	0.31	10
Gymnacanthus	L	-15116.8	1451.10	0.89	0.005	5.278	0.93	2.719	0.420	0.94	6
tricuspis	W	-2287.1	159.66	0.89	14.109	1.531	0.91	6.448	0.045	0.93	6
Artediellus	L	-9.0	10.14	0.32	4.420	1.333	0.39	2.834	0.177	0.40	12
europeus	W	16.8	9.09	0.69	16.738	0.806	0.78	3.399	0.137	0.74	12
Cottunculus	L	- 294.9	28.58	0.92	0.044	2.942	0.90	1.872	0.197	0.91	9
microps	W	- 18.2	2.52	0.94	2.192	0.997	0.90	3.783	0.017	0.94	9
Leptagonus	L	147.8	24.42	0.46	94.293	0.623	0.44	5.537	0.046	0.45	6
decagonus	W	45.7	35.60	0.51	59.525	0.833	0.50	5.320	0.069	0.51	6
Careproctus	L	- 2.6	8.89	0.76	7.466	1.049	0.67	3.830	0.066	0.67	8
reinhardti	W	75.1	1.32	0.74	28.096	0.412	0.65	4.404	0.010	0.67	8

Table 4

Food composition of some non-target fish species

Prey species	Lycodes reticulatus		Lycodes rossi		Leptoclinus maculatus		Liparis gibbus		Liparis fabricii		Careproctus reinhardti	
	% m	% f	% m	% f	% m	% f	% m	% f	% m	% f	% m	% f
Ctenophora											2.73	3.4
Vermes					1.99	5.9						
Polychaeta			5.87	14.3	24.78	5.9					4.26	3.4
Bivalvia	0.76	50.0			0.53	5.9						
Sepiidae	88.74	50.0										
Crustacea			6.16	14.3	11.66	23.5	21.63	25.0	15.02	20.0		
Copepoda									0.54	12.3		
Cumacea					0.07	5.9						
Gammaridea	5.41	50.0	3.85	14.3	5.70	11.8	18.78	75.0	35.03	20.0	82.92	82.8
Parathemisto abyssorum									15.91	26.7	0.01	3.4
P. libellula											4.95	3.4
Euphausiidae											0.35	6.9
Thysanoessa							46.47	50.0	18.62	6.7		
Decapoda			1.59	14.3								
Echinodermata					8.88	11.8						
Eggs					0.40	5.9						
Pisces							10.74	25.0				
Fish eggs							2.38	25.0				
Unidentified food	5.09	50.0	82.53	42.86	45.99	52.9			14.88	33.3	4.78	13.7
Number of stomachs	4		28		51		4		16		30	
% of empty stomachs	77.7		75.0		66.7		0		6.2		3.3	
Mean index of stomach fulness, °/oo	17.1		40.6		18.86		154.8		246.6		364.5	

Table 5

Food composition of some species of cottoid fish

Prey species	Tryglops pingeli		Icelus spatula		M. scorpius		Gymnacantus tricuspis		Artediellus europeus		Cottunculus microps		Leptagonus decagonus	
	% m	% f	% m	% f	% m	% f	% m	% f	% m	% f	% m	% f	% m	% f
Foraminiferida							0.24	5.0			9.66	5.0		
Polychaeta					1.69	7.4	24.47	20.0	2.06	6.0	32.10	30.0		
Anaitides							2.67	5.0						
Bivalvia									12.63	25.0	0.41	5.0		
Lacuna pallidula											2.46	5.0		
Nucula tenuis									0.18	6.2				
Gastropoda									5.88	6.2				
Crustacea	1.87	10.5					13.88	20.0	2.76	12.5			16.02	10.0
Mysidacea											0.66	10.0		
Isopoda					0.06	3.7								
Cumacea									3.64	6.2				
Gammaridea	4.28	15.8					16.73	35.0	31.43	18.7	43.65	55.0	25.10	40.0
Themisto libellula	28.40	26.3	6.74	25.0									51.16	40.0
Euphausiidae	4.40	15.8			0.81	14.8			2.58	6.2	3.68	10.0		
Thysanoessa	53.02	36.8												
Decapoda	6.57	10.5					9.17	10.0						
Hetairus polaris			80.31	25.0										
Pandalus borealis					1.20	7.4					1.65	5.0		
Spirontocaris					0.64	3.7								
Hyas					39.90	66.7								
H. araneus					28.41	11.1								
Eupagurus					5.86	7.4								
Eu. bernhardus					5.00	3.7								
Pantopoda					4.58	3.7								
Echinodermata									3.06	6.2				
Pisces					0.35	3.7			15.04	6.2				
Gadidae							17.14	5.0						
Gadus morhua					5.23	7.4								
Cottidae					3.25	3.7								
Fish eggs									5.88	6.2				
Unidentified food	1.02	10.5	12.95	50.0	3.52	7.4	15.70	45.0	14.86	31.2	5.73	5.0	7.72	10.0
Number of stomachs	37		4		34		20		66		21		28	
% of empty stomachs	48.6		0		20.6		0		75.7		4.7		35.7	
Mean index of stomach fulness, $^{o}/_{ooo}$	116.9		165.1		174.5		169.3		33.2		115.8		17.4	

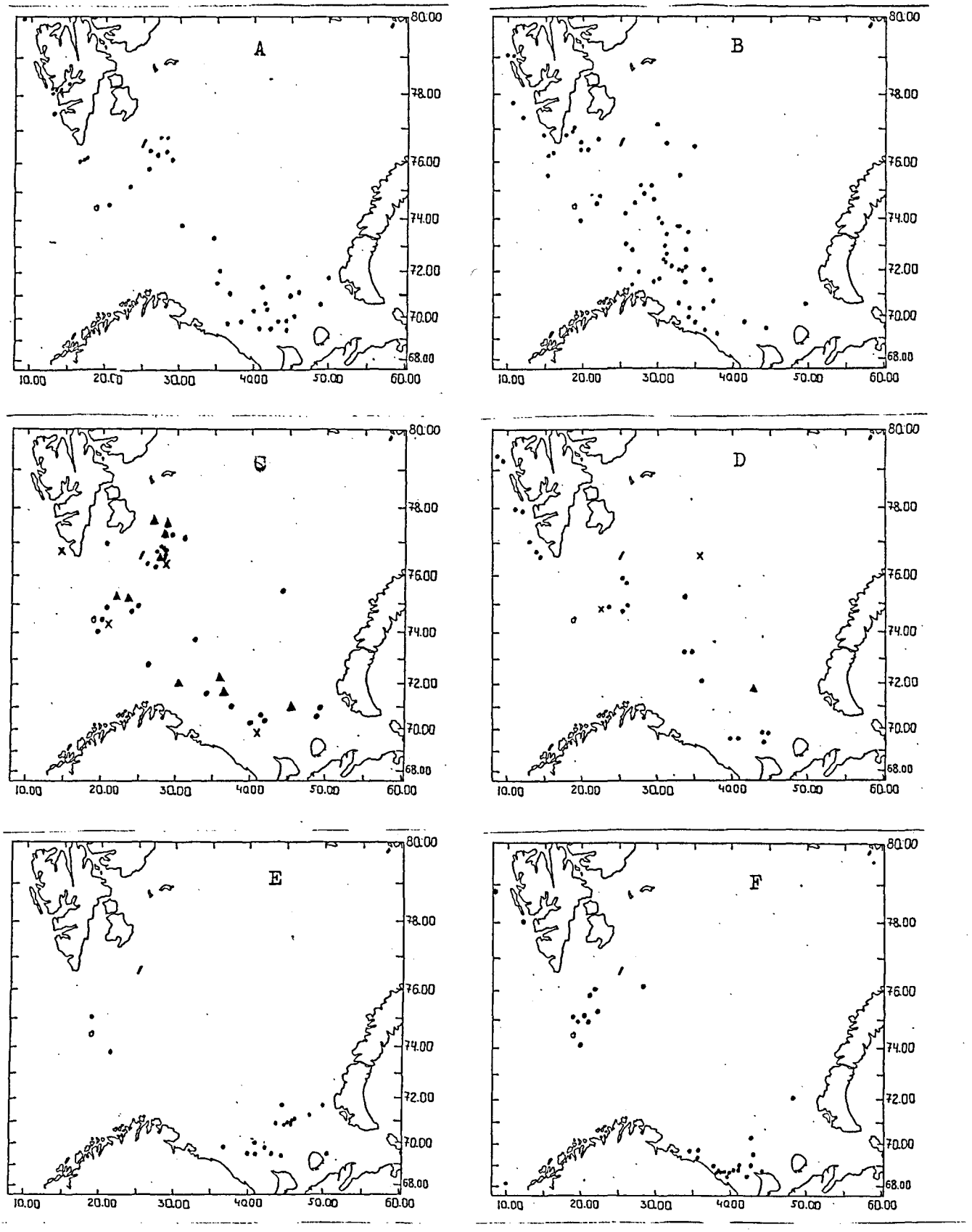


Fig.1 Locations of non-target fish dwelling

a - Leptoclinus maculatus b - Lycodes vahli gracilis

c - Triglops (▲ - T.pingeli, X - T.murrayi)

d - Icelus (▲ - I.bicornis, X - I.spatula)

e - Gymnacanthus tricuspis f - Myoxocephalus scorpius

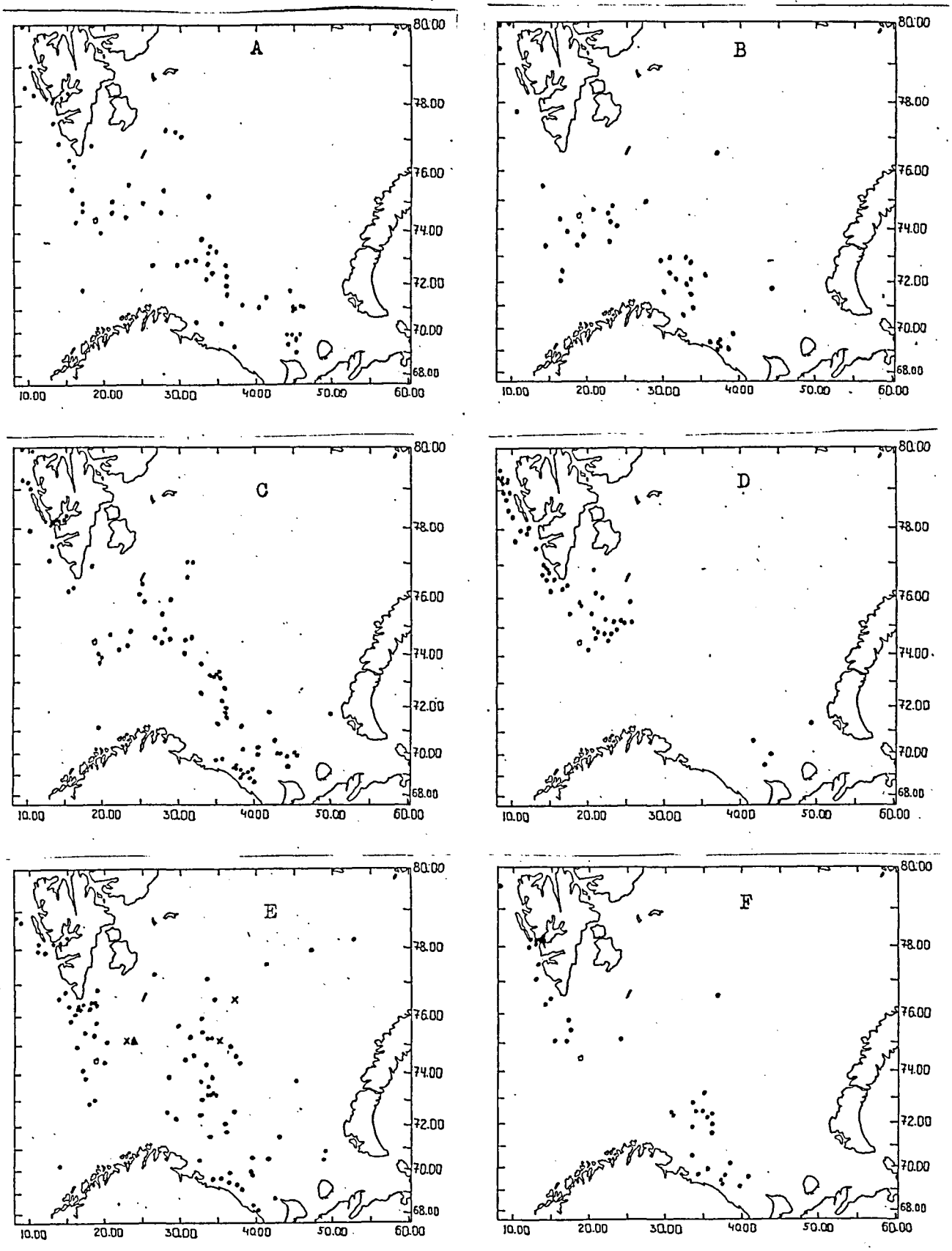


Fig.2 Locations of non-target fish dwelling

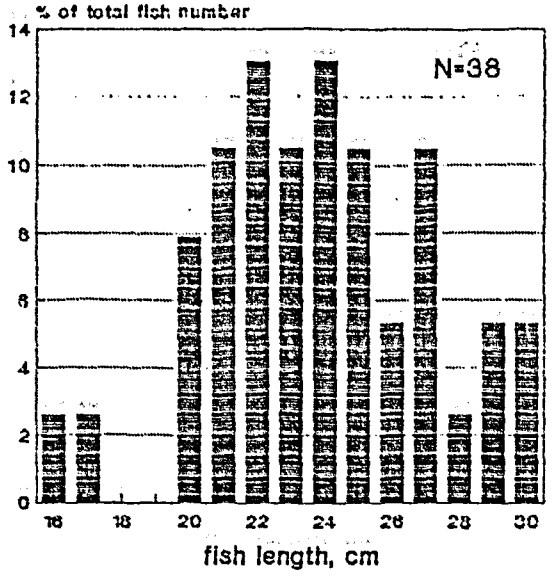
a - Artediellus europeus b - Cottunculus microps

c - Leptagonus decagonus d - Eumicrotremus spinosus

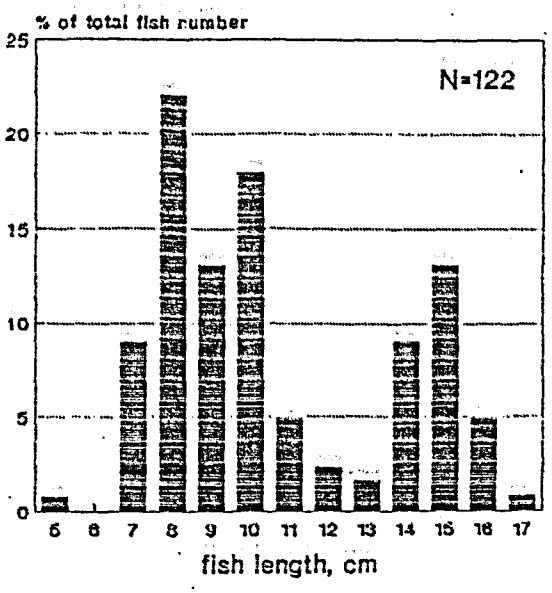
e - Liparis (▲ - L.gibbus, X - L.fabricii)

f - Careproctus reinhardti

LUMPENUS LAMPRETAEFORMIS

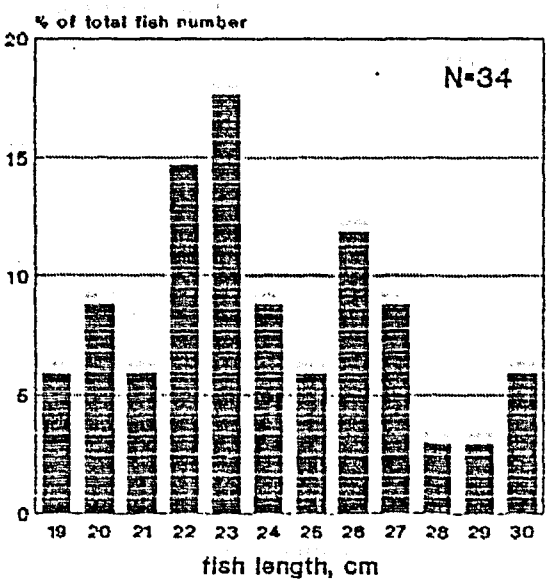


LEPTOCLINUS MACULATUS



WEST SPITSBERGEN

LYCODES VAHLII GRACILIS



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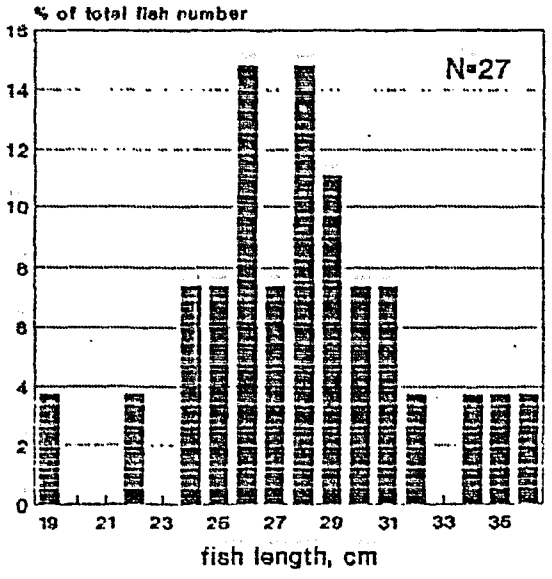

WEST SPITZBERGEN

Fig.8 Length composition of non-target species from Lumpenidae and Lycodinae.
(N - number of fish)

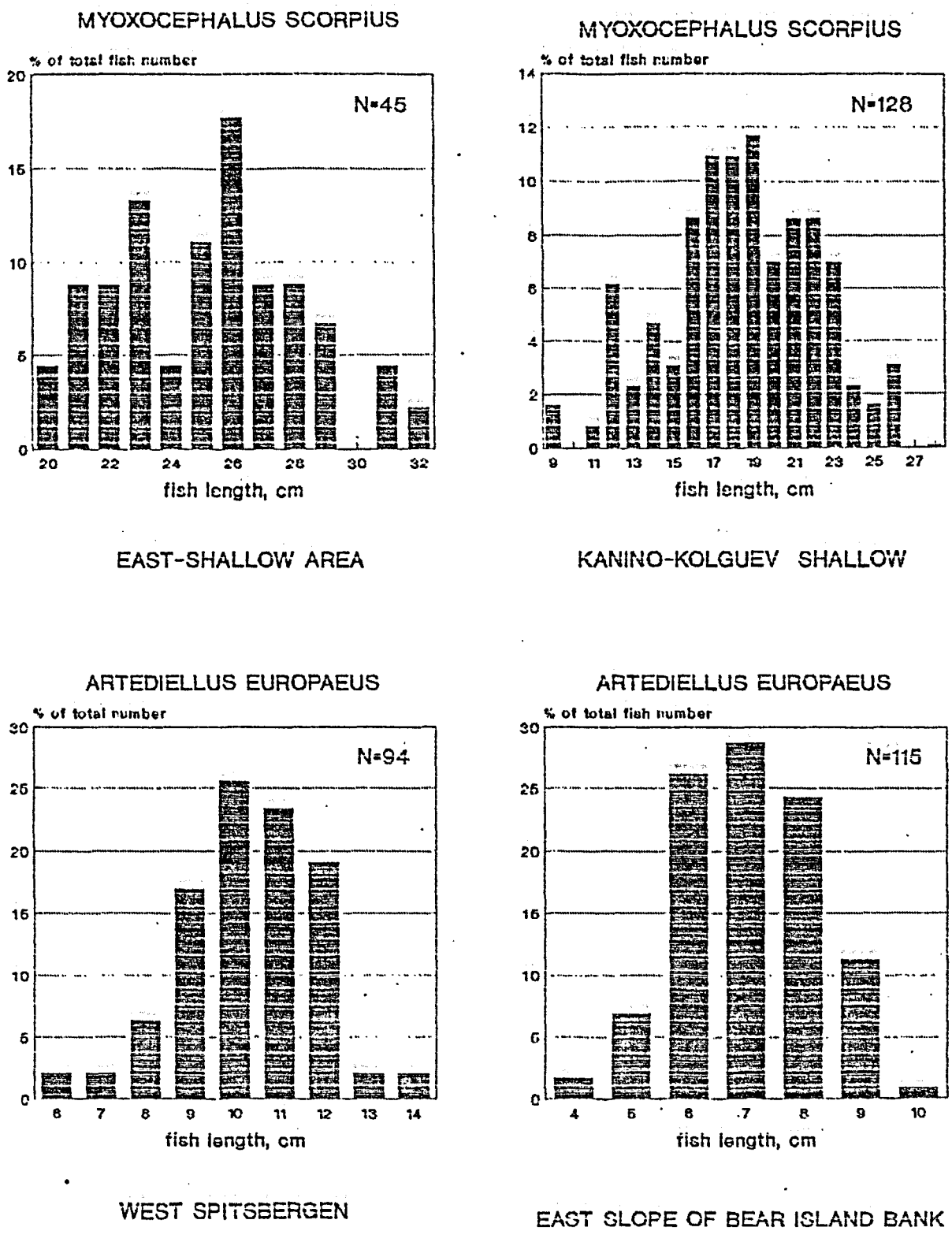

Fig.4 Length composition of Myoxocephalus scorpius and Artediellus europeus in different areas of the Barents Sea.
(N - number of fish)

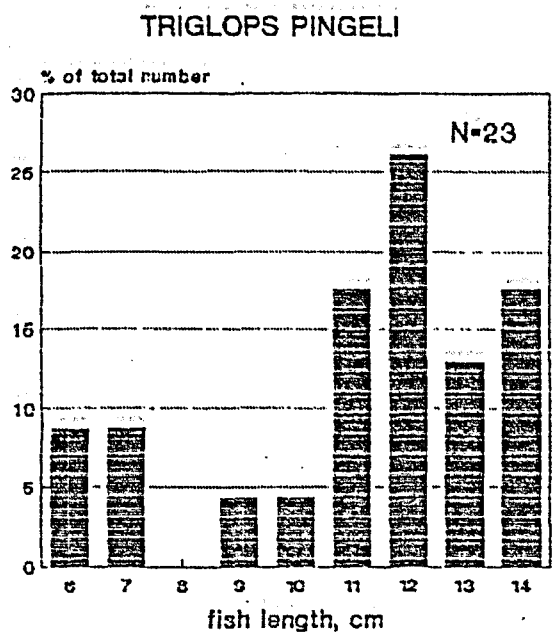

Fig.5 Length composition of Triglops pingeli and Leptagonus decagonus in different areas of the Barents Sea.
(N - number of fish)