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Long-Term Fluctuations of Abundance of Eggs and Larvae of Barents Sea Fish

by

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Summary

On the basis of extensive studies of ichthyoplankton on drift routes a relative estimation of the abundance of fish year classes was given for a 12-year period (1959-1970). Investigations were carried out twice during each year in cruises by the research vessels of PINRO: in April-May and June-July.

In the years investigated the main bulk of eggs and larvae belonged to a small number of species; they were mainly mass schooled commercial species: redfish, capelin, long rough dab, cod, haddock, while other species accounted for less than 5% of the total haul.

The total and specific abundances of eggs and larvae fluctuate greatly. A relatively great number of eggs and larvae are observed during the first five years (till 1964). Then, during the next five years a decrease in the abundance takes place and in 1969 and 1970 an increase is again registered. Such a phenomenon is found almost in all species both commercial and non-commercial. The exception is herring and partly long rough dab.

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Since 1959 the Polar Institute (PINRO) has carried out regular observations on the relative abundance of fish eggs and larvae on their drift routes from the spawning grounds. Figure 1 shows the area where the investigations are carried out. In this area two surveys are carried out annually: in April-May and June-July. Surveys and some sections were not carried out in April-May 1964 and 1967 and in June-July 1966, respectively.

Gathering of ichthyoplankton is carried out with egg-nets and a ring-trawl on the standard hydrological sections and on some banks off the north-western coast of Norway (Baranenkova, 1968).

In catches taken during twelve years eggs and larvae of 52 fish species belonging to 19 families were found (Table 1). The number of the species determined included 22 boreal species, 21 north-boreal and 9 subarctic or Arctic species. Of the number of species mentioned 25 species have pelagic eggs, 23 have bottom eggs while 3 species have viviparous eggs. Some species were represented only by eggs and some only by larvae: 17 species of fish were determined by eggs, 45 species by larvae.

The greatest number of eggs and larvae belong to the north-boreal species. The number of eggs and larvae of boreal and especially subarctic and Arctic species is smaller in the area surveyed. However, in June-July a number of eggs of boreal species, mainly of slime flounder, is greater than that of the north-boreal species.

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Figures 2, 3, and 4, 5 show the number of eggs and larvae respectively which were gathered in the different years, they are given for every year both as totals and by some species expressed in per cent of the total number gathered during 12 years.

The total abundance of eggs in April-May was approximately three times greater than that in June-July. The difference in numbers results from different spawning times of some species. A number of larvae is greater in June-July.

In the years of investigation the main bulk of eggs and larvae belonged to mass schooled commercial fish: redfish, capelin, long rough dab, cod and haddock. Other fish species account for less than 5% of the total number of eggs and larvae. Specific variety of eggs in April-May is greater than that in June-July and a variety of larvae is greater in June-July. An especially varied specific composition was noted in 1961, 1962 and 1970.

A number of species changed both by times and by areas of collecting the eggs and larvae. The greatest specific variety of eggs was registered on the most southern sections of the area investigated and on the Malangen Bank and that of larvae on the Malangen Bank and the North Cape - Bear Island and Kola sections. Parallely with a decrease in the number of egg species from April-May to June-July on the southern sections and banks (except for the Vesterålen Bank) a decrease in the number of larval species was also observed but in the more northern and eastern parts (the area of the North Cape and Kola sections); the number of larvae increased from April to June-July and this is due to hatching and larval drift of different time.

Previously it was found (Baranenkova and Khokhlina, 1961) that locations of main concentrations of eggs and larvae of different species are considerably disconnected in spite of the overlapping of their habitats and this fact was confirmed by the data collected while surveying the ichthyoplankton during twelve years. Thus, for example, the greatest number of eggs and larvae of cod were recorded in April-May, on the average for 1959-1969, on the Malangen and Røste Banks; that of haddock on the Andöy and Fugløy sections and along 72°50'N; larvae of redfish were found along 71°10'N and on the Andöy Bank; eggs of saithe on the Malangen and Fugløy Banks and eggs and larvae of long rough dab were found at 30°E and on the Kola section.

While analysing the data for a 12-year period two peaks of increase in the number of eggs are clearly seen: the first peak was in 1959-1963 and the second in 1969-1970. Over the period 1964 to 1968 the total abundance of eggs was noticeably smaller. This phenomenon is characteristic both for abundant species (cod and haddock) and non-abundant ones. The same is observed for the quantitative distribution of larvae in these years. The same peaks of the increased abundance of larvae are evident in 1959-1963 and 1969-1970 and a decrease in the abundance took place in 1964-1968. Some differences in the predominance of some or other year classes are observed in some species. An exception is herring and partly long rough dab. During the last five years larvae of herring were not found in hauls taken in June-July. It is characteristic that an increasing in the number of eggs and larvae in 1959-1963 and 1969-1970 is also observed in non-commercial fish species.

What is aid above leads to the conclusion that in 1964-1968 the conditions for the spawning and survival of eggs and larvae were unfavourable and resulted in a low abundance of the year classes of many species. Together with the particular factors affecting the abundance of eggs and larvae of some species there evidently existed a total regularity in the fluctuations of their abundance. A certain periodicity that is probably connected with factors of a wider order is outlined, may be with solar radiation and some other climatic factors. Regular investigations will make it possible to clarify more completely the reasons for the appearance of year classes of different abundance.

References

BARANENKOVA, A. S. 1968. The PINRO investigations into the estimation of the abundance of the Barents Sea fish. Trudy PINRO, No. XXIII, Murmansk.

BARANENKOVA, A. S.,and KHOKHLINA, N. S.,1961. The distribution of larvae of commercial fish in the Barents Sea in 1959 and 1960. Nauchno-technichesky Bull. PINRO, No. 2-3 (16-17), Murmansk.

List of fish species, eggs (e), larvae (l), and fry (f) of which were found in plankton in the surveyed part of the Barents Sea in April-May and in June-July, 1959-1970. (pages 3, 4, 5 and 6).

Family and fish Species	Geographical characteristics			Characteristics of eggs deposited		Occurrence in plankton				Spawning times off the Norwegian coast and in the western Barents Sea, months
						April-May		June-July		
	Boreal	North-boreal or Arctic boreal	Sub-Arctic or Arctic	Pelagic	Bottom	e	l	l	l and f	
Clupeidae										
Clupea harengus harengus Linné	+				+		+		+	II-IV
Osmeridae										
Mallotus villosus villosus (Müller)		+			+		+		+	III-VI
Argentinidae										
Argentina silus (Ascanius)	+			+		+	+	+	+	II-VII
Argentina sphyraena L.	+			+		+		+	+	IV-VI
Myctophidae										
Myctophum glaciale (Reinhardt)	+						+		+	Spring months
Gadidae										
Gadus morhua Linné		+		+		+	+	+	+	I-VI
Melanogrammus aeglefinus (Linné)		+		+		+	+	+	+	III-VI
Pollachius virens (Linné)	+			+		+	+		+	I-V
Brosme brosme (Müller)		+		+		+	+	+	+	IV-VII
Trisopterus esmarkii (Nilsson)	+			+		+	+	+	+	II-V (VI)
Boreogadus saida (Lepechin)			+	+					+	Winter months
Molva molva (Linné)		+		+		+		+		III-VII
Molva dipterygia (Pennant)		+		+		+				V-VI
Odontogadus merlangus (Linné)	+								+	IV-VII

List of fish species (continued)

Family and fish Species	Geographical characteristics			Characteristics of eggs deposited		Occurrence in plankton				Spawning times off the Norwegian coast and in the western Barents Sea, months
						April-May		June-July		
	Boreal	North-boreal or Arctic boreal	Sub-Arctic or Arctic	Pelagic	Bottom	e	l	l	l and f	
Micromesistius poutassou (Risso)	+			+				+	+	Spring months
Gadiculus argenteus thori J. Schmidt	+			+					+	Spring months
Merluccius merluccius (Linné)	+			+				+		VII-VIII
Enchelyopus cimbrius (Linné)		+		+				+	+	Spring-summer months
Gasterosteidae										
Gasterosteus aculeatus Linné	+				+		+		+	IV-VIII
Anarhichadidae										
Anarhichas latifrons (Steenstrup)			+		+				+	
Anarhichas minor Olafsen			+		+				+	III-V
Anarhichas lupus Linné		+			+		+			IX-I
Callionymidae										
Callionymus lyra L.	+			+		+		+		III-VIII
Stichaeidae										
Chirolophis galerita (Linné)					+		+		+	X-XII
Lumpenidae										
Lumpenus lampretaeformis (Walbaum)		+			+		+		+	XII
Leptoclimus maculatus maculatus (Fries)			+		+		+		+	
Pholidae										
Pholis gunnellus (Linné)	+				+		+		+	XII-I

List of fish species (continued)

Family and fish Species	Geographical characteristics			Characteristics of eggs deposited		Occurrence in plankton				Spawning times off the Norwegian coast and in the western Barents Sea, months
						April-May		June-July		
	Boreal	North-boreal or Arctic boreal	Sub-Arctic or Arctic	Pelagic	Bottom	e	l	l	l and f	
Ammodytidae										
Ammodytes hexapterus marinus (Raitt)		+			+		+		+	XI-II
Hyperoplus lancolatus (Lesauvage)		+			+				+	V-VIII
Scorpaenidae										
Sebastes marinus marinus Linné		+					+		+	IV-VI
Sebastes mentella Travin		+					+		+	IV-VI
Sebastes viviparus Kröyer									+	VI-VIII
Cottidae										
Triglops murrayi Günther	+				+		+		+	Autumn-winter months
Taelis bisotnis (Reinhardt)		+			+		+			VIII-X
Gymnacanthus tricuspis (Reinhardt)			+		+		+		+	Early spring months
Myoxocephalus scorpius (Linné)		+			+		+		+	XII-II
Agonidae										
Leptagonus decadonus (Block et Schneider)			+				+		+	Winter-spring months
Agonus cataphractus (Linné)	+				+				+	I-V
Ulcina ëlriki (Lütken)			+		+				+	
Cyclopteridae										
Cyclopterus lumpus Linné		+			+		+		+	I-VI
Liparidae										
Liparis montagui (Donovan)	+				+		+		+	II-III

List of fish species (continued)

Family and fish Species	Geographical characteristics			Characteristics of eggs deposited		Occurrence in plankton				Spawning times off the Norwegian coast and in the western Barents Sea, months
						April-May		June-July		
	Boreal	North-boreal or Arctic boreal	Sub-Arctic or Arctic	Pelagic	Bottom	e	l	l	l and f	
Liparis liparis (Linné)					+		+		+	Winter-spring months
Careproctus reinhardti Kröyer			+		+				+	
Bothidae										
Scophthalmus norvegicus (Günther)				+		+				IV-VIII
Pleuronectidae										
Reinhardtius hippoglossoides (Walbaum)			+	+		+				Winter months
Hippoglossus hippoglossus hippoglossus (Linné)		+		+		+		+	+	I-V
Hippoglossoides platessoides limandoides (Block)		+		+		+	+	+	+	III-VII
Limanda limanda (Linné)	+			+		+		+	+	V-VIII
Platessa platessa (Linné)	+			+		+	+	+	+	II-VI
Pleuronectes flesus septentrionalis (Suvorov)	+			+		+		+		IV-VII
Microstomus microcephalus (Donovan)	+			+		+		+	+	
Glyptocephalus cynoglossus	+			+					+	IV-IX

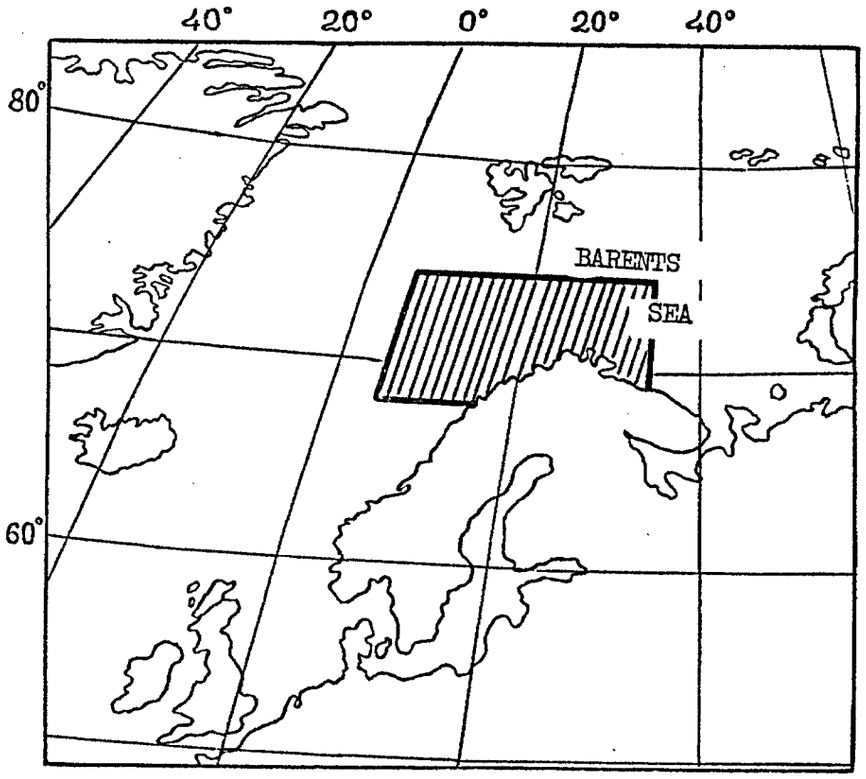

Figure 1. The area of investigations.

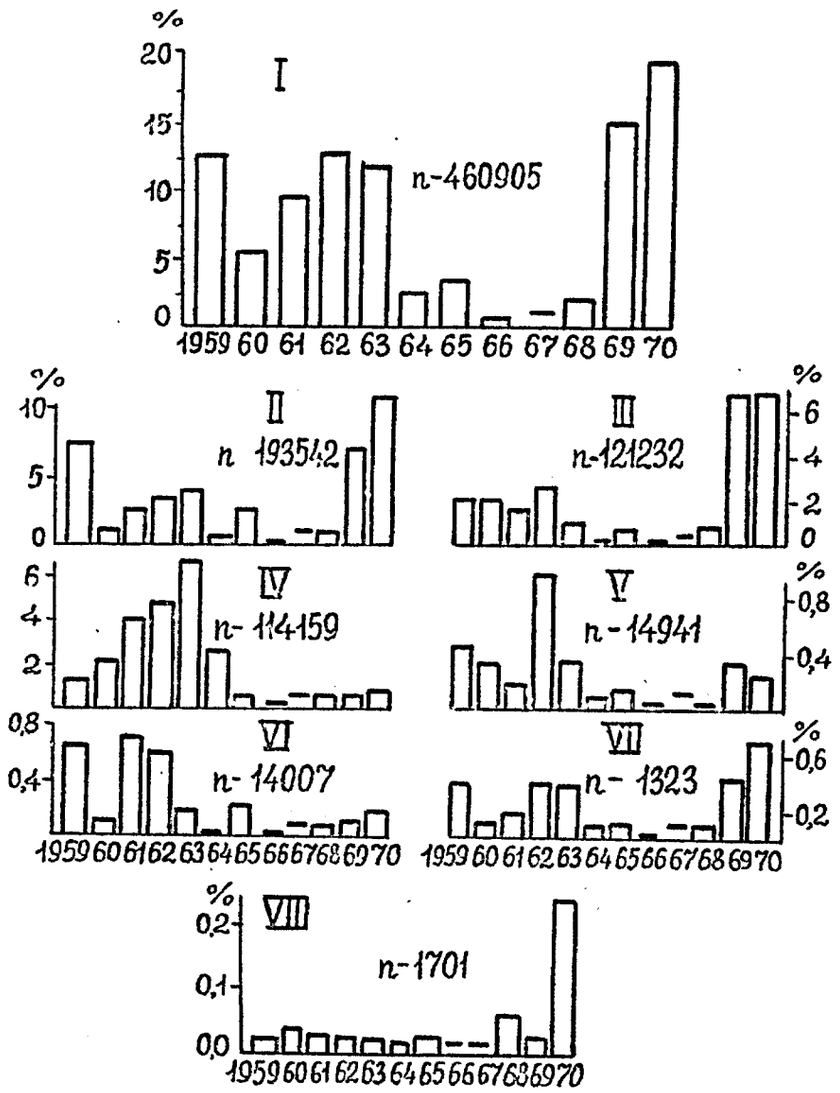

Figure 2. The number of eggs gathered in April-May of different years expressed in % of the total number collected in 1959-70.

I - all species
II - cod
III - haddock
IV - long rough dab
V - cusk
VI - Norway pout
VII - plaice
VIII - other fish.

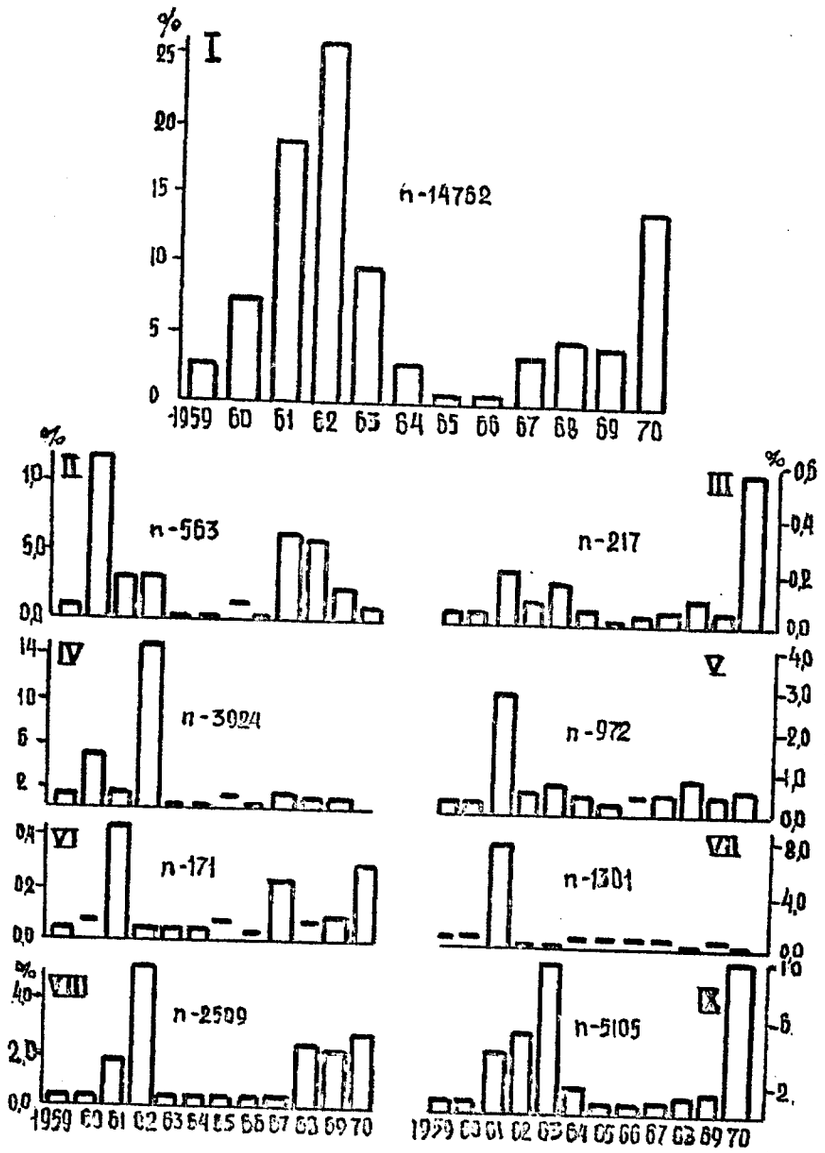

Figure 3. Number of eggs gathered in June-July of different years expressed in per cent of the total number collected in 1959-1970.

I - all species
II - cod
III - haddock
IV - long rough dab
V - cusk
VI - Norway pout
VII - plaice
VIII - other fish
IX - slime flounder.

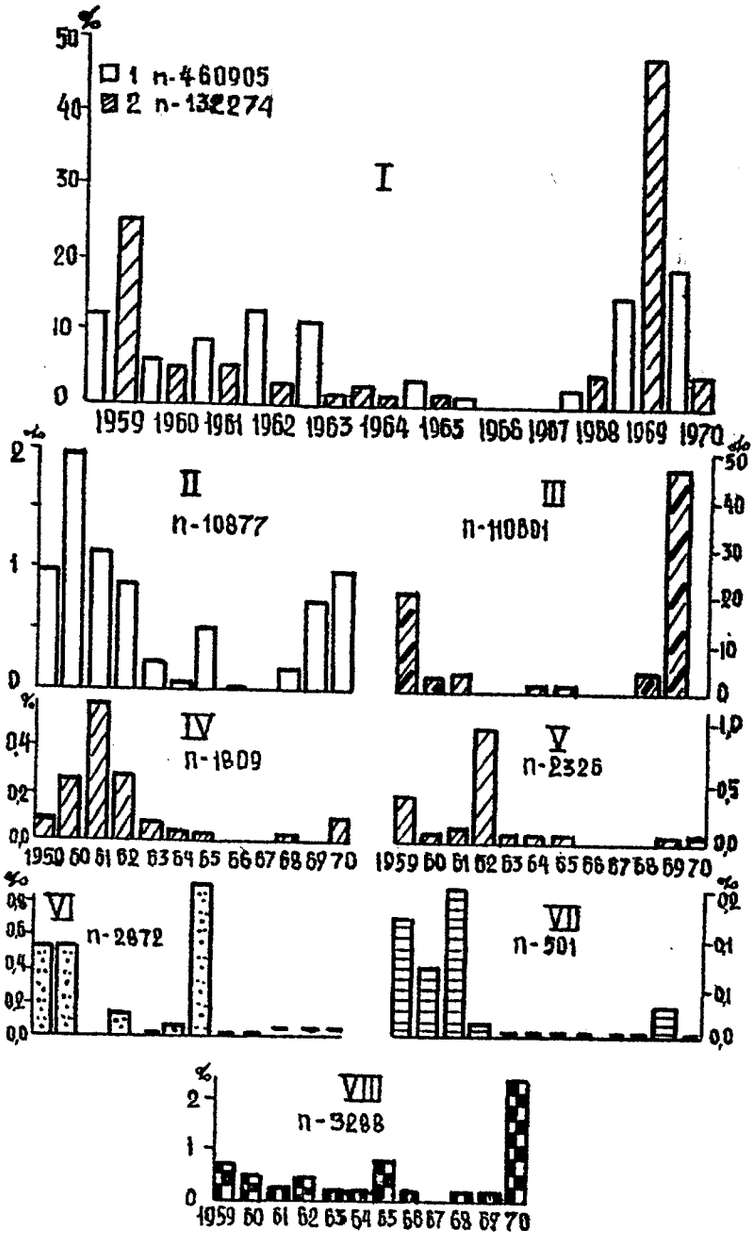

Figure 4. Number of larvae gathered in April-May of different years expressed in per cent of the total number collected in 1959-1970.

I - all species (2), eggs are also given (1)
II - redfish
III - capelin
IV - long rough dab
V - cod
VI - herring
VII - haddock
VIII - other fish.

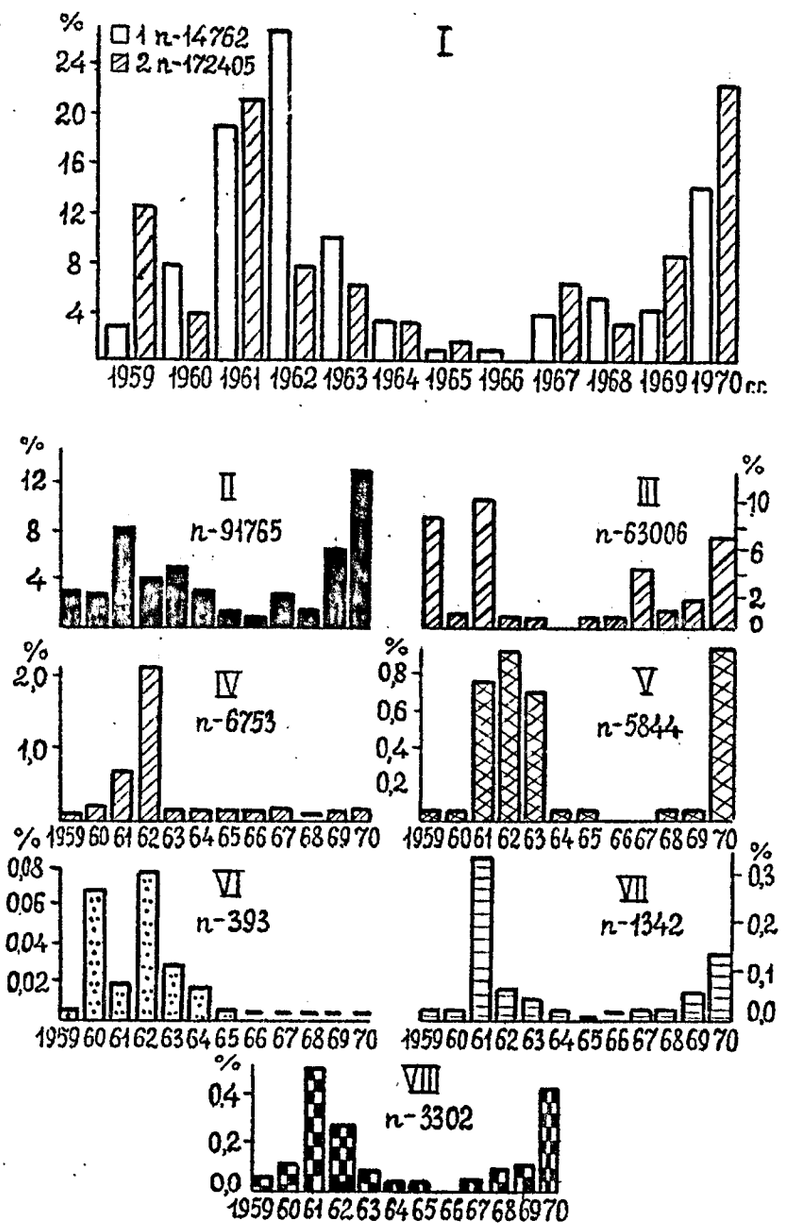

Figure 5. Number of larvae gathered in June-July in different years expressed in per cent of the total number collected for 1959-1970.

I - all species (2), eggs are also given (1)

II - redfish

III - capelin

IV - long rough dab

V - cod

VI - herring

VII - haddock

VIII - other fish.