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AMERICAN PLAICE SPAWNING IN THE NORTHWEST ATLANTIC AREA

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In the Northwest Atlantic area American plaice (Hippoglossoides platessoides platessoides Fabr.) are distributed from Greenland shores to Cape Cod. In the ICNAF Area the fishery on that fish species is intensive enough off Newfoundland. However, a relatively small number of papers concerning the biology and characteristics of that fish species spawning were published till recently. Huntsman (1918), Bigelow and Schroeder (1953), Powles (1965) analysed these problems mainly for American plaice inhabiting the Gulf of St. Lawrence, the Bay of Fundy and the Gulf of Maine.

Scientific paper by Pitt T.K. (1965) only was dedicated completely to the spawning of the American plaice inhabiting the Newfoundland shore and the Grand Newfoundland Bank. The volume of data on distribution of eggs and larvae of the American plaice in the Northwest Atlantic area is also not great (Dannevig, 1918; Tensen; 1925; Frost, 1938; Serebryakov, 1962, 1963, 1964; Kennedy and Powles, 1964; Wells, 1968; L'Herrou and Minet, 1971).

The authors of this paper made some attempts to elucidate the character of distribution of the American plaice eggs and larvae, to precise time and place of their spawning in the areas off Labrador, Newfoundland and Nova Scotia.

This work is based mainly on the analysis of gonads maturity for the adult fish and on the collections of ichthyoplankton

taken from board research vessels of PINRO during the period from 1959 to 1970. Conical egg nets with 80-cm diameter opening were mainly used as fishing gears during these collection works. Usually, a vertical haul from bottom to the surface or 15-minute horizontal hauls were made at stations of standard hydrological sections and tacks as well as at special ichthyoplankton sections while circling or drifting. In 1959-1970, a total of 3,127 stations were completed in the northern areas from Labrador to Nova Scotia.

Data on the maturity stages of the adult fish gonads were obtained for the period from 1954 to 1970 due to field analyses conducted on board the research vessels of PINRO and the scouting vessels of the Northern Prospective Fish Scouting Service. A total of about 9,000 fishes were analysed there. But, the tables characterizing the gonads maturity include only fish having the gonads at the III, IV, V, VI and VI-II maturity stages. The stages of gonads maturity were determined with six point scale (Sorokin, 1957). Stages of eggs and larvae development of the American plaice are given in accordance with Rass system (1949).

Labrador

Frost (1938) and Huntsman (1918) pointed that the spawning of the American plaice takes place off Newfoundland Banks in July and near the Labrador coast even later.

Pitt (1965) considers that the spawning of the American plaice takes place in the areas of the continental slope beginning from the Davis Strait further to the south along the Labrador

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coast, then around Newfoundland and in the cold water gulfs as well.

The observations in the Northwest Atlantic area were conducted by us mainly during the period from March to September. In April - May, only solitary eggs were caught in the Labrador shelf waters (Figs.2,3). Larvae were not observed in the ichthyoplankton samples at that period.

Ripe running fish could be observed in the catches taken from this area already in January - March (Table I); the percentage of fish with running gonads increases greatly in May and the spawned - out specimens begin to be observed in the catches.

Table I. The maturity of the American plaice gonads, South Labrador, 1960-1970

Month	Maturity stages in %					Fish : number
	III.	IV.	V.	VI.	VI-II	
January	34.1	53.4	11.8	-	0.7	161
February	63.1	36.9	-	-	-	133
March	46.1	42.4	11.5	-	-	26
May	0.9	66.7	27.2	-	5.2	114
June	-	-	9.0	9.0	82.0	22
September	22.1	24.4	-	-	53.5	86

In June, solitary American plaice eggs were found in north-eastern part of the South Labrador at depths of 500 m and even more (Fig.4). The densest concentrations of eggs were taken off Sundal Bank at depths of 400-500 m in the second half of June. The eggs at first stage of development prevailed in number (Fig.8).

Late in June, eggs were observed in the north-eastern part of the Hamilton Inlet Bank at depths of 200-300 m (Fig.5). Among eggs caught those ones at first stage of development also prevailed in number (Fig.8). In June and August, two non-developed larvae about 6.0 mm length were caught in the area of the Hamilton Bank at depths of 100 m and more than 500 m correspondingly (Figs.4, 6). As the volume of data collected is very small, it is difficult to say precisely of time and areas of spawning, it is possible only to suppose that a slightly intensive spawning of the American plaice takes place in some areas of the South Labrador Shelf at depths from 150 m to 500 m from the middle of June to the end of July.

North-eastern part of the Newfoundland Shelf (northern Newfoundland Banks) . Ichthyoplankton collections were conducted in this area from April to July. In April, the American plaice eggs were not found in the catches taken with the egg net. The largest number of eggs at the first stage of development were taken off north-eastern Newfoundland coast at depths from 200 m to 250m in the second half of May (Fig.3).

Solitary eggs were observed at the same depths in the area of Ritu Bank, near the St. of Belle Isle and in the north-eastern part of the Newfoundland shelf.

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To the end of June, only scarce number of eggs at later stages of development (III-IV) were taken at the stations near Ritu Bank and off the north-eastern Newfoundland shores at depths from 200 m to 400 m (Fig. 4).

In June, the American plaice eggs were not observed in that area.

Larvae from 4.0 mm to 6.5 mm length were found near the Newfoundland shore at depths from 160 m to 250 m early in May and late in July. To the end of June, a larva about 5.0 mm length was taken near the edge of the Newfoundland shelf at depth of 335 m.

According to Pitt (1965), the American plaice spawning begins at that area apparently in the middle of May. Taking into account data on eggs distribution, it is possible to say that the spawning of slight intensity takes place at the same time, i.e. in the second half of May and in June, mainly, in the shallows of the area and off Newfoundland coast at depths from 200 m to 250 m, though fish at pre-spawning stage, as mentioned in this paper, was observed even in February.

Grand Newfoundland Bank. Eggs of the American plaice can be found in the waters of that area from the end of March to September (Figs.I-6). In March, the eggs at the first stage of development prevailed in the ichthyoplankton samples (Fig.8). At that period, eggs were mainly distributed at depths from 50 m to 100 m in the north-eastern part of the Grand Bank and in its south-eastern part. In the second part of April, the largest number of eggs were caught in the central part of the Grand Bank

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shallow westerner the Flemish Cap Bank, less number of eggs were taken in its southern slopes. Eggs were taken in the depths from 50 m to 500 m, but, the bulk of them was got from the hauls of nets at depths of 50-200 m. Some eggs were found at depth over 400 m.

Eggs at early stages of development (I and II) prevailed in the samples taken from this area and the proportion of these two stages was quite similar.

In the second half of May, the eggs of the American plaice in the waters of northern part of the Grand Bank were registered in a very great number, they are distributing throughout this area at depths from 100 m to 200 m. The samples were represented by the eggs at all stages of development, though eggs at earlier stages prevailed (Fig.8).

In May, an insignificant number of eggs at all stages of development were caught in some areas of the southern slopes of the Grand Bank at depths from 50 m to 500 m. But, there is some difference in the stages of development of the eggs observed. Thus those ones registered in May in its south-eastern coast were for the most of cases at early stages of development, and eggs found in its south-western slope were at later stages of development (Fig.8).

In the first half of June, the eggs of the American plaice were observed in the southern and south-western parts of the Newfoundland shallow and throughout all the south-western slope of the Grand Bank, mainly, at depths from 50 m to 300 m. At that time, eggs at the III and the IV stages of development prevailed in number in the waters of the southern part of the Grand Bank,

and those at early stages of development - in its south western slope. Some eggs were carried out the shallows to great distances from the Bank by the currents and were even observed at depths of 4000-5000 meters. The cases of bringing out the eggs from the zone of the Grand Bank to the area of great oceanic depths were registered also in July - August and, as a rule, such eggs were dead.

In July, August and September solitary eggs of the American plaice were observed throughout all the area of the Grand Bank shallows and near the Avalon Peninsula at depths from 50 m to 200 m. Samples taken in July in the south-eastern part of the Grand Bank contained only eggs at first stage of development (Fig.8). Larvae were found in the areas of the Grand Bank at depths 50 - 800 meters from May up to the middle of September. The sizes of larvae caught fluctuated from 3.0 mm up to 22.0 mm, for the most of cases, those were pre-larvae and non-developped larvae with middle sizes from 4.0 mm to 8.00 mm.

In the second half of August larvae were mostly found in the waters of the south-western slope at depths of 80-350 meters. The length of larvae varied from 4.0 mm to 15.0 mm. Different terms of spawning were determined for different areas of the Grand Bank, i.e. from the middle of April up to the end of May in the northern part of the Bank and from the beginning of April up to the second half on May in the areas of its southern slopes (Pitt, 1965). The analysis of distribution of the spawning fish in this area shows that in January fish with running eggs ^{were} observed in the catches taken from the northern part of the Grand Bank.

The greatest number of spawning fish were observed in April -May (the volume of data was very small for March to allow to

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make some conclusions basing on them), (see Table 2).

Table 2. Maturity stages of the American plaice in the waters of the Grand Newfoundland Bank, 1954-1970

Division	Month	Maturity stages in %					Fish number
		III.	IV.	V.	VI.	VI-II	
3L	I	58.6	38.0	3.4	-	-	87
	II	18.6	72.4	9.0	-	-	311
	III	-	52.2	38.7	2.3	6.8	44
	IV	13.1	40.6	31.7	4.6	10.0	281
	V	45.8	20.0	29.5	-	4.7	190
	VII	31.8	11.6	6.4	7.8	42.4	467
	VIII	33.1	23.8	3.2	4.3	35.6	650
	IX	75.5	23.7	0.8	-	-	123
	3N	I	59.8	31.7	8.5	-	-
II		45.2	45.2	9.6	-	-	73
III		2.0	44.1	23.5	1.0	29.4	102
V		25.6	25.6	18.6	0.8	29.6	125
VI		36.2	21.4	26.8	3.4	12.2	354
VII		58.3	11.1	0.8	11.1	18.7	235
VIII		56.4	5.3	-	10.6	27.8	133
30		II	60.0	31.0	3.6	-	5.4
	III	17.4	60.9	17.4	-	4.3	69
	IV	22.2	15.6	57.8	-	4.4	45
	V	26.1	30.4	43.5	-	-	23
	VI	45.0	19.3	8.6	3.7	23.4	406
	VII	29.3	23.6	5.6	7.5	34.0	106
	IX	27.2	23.8	5.4	-	43.6	92

In the southern areas of the Grand Bank the maximum quantity of spawning fish was registered in March, May, June (Division 3M) and in April, May (Division 3O).

Thus, taking into consideration the character of distribution of eggs, larvae and spawning fish, it is possible to conclude that the spawning period for the American plaice is very long in the areas of the Grand Bank and it lasts approximately from the middle of March up to September. The most intensive spawning of the American plaice was observed in the northern part of the Grand Bank shallow apparently, from the second half of April up to the middle of May, mainly, at depths from 50m to 200 m.

The spawning was much less intensive in southern areas of the Bank. Thus, the period of spawning took place mainly from the middle of April up to the end of May at depths from 50 m to 150 m in some areas of the south eastern slope. From the middle of May up to the first half of June the spawning was also observed in the area of the south-west^{ern} part of the Grand Bank at depths from 50 to 100 meters.

Flemish Cap Bank. Some eggs of the American plaice were observed in the waters of the Flemish Cap Bank beginning from the second part of March up to the end of July (Fig.I-5). The greatest number of eggs was caught in the central part of the Bank at depths 150-200 m in the second part of May and in June (Figs 3,5). Eggs of the first stage of development prevailed in numbers (Fig.8) Solitary eggs were found only in the first half of July at depths from 150 to 320 meters. Larvae caught were 5-6 mm length. Spawning

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fish were observed in this area already in March (Table 3).

Table 3. American plaice maturity, Flemish
Cap area

Mouth	Maturity stages in %					Fish number
	III.	IV.	V.	VI.	VI.-II.	
III	55.5	19.5	22.2	-	2.8	72
VI	58.0	37.7	4.3	-	-	69
IX	42.9	30.4	7.1	-	19.6	56

In summer period, the spawning fish with running gonads among fish caught could be found up to September. According to our data, it is difficult to determine the time of the American plaice spawning. Apparently, the main spawning of that small population takes place in central part of the Bank from the middle of May up to the end of July, mainly, at depths of 150-200 meters.

Saint - Pierre and Green Banks

In March - April, the eggs of the American plaice were observed in the catches of the egg nets in the area of St. Pierre Bank. During May, the eggs were found throughout large area from the Newfoundland shore up to the slope of the shelf at depths of 50-500 meters and even more (Fig.3).

Late in May the bulk of eggs were distributed in the waters

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of the Burgeo Bank and in the area encircling this Bank, then in the north-western and southern parts of the St. Pierre Bank, as well as in the southern part of Green Bank at depths of 50-200 meters. A large number of eggs were also observed in the area of the underwater gut in the Cabot Strait and in the southern part of the area, i.e. in the waters of the shelf slope (depths from 200 m up to 500 m and more).

In the first and second ten-day periods in May, fish at early stages of development prevailed, but, a great number of eggs at III and IV stages could be also found. Late in May, fish at all stages of development were represented in the samples, but even then the specimens at III and IV stages prevailed significantly in number (Fig.8). In June, the eggs of the American plaice were distributed in small quantity throughout the shallows of the St. Pierre Bank at depths of 50-100 meters and in the area of the continental slope (depths up to 500 meters). Solitary eggs were caught in the waters lying to the south of the St. Pierre Bank at oceanic depths of 2000-3000 meters. In August, American plaice eggs were not observed in that area. In May - June, eggs were found in the area of Burgeo Bank, in the north-western and southern slopes of the St. Pierre Bank, then in the waters of the continental slope to the south of the St. Pierre Bank, as well as in the area of the underwater gut of the Cabot Strait. The larvae observed were from 3.00 mm up to 8.00 mm length. The greatest number of larvae caught in those areas was in the second half of May. To the end of August, some larger larvae from 7.0 to 12 mm length were observed in the northern

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part of the St. Pierre Bank shallow (Fig.6).

Pre-spawning and spawning fish can be found in those areas practically during the whole year, i.e. from February to December (Table 4).

Table 4. Maturity stages of the American plaice gonads, Saint Pierre area

Month	Maturity stages in %					Fish number
	III.	IV.	V.	VI.	V-II	
II	43.5	26.4	3.7	-	26.4	53
V	68.0	16.0	-	-	16.0	25
VI	26.2	8.9	20.2	7.3	37.4	326
IX	50.8	39.2	9.2	-	0.8	1566
X	39.3	21.4	39.2	-	-	178
XII	47.5	49.5	1.0	-	2.0	97

Spawmed-out fish with gonads condition allowing for catching were observed only in June.

Analysing the picture of distribution of eggs and larvae of the American plaice it can be supposed that its spawning takes place in the area of the St. Pierre Bank, apparently, from May to June with its peak in May. The spawning areas are lying off Newfoundland shore near the Burgeo Bank and in the waters

encircling it, as well as in the areas of the north-western and southern slopes of the St. Pierre and Green Banks, mainly, at depths of 50-200(250) meters. It is doubtful whether the American plaice spawning takes place in the area of the underwater gut of the Cabot Strait and in great depth areas of the continental slope to the south of the St. Pierre Bank. It is possible to suppose, that the eggs are, apparently driven away the St. Lawrence Gulf, the ashore areas of the south-western Newfoundland areas and the north-western slopes of the St. Pierre Bank to the Cabot Strait together with currents. Eggs shut in the southern part of the St. Pierre Bank can be carried out to the areas of the Green Bank and the south-western slope of the Grand Bank.

Nova Scotia areas

In April, a solitary American plaice egg was caught on the south-western slope of Banquereau Bank (Fig.2).

In May, the largest quantity of eggs were observed in the southern part of the Banquereau Bank shelf zone near the Cape Breton shore, as well as in the areas of the Scatterry and Misaine Banks at depth from 50 m to 200 m. Less quantities of the American plaice eggs were found in the shallows of the Banquereau Bank, in the areas of the underwater gut of the Cabot Strait and in the continental slope waters at depths from 50 m to 200 m. A scarce number of eggs were taken in the areas of Banquereau, Browns and Georges Banks at depths from 2000 m to 3000 m.

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In the second ten-day period of May, eggs at early stages of development prevailed among those caught in the area of the Banquereau Bank (Division 4V), and late in May the correlation of fish at early and late stages of development was quite similar (Fig.8). The eggs at late stages of development prevailed in number among those caught in the area of the Emerald Bank (Division 4W), especially high was the percentage of eggs at the IV stage of development (Fig.8).

Larvae from 4.0 mm up to 13.0 mm length were observed in the waters of the Banquereau Bank in May and August. Middle sizes of those larvae were of the order of 6.0 mm and 7.8 mm correspondingly. Solitary larvae from 4.0 mm up to 8.0 mm length were found in the areas of the Emerald and Browns Banks.

The analysis of the character of eggs distribution allows us to conclude that in May the most intensive spawning takes place in the Nova Scotia area and in the northern part of the Banquereau Bank at depths from 50 to 200 meters.

The spawning of much less intensity is, apparently, observed in some areas of the Nova Scotian Shelf near the Emerald and the Browns Banks at the same period.

But, those conclusions should be considered as preliminary, as we have no data on spawning fish distribution.

The American plaice spawning is insignificant in the area of the Georges Bank and it takes place in earlier terms than in the waters off Nova Scotia. It is not excepted that the most part of eggs and larvae for the American plaice as well as some of them for the cod, haddock and some other fish species are carried out the areas of Georges Bank to the south-western direction of the shelf slope into the high sea (Colton and Temple, 1961).

Conclusion

The American plaice (Hippoglossoides platessoides platessoides Fabr.) or the long rough dab is the Arctic-boreal species distributed throughout the Northwest Atlantic area from Greenland up to the Cape Cod.

There are some local populations within this area, and the most numerous is the population inhabiting the waters of the northern part of the Grand Bank. (Templeman, 1960 ; Yanulov, 1962 ; Pitt, 1963, 1967; Powles, 1965). The scientists suppose that this species do not migrate to long distances (Pitt, 1969).

The spawning areas of the American plaice are located almost everywhere within this area, as far as it is possible to judge about by data on eggs and spawning fish distribution. The most intensive spawning is observed in the northern part of the Grand Bank shallows, off eastern and southern Newfoundland shores, on St. Pierre and Green Banks, near the Cape Breton Island and the Banquereau Bank (Fig.7). The spawning takes place in those areas mainly in April, May and June. The spawning of the American plaice in other areas of the Northwest Atlantic (Table 5) and in the waters of the Northeast Atlantic areas (Milinsky, 1944) is usually observed approximately, at the same period. Thus, the American plaice can be related to the category of spring-time spawning fish.

The temperature of the near-bottom water layers is within the range from 0° up to 6° and this one of the surface layers from 6.0° up to 18.0° in spring period. The most intensive spawning is observed with temperature of the bottom layers of the

order of 0.0° - 2.5° and 0.36° - 6.0° and this one of the surface waters - 10.0° - 18.0° .

The spawning areas are situated at depths from 50 m to 250 m. Everywhere they are lying in the areas of turbulences and rotations of the cold Labrador branches (Newfoundland Banks) and in cold waters carried out the St. Lawrence Gulf (Banquereau Bank). The American plaice larvae at different stages of development (length 3.0 - 22.0 mm) were observed in the same habitats that eggs, i.e. in the spawning areas. Low current velocities in the spawning areas of Newfoundland Banks and the peculiarities of larvae distribution allow us to suppose that the American plaice at its early stages of development do not drift for long distances in that area. But, this conclusion can not be related to Nova Scotia waters, where the current velocities are high enough and passive migrations should bear another character.

R e f e r e n c e s

- Yanulov K.P., 1962. On age and growth of the American plaice in the Northwest Atlantic area. Soviet Fisheries Investigations in the North-west Atlantic. VNIRO - PINRO.
- Milinsky G.I., 1944. Data on biology and fishery of the Barents Sea American plaice. Trudy of PINRO, ed.8.
- Rass T.S., 1949. Composition of the Barents Sea ichthyofauna and systematic signs of eggs and larvae for fish of that area. Trudy of VNIRO, v.XVII.

- Serebryakov V.P., 1962. Ichthyoplankton studies of the Labrador and Newfoundland areas. Soviet Fisheries Investigations in the North-West Atlantic. VNIRO - PINRO.
- Sorokin V.P., 1957. Ovogenesis and the biological circle of the cod (Gadus morhua L). Trudy of PINRO, ed.10.
- Bigelow H.B. and Schroeder W.C., 1953. Fishes of the Gulf of Maine. Bull. U.S. Fish and Wildlife Serv., 53.
- Colton I.B. and Temple R.F. 1961. The Enigma of Georges Bank Spawning. Limnology and Oceanography, 6 (3).
- Dannevig A, 1918. Candian Fish eggs and larvae, Canadian Fish and Mar.Invest.v.3, N 5.
- Frost N., 1938. Newfoundland fishes. A popular account of their life histories. Newfoundland Dept.Nat,Res.Serv. Bull, N 4.
- Runtsman A.G., 1918. Histories of new food fishes. I. The Canadian plaice. Bull. Biol.Bd.Canada. N 1.
- Jensen A.S., 1925. On the fishery of the Greenlanders. Medd.Komm. for Havundersøgelser. Ser.Fiskeri, Bd.7, N 7.
- Kennedy V.S. and Powles P.M., 1964. Plankton collections from the western Gulf of St.Lawrence and central Nova Scotian banks 1958 to 1962. Fish.Res.Bd.Canada, M.S.Rept.(Biol.).
- L'Herrou R. and Minet J.P., 1971. Environmental studies in ICNAF Div.3P and 4v in spring, 1970. ICNAF, Redbook, Part.3.

- Pitt T.K., 1963. Vertebral numbers of American plaice *Hipp,platessoides* (Fabr.) in the Northwest Atlantic. *J.Fish.Res.Bd.Canada*, 20(5).
- Pitt T.K., 1965. Sexual Maturity and Spawning of the American Plaice, *Hipp.platessoides* (Fabricius), from Newfoundland and Grand Bank Areas. *Ibid.*23 (5).
- Pitt T.K., 1967. Age and growth of American plaice (*Hippoglossoides platessoides*) in the Newfoundland area of the Northwest Atlantic. *Ibid.*24 (5).
- Pitt T.K., 1969. Migrations of American plaice on the Grand Bank and in St.Mary's Bay, 1954, 1959 and 1961., *Ibid.*26 (5).
- Powles P.M., 1965. Life history and ecology of American plaice (*H.platessoides* F.) in the Magdalen Shallows. *Ibid.*22 (2).
- Serebryakov V.P., 1963. Distribution of the pelagic eggs and larvae of commercial fishes in the North-West Atlantic area, ICNAF. Ann.meet, Doc.56.
- Serebryakov V.P., 1964. Some results of Soviet research work on ichthyoplankton in the North-West Atlantic. ICNAF. Environmental symposium. N B-18.
- Templeman W., 1960. Canadian research report, 1959. Subareas 2 and 3, ICNAF. Ann.Meet., Doc. N II.
- Wells R., 1968. Report on American Plaice eggs and larvae. ICNAF. Special Publication, N 7. Environmental Surveys-Norwestlant I-3, Part I.

Table 5. Spawning period of the American plaice in the North-West Atlantic

Areas & authors :	Months							
	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
West Greenland (Jensen, 1925)				▨				
Labrador (Frost, 1938; Pitt, 1965; Soviet data) ✓				▨			▩	
Newfoundland (Huntsman, 1918; Frost, 1938; Pitt, 1965; Soviet data) ✓			▨				▩	
St. Lawrence Gulf (Huntsman, 1918; Frost, 1938; Powles, 1965).			▨				▩	
Northern part of the Grand Bank (Pitt, 1965; Soviet data) ✓		▩	▨				▩	
Southern part of the Grand Bank (Frost, 1968; Bigelow & Schroeder, 1953; Pitt, 1965; Soviet data).		▩	▨				▩	
Flemish Cap Bank, Pitt, 1965; Soviet data. ✓			▨					

✓ Please consider the words "Soviet data..." as data given by the authors of this paper.

Areas & authors :	Months							
	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
Saint Pierre & Green Banks (Pitt, 1965; L'Herron & Minot, 1971; Soviet data). ✓		■	■	■	■			
Nova Scotia (Frost, 1958; L'Herron & Minot, 1971; Soviet data). ✓		■	■	■	■	■		
Gulf of Fundy (Huntman, 1918; Bigelow & Schroeder, 1953).			■	■	■	■		
Gulf of Mexico (Bigelow & Schroeder, 1953).		■	■	■	■	■	■	

■ -1

■ -2

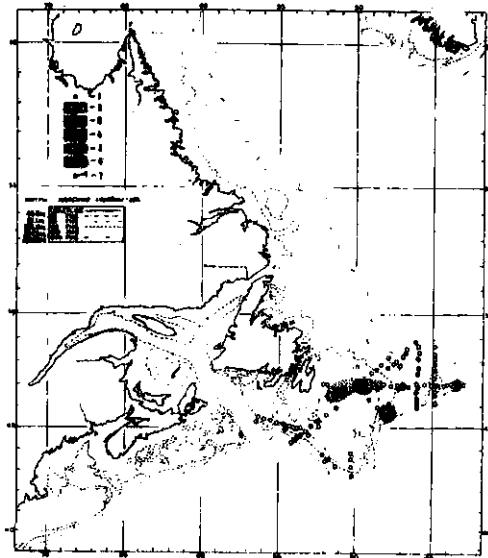


Fig.1. Distribution of the American plaice eggs and larvae in March.

- Signs:
- 1. - stations
 - 2. - I-10 eggs
 - 3. - II-100 eggs
 - 4. - I0I-500 eggs
 - 5. - 50I-1000 eggs
 - 6. - 1000 eggs
 - 7. - number of larvae at stations

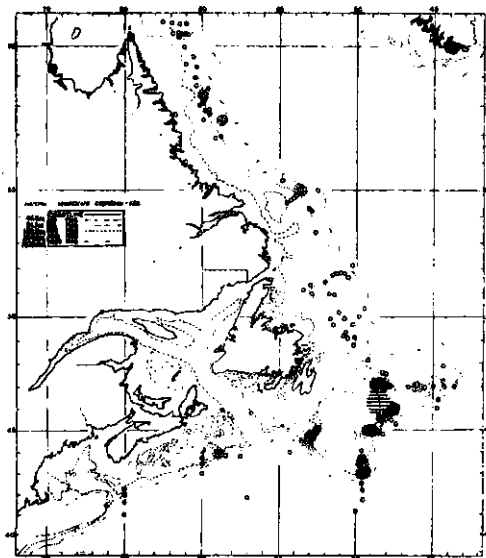


Fig.2. Distribution of the American plaice eggs and larvae in April. Signs are the same as for Fig.1.

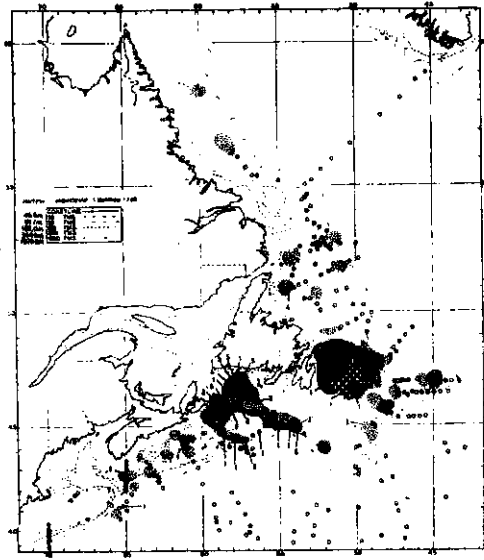


Fig.3. Distribution of the American plaice eggs and larvae in May. Signs are the same as for Fig.1.

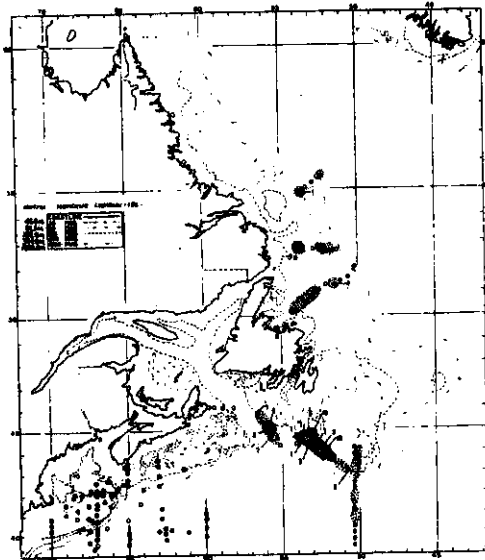


Fig.4. Distribution of the American plaice eggs and larvae in June. Signs are the same as for Fig.1.

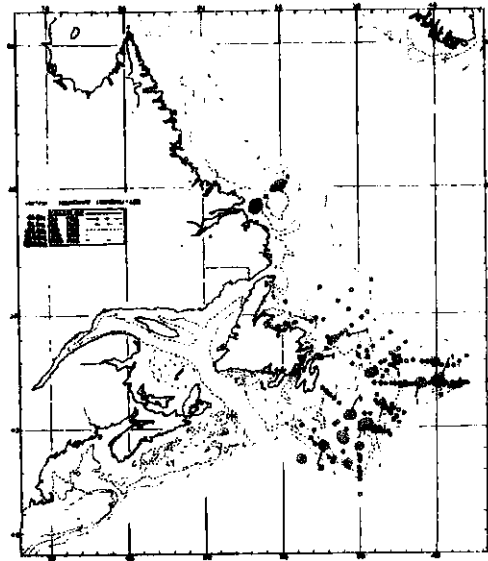


Fig.5. Distribution of the American plaice in July. Signs are the same as for Fig.I.

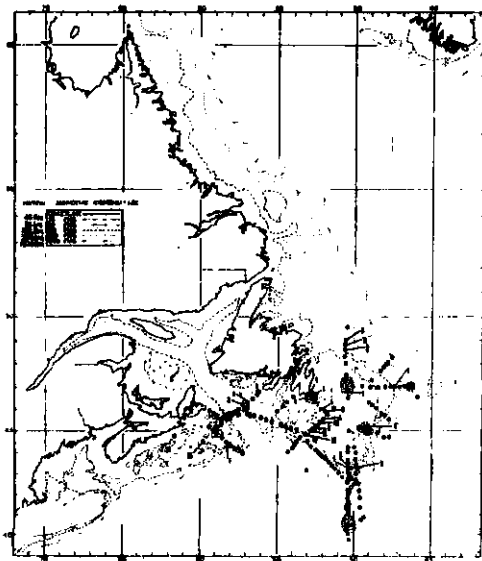


Fig.6. Distribution of the American plaice eggs and larvae in August - September. Signs are the same as for Fig.I.

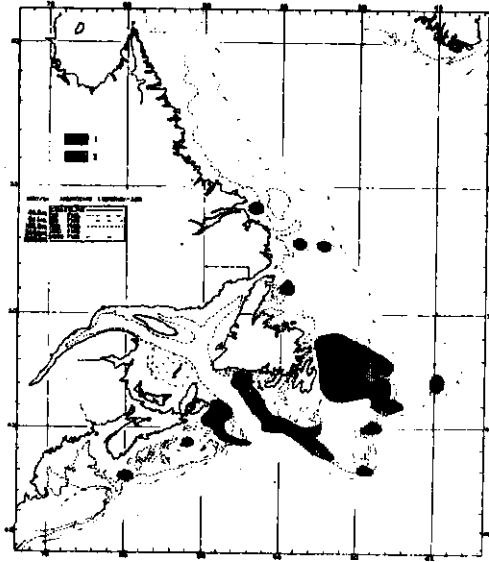
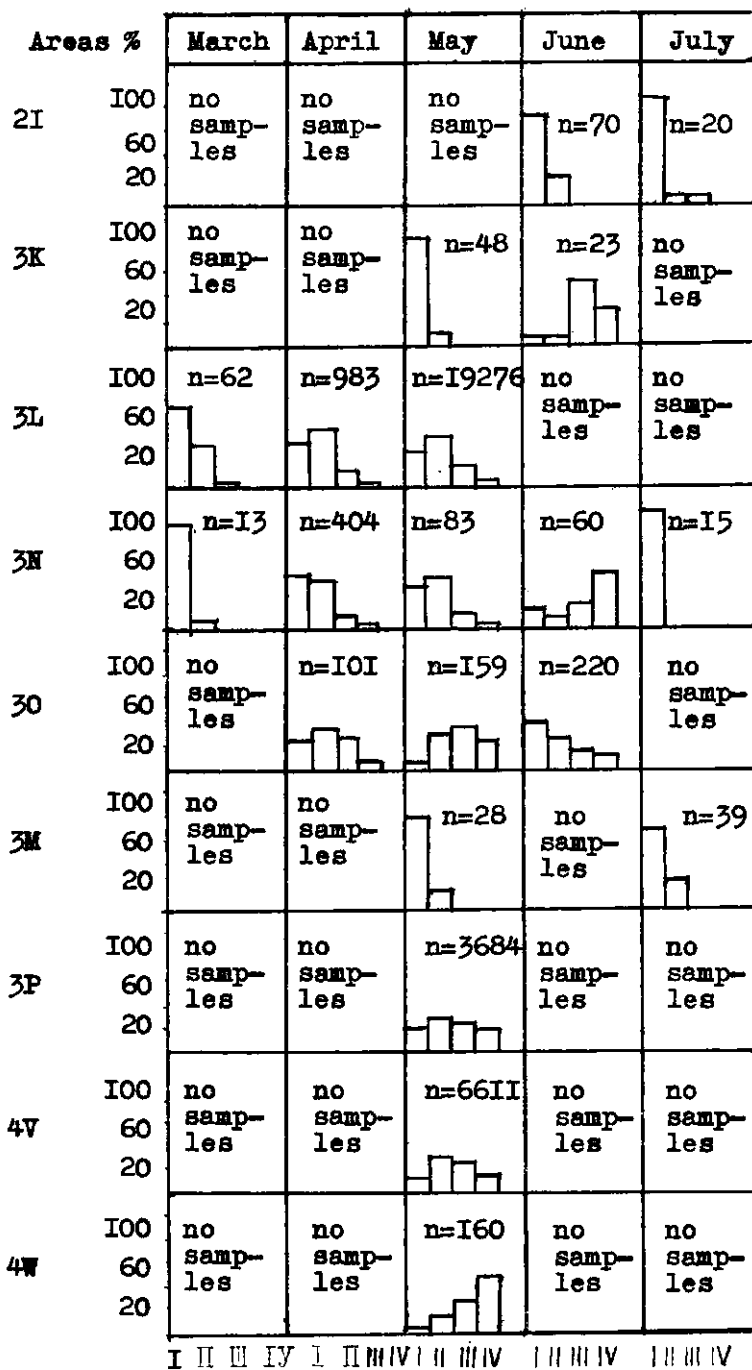


Fig.7. Distribution of the American plaice spawning grounds.
Signs: 1. - intensive spawning
2. - not intensive spawning



Stages of eggs development

Fig.8. The correlation of the development stages of the American plaice eggs in the areas of the North-West Atlantic.

