THE DESTRUCTION OF PRE-RECRUIT HADDOCK ON INSHORE NURSERY GROUNDS

by

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Introduction

Since the haddock mesh regulation was put into effect in 1953, new fisheries have developed that, by their nature, harvest small haddock as well as other groundfish species. The amounts landed usually do not exceed 5,000 pounds per trip. The number of trips, however, has increased steadily in recent years with the result that the total poundage landed has become rather large. This is particularly true of the landings from certain grounds and at certain seasons when small haddock tend to gather in number. The harvesting of these smaller haddock may be seriously decreasing the potential haddock yield and obscuring the benefits that accrue from mesh regulation. This report summarizes our data on this subject to date.

Areas Involved

There are three particular inshore areas that may be classified as "groundfish nursery grounds" (fig. 1), the Ipswich Bay-Isle of Shoals region, Stellwagen Bank, and the Nauset grounds. To be considered a nursery ground an area must, over an extended period of time, support large numbers of pre-recruit groundfish. Stellwagen Bank and the Nauset grounds especially are characterized by large numbers of such fish as will be shown later.

Fisheries Involved

The fisheries that are involved in taking large numbers of small haddock, cod, and other groundfish species, are as follows:

1. The mixed groundfish fleet
2. Silver hake (whiting) fleet
3. Industrial fishery
4. The animal food fishery
5. The exempted fleet.

Without exception, each of the fisheries listed above has steadily increased its volume of landings from nursery grounds in the past 10 years. This is especially true in respect to the industrial fishery, the silver hake fishery, and the animal food fishery.

Pertinent landings are summarized in table 1.

Species composition of the Industrial Landings

The industrial fleet operating out of Gloucester fished the nursery grounds because they are areas where red and silver hake are most abundant and, of course, they are close to port. This fishery is in part the silver hake fishery, depending on the market situation, the vessel captain, and the relative abundance of other species (cf. Edwards, 1958), and these samples are reasonably representative of the unsorted catch of any small mesh fishery on these grounds. The nets used by either of these fisheries are usually standard mesh otter trawls with small mesh (1-1/2 or 2") liners in the cod-ends.

A. Ipswich Bay-Isle of Shoals Ground

This area lies generally to the north of Cape Ann. Much of the fishing takes place along the 30 fathom contour. The bottom here is a muddy sand. This area is fished by vessels of the silver hake and industrial fisheries as well as by mixed groundfish vessels.

The species composition for the Ipswich Bay area is given in table 2. The red hake clearly dominates the catch; the silver hake is the second-most abundant fish, particularly in the fall. Dab are commonly taken in fair numbers in the fall months. Small haddock are usually present, sometimes in large number.

The changes in species composition for the period 1957 to 1959 are presented in table 3, and the pounds landed of each of the species for each year is given. During this period approximately 10 million pounds of industrial fish for reduction were landed from Ipswich Bay, of which an estimated 156 thousand pounds was haddock, 31 cod, 484 dab, and 65 redfish.

B. Stellwagen Bank

This fishing ground lies just to the north and west of the tip of Cape Cod. Stellwagen Bank is a sandy lateral moraine of roughly elliptical shape. The average depth of fishing varies from 20 to 30 fathoms. It is a favorite fishing ground of the mixed groundfish fishery as well as the industrial and animal food fisheries.

The species composition for Stellwagen Bank is presented in table 4. Here the red hake and the silver hake share about the same predominant role in the fish community. The red hake is particularly abundant in the fall, the silver hake in the spring. Seasonal changes in abundance of minor species is pronounced, due in part to late summer influxes of warmer water species. Where the dab was secondarily characteristic in the Ipswich Bay area, here the cod stands out in abundance amongst the minor species.

The changes in species composition and poundages landed from Stellwagen Bank for the period 1957 to 1959 are presented in table 5. The changes in relative quantity of both cod and silver hake are noteable. During this period approximately 30 million pounds of industrial fish for reduction were landed from this area, of which an estimated 1,496 thousand pounds was haddock, 1,147 cod, 134 greysole, 744 dab, and 355 thousand pounds redfish.

C. Nauset Area

This fishing ground extends the length of the eastern shore of Cape Cod. The bottom here is sandy in areas less than 30 fathoms, sandy mud or muddy below 30 fathoms. Fishing here may be conducted at almost any reasonable depth depending upon the fish sought. The data presented here are based on the industrial landings samples which represent fish caught in less than 40 fathoms. This is a popular groundfish area and vessels representing any fleet may be found working it from time to time.

The species composition of the industrial landings from the area is presented in table 6. This ground, like Ipswich Bay, is dominated by the red hake with silver hake a poor second in relative abundance. The haddock stands out amongst the minor species. It is always present in fair numbers, and becomes particularly abundant in the fall.

The changes in relative abundance during the period 1957 to 1959 are given in table 7. During this period approximately 44,238 thousand pounds of industrial fish for reduction were taken from the Nauset area, of which an estimated 1,341 thousand pounds was haddock, 171 cod, 360 dab, and 130 thousand pounds of pollock.

Length Frequencies

The length frequencies of the haddock and cod included in the industrial samples discussed earlier are presented in tables 8, 9, 10, and 11. It is apparent that the catches include few haddock in excess of 40 cm. Normally whatever fish exceed this size are landed as food fish. Such landings are not adequately documented, but it will be shown later that the numbers of such fish are low on these nursery grounds. The average age composition of the haddock included in the industrial samples is shown in table 12.

One-year-old fish obviously predominate on these grounds. There is a suggestion of a northward trend in the data, the two-year-olds being more abundant on the Ipswich Bay-Isle of Shoals grounds. This, however, has little immediate bearing on the problem under discussion except that fish of either age are not recruited to any extent using the regulation 4-1/2" mesh. The average weight of these haddock is 0.54 pounds (Ipswich 0.50 lbs., Nauset 0.52 lbs., and Stellwagen 0.58 lbs.).

Results of 1960 Research Vessel Nursery Grounds Study

In 1960 four research vessel surveys were made to obtain more precise information on the species composition, sizes of fish, and distributional data on the grounds in question. These cruises were conducted in July, August, September and November. A series of tows with a standard 36 Yankee otter trawl having a 1/2" cod-end liner using a random survey pattern were made on each of the three nursery grounds. Since it is virtually impossible to obtain weight aboard ship, the data is compared with the industrial sample data in terms of numbers (see table 13).

Two salient features of the comparison are worth discussion here. The percentages of haddock and spiny dogfish obtained are much higher than observed in the industrial samples, while the percentages of silver and red hake are lower. In general, the percentages of the other species are of similar orders of magnitude. There is at least one factor operating that explains most of these differences. The industrial and silver hake fleet are species oriented and do not fish these areas at random.. They do not usually, for example, search out the haddock, and they do try to avoid the dogfish. The research vessel tows present the best generalized picture of the grounds and do serve to emphasize the fact that young haddock abound in these areas.

It is apparent from these comparative statistics that Stellwagen Bank offers the greatest range of choice of species, whatever the fishery, while Ipswich Bay is the least variable. Nonetheless it is obvious that the captain of a vessel can greatly influence the species composition of the catch by searching out concentrations of fish. That this condition exists was amply demonstrated on the research vessel cruises. Wherever the silver and/or red hake predominated, the percentages of haddock were more nearly comparable to those obtained in the industrial samples.

Some haddock are landed as food fish by the industrial fleet. Some are landed as "shack" by the crew, as is also the case with snapper haddock in the exempted fleet. However, analysis of this aspect is not feasible since the ancillary food fish landings' data is frequently not available to the Bureau.

The 1958 haddock year class was above average in size and certainly contributed to the high percentages of haddock indicated in table 13. A comparison of length frequency data obtained from the industrial samples (see tables 8 - 10) with that from the research vessel samples (see tables 14 - 16) does not, however, indicate that older year classes are responsible to any large extent for the increased percentage. For this reason we do not feel that the small mesh fleet have been sorting out significant quantities of haddock from the industrial and animal food catches for sale separately as food fish.

Estimated Quantity of Pre-recruit Haddock Landed by Various Fisheries and Potential Loss to Food Fishery

The estimated quantity of haddock caught and landed and/or discarded by various small mesh fisheries in the period 1957 to 1959 totals approximately 9 million pounds, as indicated in table 17a. If this small haddock had not been taken by the small mesh fleets and had been fished later with regulation gear the catch would have amounted to 34 million pounds of haddock for food (see table 17c), assuming a fishing mortality of 30% and a natural mortality of 10%.

Discussion

The figures given in table 17 are conservative. They include the estimated quantities taken by the industrial, silver hake, and animal food fisheries, but do not include whatever quantities of small haddock may be landed and/or discarded by the small boat mixed groundfish fishery of Gloucester and Cape Cod ports, and the exempted fleet. Observations not adequately documented with samples indicate that the animal food fishery may land very large quantities of small haddock at times. The research vessel data would suggest that the quantity of haddock on the grounds is in excess of that demonstrated by the industrial samples. That this is true on a random survey basis, we have no doubt. However, the various fleets involved are not necessarily searching out the concentrations of haddock, rather the industrial and animal food fisheries are searching for the greatest concentration of silver and red hake and taking haddock and other groundfish incidentally.

In recent years there has been a steady growth of small boat groundfish fisheries, operating largely on inshore grounds. These fisheries are harvesting a resource with a potential of several hundred million pounds. Market conditions, however, are such that the haddock, as a food fish, is still more valuable than the so-called "trash" species. A general increase in mesh size for the small mesh fisheries, to the point where the majority of the included small haddock could escape, would undoubtedly severely reduce the catches of other species upon which these small boat small mesh fisheries depend. Thus, a complicated management problem presents itself.

LITERATURE CITED

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1958. Gloucester's Trawl Fishery for Industrial Fish. Commercial Fisheries Review 20, 8. Separate No. 519.

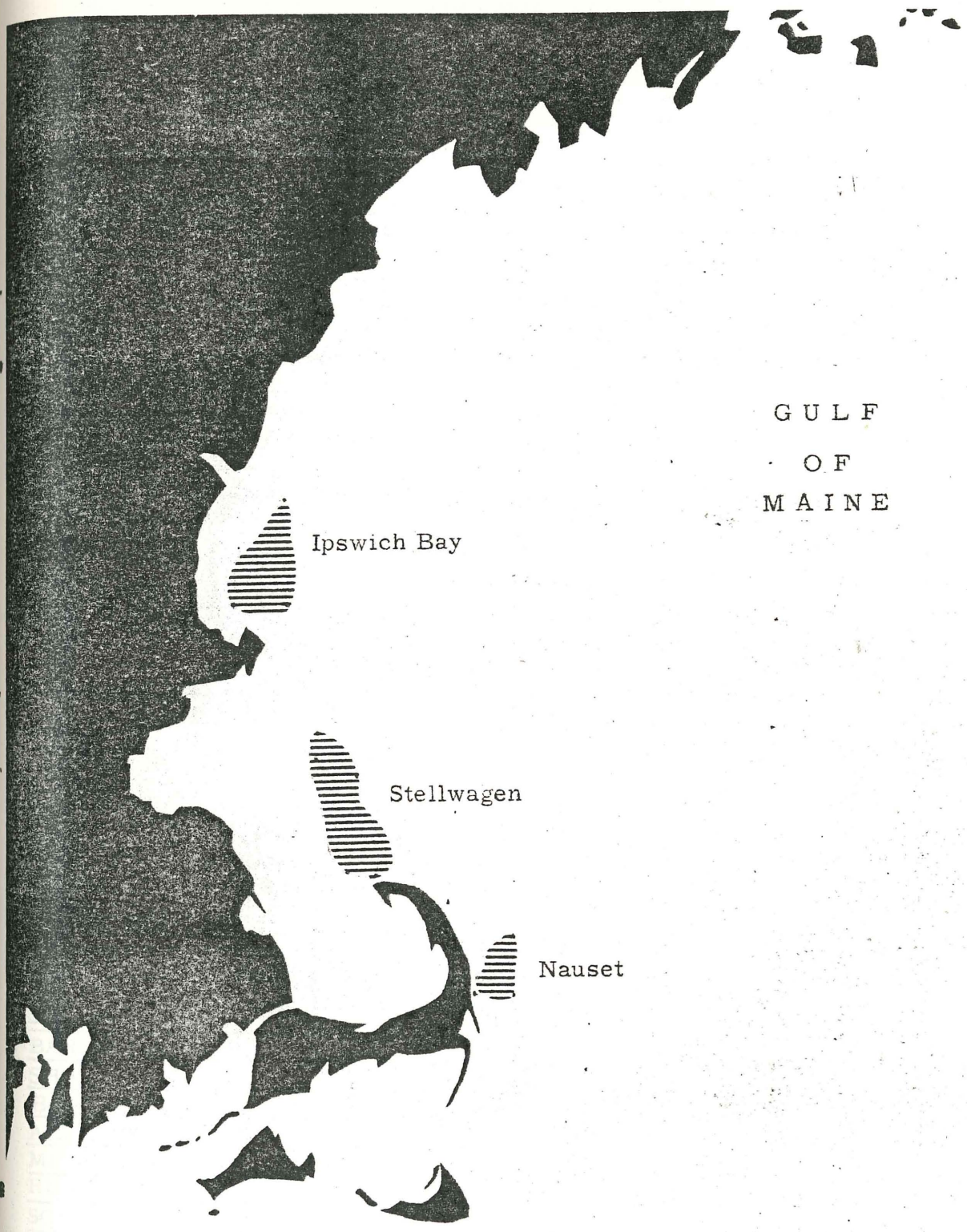

Figure 1. --Areas covered by research vessel cruises

Table 1.--Landings, since 1950, of the fisheries that predominantly operate on the so-called groundfish nursery grounds in the Gulf of Maine, to nearest 1,000 pounds

Fishery	Silver Hake		Industrial	Animal
Year / Area	Ipswich and Stellwagen	Nauset only	All grounds	All grounds
1950	28,500	1,690	5,500	1,000
1951	54,430	8,970	800	1,800
1952	51,330	2,550	70	1,000
1953	63,140	6,840	5,600	1,400
1954	53,540	17,820	22,670	4,000
1955	32,660	14,330	14,220	9,000
1956	26,310	17,420	15,950	9,500
1957	50,170	20,350	37,620	15,000
1958	46,120	21,540	16,430	16,000
1959	34,690	21,840	30,480	20,000

TABLE 2. --Percent by weight of the more important species taken by the industrial fishery

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL 1957-1959

FISHING GROUND Ipswich Bay-Isle of Shoals

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.
No. of samples	5	9	4	3	1	4	3
RED HAKE	53.3	56.4	80.3	49.3	42.4	33.7	23.3
WHITE HAKE	1.2	--	--	--	--	--	--
SILVER HAKE	11.6	8.4	6.1	17.8	37.9	25.2	35.5
LITTLE SKATE	0.9	0.2	--	--	--	2.0	0.3
BIG SKATE	0.4	--	0.5	--	--	0.5	--
HADDOCK	0.3	3.8	0.6	1.6	5.5	0.4	4.0
REDFISH	2.3	0.1	--	0.1	--	0.1	--
EEL POUT	0.6	3.7	0.5	2.2	--	0.9	1.6
L. H. SCULPIN	0.1	3.1	0.1	0.1	--	--	0.2
SEA ROBIN							
STR. SEA ROBIN							
ANGLER	9.8	4.0	1.6	9.3	--	9.3	4.9
4-SPOT							
SAND FLDR.							
GULF STR. FLDR.							
YELLOWTAIL	0.1	1.2	--	--	--	--	--
BLACKBACK	--	--	0.4	0.3	--	--	--
DABS	4.4	3.2	1.5	1.7	1.5	18.4	8.3
GREYSOLE	0.3	0.4	--	0.3			0.7
SEA RAVEN	--	--	0.4	--	--	--	--
PUFFER							
SP. DOG	3.1	2.9	3.6	2.5	--	--	2.3
SM. DOG							
BARNDOOR	6.5	--	--	--	--	--	0.6
SHAD	--	1.9	1.1	2.1	--	--	1.6
BLUEBACK	0.9	4.7	2.8	4.0	--	--	--
ALEWIFE	--	0.3	--	5.5	--	--	5.9
MENHADEN							
HERRING	0.1	3.1	0.9	2.0	11.9	1.4	0.3
SCUP	--	0.2	--	--	--	--	--
BUTTERFISH	--	--	0.2	0.1	0.1	0.1	0.2
POLLOCK	--	0.1	--	--	--	--	--
COD	0.1	1.1	--	0.4	--	0.6	0.2
CUNNER							
ROCKLING	0.2	0.2	0.1	0.5	0.7	1.9	0.3
KINGFISH							
CONGER EEL							

TABLE 3. --Prorated annual landings by the industrial fishery of various species in percent by weight and total pounds landed for each year (pounds in thousands)

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL 1957-1959

FISHING GROUND Ipswich Bay-Isle of Shoals

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	IPSWICH BAY 1957		1958		1959	
No. of samples	12		9		8	
	lbs.	%	lbs.	%	lbs.	%
RED HAKE	726	40.5	1409	57.1	3177	53.8
WHITE HAKE	6	0.3	--	--	--	--
SILVER HAKE	464	25.9	316	12.8	794	13.4
LITTLE SKATE	13	0.8	8	0.3	38	0.6
BIG SKATE	6	0.3	12	0.5	11	0.2
SHAD	13	1.0	21	0.8	58	1.0
EEL POUT	23	1.3	56	2.3	40	0.7
L. H. SCULPIN	2	0.1	54	2.2	5	0.1
SEA ROBIN	--	--	+	+	--	--
STR. SEA ROBIN						
ANGLER	102	5.7	149	6.0	524	8.9
REDFISH	4	0.2	28	1.1	33	0.6
4-SPOT	--	+	--	--	--	--
SAND FLDR.						
GULF STR. FLDR.						
YELLOWTAIL	--	--	20	0.8	2	+
BLACKBACK	3	0.2	1	+	--	--
GREYSOLE	1	+	5	0.2	26	0.4
SEA RAVEN	--	--	+	+	6	0.1
PUFFER						
SP. DOG	39	2.2	28	1.1	288	4.9
SM. DOG	--	--	8	0.3	--	--
BARNDOOR	15	0.9	--	--	232	3.9
DABS	149	8.4	111	4.5	224	3.8
BLUEBACKS	77	4.3	88	3.6	155	2.6
ALEWIFE	17	1.0	--	--	53	0.9
MENHADEN	--	--	7	0.3	--	--
HERRING	42	2.4	71	2.9	73	1.2
SCUP	--	--	--	--	4	0.1
BUTTERFISH	--	--	1	+	11	0.2
POLLOCK	--	--	--	--	1	+
HADDOCK	23	1.3	42	1.7	91	1.5
COD	4	0.3	22	0.9	5	0.1
CUNNER						
ROCKLING	11	1.0	13	0.5	25	0.4
KINGFISH						
CONGER EEL						

TABLE 4. --Percent by weight of the more important species taken by the industrial fishery

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL 1957-1959

FISHING GROUND Stellwagen Bank

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.
No. of samples	2	3	1	15	18	8	11
RED HAKE	1.5	14.2	43.4	31.3	18.6	55.4	59.6
WHITE HAKE							
SILVER HAKE	45.0	72.5	6.3	39.6	44.3	20.7	17.2
LITTLE SKATE	--	--	--	0.1	--	--	--
BIG SKATE	--	--	--	0.5	0.5	0.1	1.8
HADDOCK	5.3	--	1.4	5.1	3.5	4.0	7.5
REDFISH	0.1	--	4.6	1.4	1.3	1.4	0.7
EEL POUT	11.9	0.6	2.9	0.2	0.3	0.6	0.4
L. H. SCULPIN	3.4	0.1	--	0.3	0.1	0.6	0.7
SEA ROBIN							
STR. SEA ROBIN							
ANGLER	9.4	--	7.6	2.2	0.3	--	0.1
4-SPOT							
SAND FLDR.							
GULF STR. FLDR.							
YELLOWTAIL	3.3	--	--	0.2	0.4	0.9	0.4
BLACKBACK	--	--	--	--	--	--	0.1
DABS	0.1	1.0	9.3	0.5	1.6	1.6	0.1
GREYSOLE	--	--	0.1	--	0.7	0.3	--
SEA RAVEN	0.1	--	--	--	+	--	+
PUFFER							
SP. DOG	2.9	5.3	17.0	0.3	2.1	5.5	1.4
SM. DOG							
BARNDOOR	--	--	--	0.2	0.1	0.9	--
SHAD	--	--	--	0.8	0.7	--	+
BLUEBACK	0.8	--	--	0.4	11.7	0.7	0.5
ALEWIFE	--	--	--	1.1	--	--	--
MENHADEN							
HERRING	4.6	0.2	1.2	7.8	4.9	--	0.6
SCUP							
BUTTERFISH	--	--	--	0.1	1.1	0.1	0.1
POLLOCK	--	--	--	0.1	0.1	--	0.4
COD	13.9	--	--	5.2	0.1	2.3	6.5
CUNNER							
ROCKLING	--	--	2.9	0.3	0.4	0.3	+
KINGFISH							
CONGER EEL							

TABLE 5. --Prorated annual landings by the industrial fishery of various species in percent by weight and total pounds landed each year

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL 1957-1959

FISHING GROUND Stellwagen Bank

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	Stellwagen Bank 1957		1958		1959	
No. of samples	33		5		18	
	lbs.	%	lbs.	%	lbs.	%
RED HAKE	5686	30.3	1284	33.0	3129	42.0
WHITE HAKE						
SILVER HAKE	7515	40.4	414	10.6	2028	27.2
LITTLE SKATE	7	+	3	0.1	--	--
BIG SKATE	168	0.9	21	0.5	97	1.3
SHAD	105	0.6	--	--	34	0.4
EEL POUT	72	0.4	254	6.5	76	1.0
L. H. SCULPIN	115	0.6	90	2.3	20	0.3
SEA ROBIN						
STR. SEA ROBIN						
ANGLER	268	1.4	164	4.2	62	0.8
REDFISH	166	0.9	25	0.6	164	2.2
4-SPOT						
SAND FLDR.	1	+	1	+	--	--
GULF STR. FLDR.						
YELLOWTAIL	124	0.7	81	2.1	20	0.3
BLACKBACK	7	+	1	+	--	--
GREYSOLE	39	0.2	12	0.3	83	1.1
SEA RAVEN	1	+	1	+	3	+
PUFFER	--	--	--	--	45	0.6
SP. DOG	145	0.8	126	3.2	347	4.6
SM. DOG						
BARNDOOR	14	0.1	--	--	29	0.4
DABS	432	2.3	106	2.7	236	3.2
BLUEBACKS	887	4.7	262	6.7	78	1.0
ALEWIFE	127	0.7	13	0.3	599	8.0
MENHADEN						
HERRING	815	4.3	316	8.1	56	0.8
SCUP						
BUTTERFISH	18	0.1	49	1.3	32	0.4
POLLOCK	7	+	--	--	15	0.2
HADDOCK	1091	5.8	219	5.6	186	2.5
COD	931	5.0	369	10.2	47	0.6
CUNNER						
ROCKLING	40	0.2	23	0.6	37	0.5
KINGFISH						
CONGER EEL	5	+	3	0.1	9	0.1

TABLE 6. --Percent by weight of the more important species taken by the industrial fishery

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL 1957-1959

FISHING GROUND Nauset Grounds

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.
No. of samples	1	9	11	18	10	10	5	2
RED HAKE	83.5	52.1	50.0	68.0	73.4	62.5	31.3	54.8
WHITE HAKE	--	0.7	1.8	0.5	--	0.5	--	--
SILVER HAKE	8.3	24.2	35.0	17.6	13.2	10.7	39.2	9.8
LITTLE SKATE	--	+	+	0.1	0.2	0.1	0.1	0.3
BIG SKATE	--	--	0.5	0.5	0.4	3.1	0.3	--
HADDOCK	--	2.7	1.1	2.3	2.7	2.9	9.4	18.9
REDFISH	--	0.1	--	--	--	+	--	--
EEL POUT	--	13.1	5.2	1.8	2.0	2.5	2.1	1.6
L. H. SCULPIN	--	0.2	+	0.3	0.1	0.4	1.6	0.2
SEA ROBIN	--	--	--	--	--	--	0.2	0.2
STR. SEA ROBIN								
ANGLER	8.2	0.6	2.2	2.9	0.6	1.9	1.7	2.5
4-SPOT	--	--	--	--	--	+	0.2	--
SAND FLDR.								
GULF STR. FLDR.								
YELLOWTAIL	--	0.1	0.1	0.2	0.2	0.4	--	--
BLACKBACK	--	--	+	--	--	--	--	--
DABS	--	1.4	0.7	0.5	0.5	0.7	0.9	0.6
GREYSOLE	--	0.1	--	+	--	--	--	--
SEA RAVEN	--	--	0.1	0.4	0.4	0.1	0.1	0.8
PUFFER								
SP. DOG	--	1.4	2.1	2.8	0.2	3.4	--	2.6
SM. DOG								
BARNDOOR								
SHAD	--	--	0.1	0.2	0.2	--	--	3.0
BLUEBACK	--	0.3	0.1	0.1	0.5	2.2	11.2	2.3
ALEWIFE	--	--	--	--	--	0.3	--	0.8
MENHADEN								
HERRING	--	1.0	2.2	1.6	1.8	7.0	0.8	0.7
SCUP	--	--	--	--	--	--	0.4	0.2
BUTTERFISH	--	--	--	--	2.7	0.9	0.3	0.4
POLLOCK	--	--	0.2	0.3	--	--	--	--
COD	--	0.1	0.7	--	0.2	+	--	--
CUNNER								
ROCKLING	--	0.9	0.1	--	0.1	0.1	--	--
KINGFISH								
CONGER EEL	--	0.2	--	0.2	--	--	--	--

TABLE 7. --Prorated annual landings by the industrial fishery of various species in percent by weight and total pounds landed each year

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL 1957-1959

FISHING GROUND Nauset Grounds

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	NAUSET AREA 1957		1958		1959	
No. of samples	31		20		15	
	lbs.	%	lbs.	%	lbs.	%
RED HAKE	10,571	62.0	5484	54.4	9805	57.3
WHITE HAKE	123	0.7	15	0.1	--	--
SILVER HAKE	3729	21.9	1306	13.0	2600	15.1
LITTLE SKATE	61	0.4	12	0.1	7	+
BIG SKATE	38	0.2	68	0.7	285	1.7
SHAD	112	0.7	30	0.3	31	0.2
EEL POUT	561	3.3	335	3.3	850	5.0
L. H. SCULPIN	26	0.1	212	2.1	144	0.8
SEA ROBIN	--	--	25	0.2	13	0.1
STR. SEA ROBIN						
ANGLER	527	3.1	294	2.9	197	1.2
REDFISH	--	--	3	+	2	+
4-SPOT	--	--	25	0.2	15	0.1
SAND FLDR.						
GULF STR. FLDR.						
YELLOWTAIL	2	+	9	0.1	75	0.4
BLACKBACK					16	0.1
GREYSOLE	3	+	5	+	5	+
SEA RAVEN	104	0.6	11	0.1	4	+
PUFFER						
SP. DOG	268	1.6	164	1.6	841	4.9
SM. DOG						
BARNDOOR						
DABS	57	0.3	77	0.8	226	1.3
BLUEBACKS	122	0.7	1178	11.7	544	3.2
ALEWIFE	--	--	4	+	18	0.1
MENHADEN						
HERRING	117	0.7	342	3.4	371	2.2
SCUP						
BUTTERFISH	15	0.1	37	0.4	270	1.6
POLLOCK	12	0.1	--	--	118	0.7
HADDOCK	458	2.7	229	2.3	654	3.8
COD	3	+	157	1.6	11	0.1
CUNNER						
ROCKLING	5	+	40	0.4	20	0.1
KINGFISH						
CONGER EEL	60	0.3	--	--	--	--

Table 8.--The length frequencies of haddock landed as part of the industrial catch from Ipswich Bay-Isle of Shoals grounds, by 3-centimeter groups, 1957-1959

Mid-point	May #	May %	June #	June %	July #	July %	Aug. #	Aug. %	Sept. #	Sept. %	Oct. #	Oct. %	Nov. #	Nov. %
<9														
9														
12													1	9.1
15	1	12.5	3	3.0									0	0
18	1	12.5	14	13.9	1	8.3							0	0
21	4	50.0	24	23.7	4	33.4	1	11.1			2	5.9	0	0
24	1	12.5	18	17.8	2	16.7	0	0	3	11.1	8	23.5	1	9.1
27	1	12.5	13	12.9	1	8.3	0	0	5	18.6	9	26.5	8	72.7
30			9	8.9	0	0	3	33.4	6	22.2	1	2.9	0	0
33			10	9.9	3	25.0	2	22.2	6	22.2	5	14.7	1	9.1
36			6	5.9	0	0	0	0	4	14.8	7	20.6		
39			2	2.0	1	8.3	2	22.2	3	11.1	2	5.9		
42			2	2.0			1	11.1						
45														
48														
51														
54														
57														
60														
>60														

Table 9.--The length frequencies of haddock landed as part of the industrial catch from Stellwagen Bank, by 3-centimeter groups, 1957-1959

Mid-point	June #	June %	July #	July %	Aug. #	Aug. %	Sept. #	Sept. %	Oct. #	Oct. %	Nov. #	Nov. %	Dec. #	Dec. %
<9														
9														
12							5	31.3						
15							1	6.1			20	20.4	9	6.0
18	5	14.3	5	11.9			0	0			11	11.2	8	5.4
21	11	31.4	16	38.1			0	0			1	1.0	0	0
24	11	31.4	9	21.4			5	31.3	7	6.2	4	4.1	5	3.4
27	2	5.7	1	2.4			5	31.3	23	20.5	26	26.6	27	18.1
30	3	8.6	6	14.3					51	45.6	22	22.5	60	40.2
33	2	5.7	4	9.5	2	100.0			28	25.0	11	11.2	31	20.8
36	1	2.9	1	2.4					3	2.7	2	2.0	5	3.4
39											1	1.0	2	1.3
42													1	0.7
45													1	0.7
48														
51														
54														
57														
60														
>60														

Table 10.--The length frequencies of haddock landed as part of the industrial catch from Nauset grounds, by 3-centimeter groups, 1957-1959

Mid-	May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
point	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
<9							4	4.3								
9							9	9.7								
12							1	1.1	8	10.8						
15					1	0.7	0	0	3	4.1			1	0.8		
18	18	18.9			2	1.4	0	0	0	0			0	0	3	15.0
21	42	44.2			31	22.1	9	9.7	2	2.7	1	2.3	0	0	0	0
24	11	11.6	2	20.0	50	35.8	31	33.3	16	21.6	1	2.3	4	3.3	2	10.0
27	1	1.1	3	30.0	28	20.0	30	32.2	22	29.6	4	9.1	48	39.7	5	25.0
30	2	2.1	1	10.0	12	8.6	3	3.2	14	18.9	13	29.5	53	43.8	5	25.0
33	6	6.3	3	30.0	9	6.4	3	3.2	7	9.5	19	43.2	13	10.7	5	25.0
36	13	13.7	1	10.0	5	3.6	1	1.1	1	1.4	4	9.1	2	1.7		
39	2	2.1			1	0.7	1	1.1	1	1.4	2	4.5				
42					0	0	0	0								
45					0	0	0	0								
48					1	0.7	0	0								
51							1	1.1								
54																
57																
60																
>60																

Table 11.--The length frequencies of cod landed as part of the industrial catch from all inshore nursery grounds, 1957 - 1959, by 3-centimeter groups

Mid-point	1957 #	1957 %	1958 #	1958 %	1959 #	1959 %
<9						
9						
12						
15						
18	1	0.7	5	8.9	3	7.9
21	0	0	6	10.7	25	65.8
24	11	7.4	8	14.3	4	10.5
27	34	23.0	16	28.6	3	7.9
30	53	35.8	8	14.3	3	7.9
33	36	24.3	9	16.1		
36	11	7.4	4	7.1		
39	1	0.7				
42	1	0.7				
45						
48						
51						
54						
57						
60						
>60						

Table 12.--Average age composition (in percent) of haddock in the industrial landings, 1957 - 1959

Age / Grounds	Nauset	Stellwagen	Ipswich
0	6.6	8.3	1.4
1	83.7	79.7	55.0
2	9.4	12.0	43.3
3	0.3	0	0.3

TABLE 13.--A comparison of the percent by number species composition of the industrial landings (I) and the research vessel catches (R). Industrial percentages based on samples taken 1956 - 1959

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL _____

FISHING GROUND _____

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	Ipswich								Stellwagen							
	July		August		Sept.		Nov.		July		August		Sept.		Nov.	
No. of samples	10	7	6	5	9	5	8	4	13	4	12	1	9	17	8	7
	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I
HADDOCK	12.5	4.4	9.9	0.6	5.4	2.6	1.7	3.2	56.8	4.1	23.4	1.1	29.8	3.8	28.9	4.4
RED HAKE	12.7	49.9	8.5	36.6	4.8	23.1	9.3	--	--	5.1	4.8	23.7	3.3	22.9	--	34.2
WHITE HAKE	0.7	0.3	1.3	0.1	--	--	17.2	17.5	--	--	--	--	--	--	0.7	--
SILVER HAKE	12.9	24.0	37.9	34.0	38.6	34.4	47.9	40.1	1.5	76.0	22.5	42.8	6.5	48.5	3.8	43.3
LITTLE SKATE	--	--	--	--	--	0.2	--	0.1	0.1	--	0.1	--	0.1	0.2	0.1	0.1
BIG SKATE	--	0.1	--	--	--	0.2	--	0.2	1.0	--	1.6	--	1.6	0.1	0.1	--
REDFISH	20.7	0.3	2.3	8.2	1.1	4.4	2.5	0.4	0.4	0.4	0.4	4.8	0.1	2.7	--	1.8
EEL POUT	2.5	1.2	3.3	1.5	0.7	3.2	0.2	0.8	3.3	1.3	9.2	1.1	2.4	0.4	--	0.5
L. H. SCULPIN	0.5	0.1	0.6	0.3	0.2	0.2	0.6	0.2	0.8	0.6	2.6	--	1.0	0.5	--	0.9
SEA ROBIN																
STR. SEA ROBIN																
ANGLER	0.5	0.5	0.7	0.7	0.5	0.7	0.3	1.0	0.3	0.4	0.5	1.1	0.2	0.2	0.2	--
4-SPOT	--	--	--	0.1	--	--	--	--	--	--	--	--	--	--	--	--
SAND FLDR.	--	--	--	--	--	--	0.4	--	--	--	--	--	--	0.2	--	--
GULF STR. FLDR.																
YELLOWTAIL	0.6	--	0.4	--	1.8	--	4.9	--	1.6	--	1.4	--	--	0.4	1.3	--
BLACKBACK	0.9	--	0.6	--	0.1	--	2.5	0.1	1.6	--	0.4	--	0.4	--	0.3	--
DAB	11.3	5.9	12.9	6.9	12.1	20.2	6.4	18.1	4.1	5.1	3.3	15.9	0.7	5.0	2.4	5.6
GREYSOLE	0.5	--	1.4	0.6	1.1	1.2	0.5	1.9	0.3	--	0.4	1.1	--	0.7	0.9	0.4
SEA RAVEN	0.2	0.2	0.1	--	0.1	--	0.2	0.1	--	--	--	--	--	--	--	--
PUFFER																
SP. DOG	3.4	0.3	5.1	0.6	5.8	0.8	0.8	0.2	20.6	0.3	19.9	2.1	37.6	0.1	48.3	0.8
SM. DOG																
BARNDOOR	--	--	3.3	--	--	--	0.2	--	--	--	--	--	--	--	0.1	--
SHAD	2.2	0.2	--	0.4	2.3	0.1	0.2	0.6	--	--	--	--	0.2	0.3	0.3	--
BLUEBACK	2.2	7.5	2.7	7.0	15.6	3.4	--	12.9	--	1.9	--	--	7.0	1.4	--	3.4
ALEWIFE	0.5	--	1.6	1.3	2.3	--	0.5	--	0.1	--	--	--	1.8	0.2	0.4	0.5
MENHADEN																
HERRING	0.2	4.0	2.2	0.2	2.6	4.5	0.3	0.9	0.4	1.0	1.7	0.5	0.1	7.7	0.1	0.1
SCUP																
BUTTERFISH	--	0.3	0.3	--	2.7	0.3	1.7	0.2	--	0.1	0.1	--	0.3	0.4	--	0.4
POLLOCK	--	0.7	--	--	0.1	--	2.3	--	0.1	--	0.1	--	--	0.1	5.4	--
COD	3.3	--	3.5	0.5	1.4	0.3	0.5	--	6.1	0.7	6.0	--	4.8	3.5	4.2	1.2
CUNNER																
ROCKLING	--	0.1	--	0.4	--	0.2	--	0.6	--	--	--	5.8	--	0.7	--	2.4
KINGFISH																
CONGER EEL																

TABLE 13.--A comparison of the percent by number species composition of the industrial landings (I) and the research vessel catches (R). Industrial percentages based on samples taken 1956 - 1959 (Continued)

INDUSTRIAL SAMPLE ANALYSIS

PORT Gloucester DATE _____ INTERVAL _____

FISHING GROUND _____

REMARKS Haddock inshore nursery grounds study

DATE/BOAT DEPTH	Nau sets													
	July		August		Sept.		Nov.							
No. of samples	6	23	6	24	5	15	4	5						
	R	I	R	I	R	I	R	I						
HADDOCK	15.7	3.1	21.2	3.0	15.8	3.1	25.3	17.1						
RED HAKE	22.1	59.3	14.9	55.6	9.5	54.2	4.2	44.5						
WHITE HAKE	0.8	1.5	0.2	0.9	0.1	0.3	1.3	0.7						
SILVER HAKE	18.4	30.8	26.8	33.6	28.3	26.0	9.5	14.1						
LITTLE SKATE	--	0.1	--	0.1	--	0.2	--	0.3						
BIG SKATE	0.5	--	0.7	--	0.1	--	--	--						
REDFISH	5.3	--	3.6	--	0.1	--	0.5	0.8						
EEL POUT	9.3	1.2	2.9	1.1	0.6	2.0	0.9	0.6						
L. H. SCULPIN	2.3	0.4	0.2	0.3	0.4	0.5	0.1	2.0						
SEA ROBIN	--	--	--	--	--	--	--	0.1						
STR. SEA ROBIN														
ANGLER	1.0	0.1	1.0	0.1	1.1	0.2	0.1	0.2						
4-SPOT	--	--	--	--	--	--	0.1	0.1						
SAND FLDR.	--	--	--	--	--	--	--	0.1						
GULF STR. FLDR.														
YELLOWTAIL	0.4	0.3	0.2	0.3	0.1	0.3	1.0	0.2						
BLACKBACK	--	--	--	--	--	--	0.5	--						
DAB	11.7	0.8	10.2	0.9	0.8	1.9	2.7	3.0						
GREYSOLE	1.9	--	0.6	0.1	--	--	--	0.1						
SEA RAVEN	1.0	0.1	0.4	0.1	0.2	--	--	0.2						
PUFFER														
SP. DOG	2.4	0.3	3.4	0.1	15.0	0.4	--	0.4						
SM. DOG														
BARNDOOR														
SHAD	--	0.1	--	--	--	--	1.9	1.2						
BLUEBACK	--	0.1	0.2	0.2	--	3.5	--	11.3						
ALEWIFE	--	--	--	--	0.2	0.1	0.3	--						
MENHADEN														
HERRING	3.7	1.8	9.6	0.8	10.7	6.6	--	0.7						
SCUP														
BUTTERFISH	--	--	--	2.7	--	0.4	2.3	2.2						
POLLOCK	0.2	--	--	--	0.1	--	0.9	--						
COD	1.3	--	0.7	--	0.6	--	0.4	0.1						
CUNNER														
ROCKLING	0.8	--	0.2	0.1	0.5	0.3	--	--						
KINGFISH														
CONGER EEL														

Table 14.--Length frequencies of haddock taken on the research vessel cruises in 1960 on the Ipswich Bay-Isle of Shoals grounds, by 3-centimeter groups

Mid-point	July #	July %	Aug. #	Aug. %	Sept. #	Sept. %
<9						
9			5	0.9		
12			2	0.4		
15	1	0.2	3	0.6	4	1.0
18	49	11.7	29	5.7	8	2.0
21	123	29.4	159	31.2	54	13.5
24	43	10.3	129	25.3	78	19.4
27	27	6.5	27	5.3	24	6.0
30	56	13.4	36	7.1	35	8.7
33	40	9.6	39	7.7	81	20.2
36	20	4.8	33	6.5	67	16.7
39	10	2.4	22	4.3	24	6.0
42	12	2.9	3	0.6	5	1.2
45	4	0.9	9	1.8	7	1.7
48	12	2.9	6	1.2	6	1.5
51	9	2.2	4	0.8	4	1.0
54	2	0.5	3	0.6	2	0.5
57	4	0.9			1	0.3
60	4	0.9			1	0.3
>60	2	0.5				

Table 15.--Length frequencies of haddock taken on the research vessel cruises in 1960 on Stellwagen Bank, by 3-centimeter groups

Mid-point	July #	July %	Aug. #	Aug. %	Sept. #	Sept. %
<9			1	0.1		
9			19	1.2		
12			27	1.8	48	5.3
15	2	0.1	2	0.1	17	1.9
18	67	2.4	18	1.2	5	0.6
21	407	14.6	208	13.6	108	11.9
24	260	9.3	497	32.6	322	35.6
27	80	2.9	156	10.2	120	13.3
30	278	10.0	55	3.6	31	3.4
33	657	23.5	163	10.7	57	6.3
36	597	21.4	180	11.8	80	8.8
39	219	7.8	101	6.6	54	6.0
42	69	2.5	29	1.9	13	1.4
45	51	1.8	12	0.8	13	1.4
48	36	1.3	15	1.0	23	2.5
51	32	1.1	8	0.5	8	0.9
54	14	0.5	10	0.7	5	0.6
57	13	0.5	2	0.1	1	0.1
60	7	0.2	8	0.5		
>60	4	0.1	15	1.0		

Table 16.--Length frequencies of haddock taken on the research vessel cruises in 1960 on the Nauset grounds, by 3-centimeter groups

Mid-point	July #	July %	Aug. #	Aug. %	Sept. #	Sept. %
<9						
9			2	0.5	2	1.2
12			3	0.8	26	15.3
15	3	0.9	1	0.3	4	2.4
18	35	10.9	5	1.3	0	0
21	39	12.1	42	10.7	6	3.5
24	48	15.0	96	24.4	33	19.4
27	12	3.7	63	16.0	36	21.1
30	22	6.9	24	6.1	15	8.8
33	51	15.8	61	15.5	12	7.1
36	45	14.0	60	15.3	20	11.8
39	21	6.5	17	4.3	8	4.7
42	10	3.1	6	1.5	7	4.1
45	6	1.9	6	1.5	1	0.6
48	10	3.1	2	0.5		
51	4	1.3	5	1.3		
54	4	1.3				
57	5	1.6				
60	1	0.3				
>60	5	1.6				

Table 17a. --Estimated quantities of haddock taken by various fisheries during the period 1957 - 1959 in 1,000 pounds

Year / Fishery	Industrial	Animal	Silver Hake 1/	Total
1957	1,572	60	2,330	3,962
1958	490	64	2,150	2,704
1959	931	80	1,580	2,591
Totals	2,993	204	2/ 6,060	9,257

1/ Calculated on species composition of industrial fishery.
2/ Mostly discards.

Table 17b. --Numbers of haddock taken

Year / Fishery	Industrial	Animal	Silver Hake	Total
1957	2,910	111	4,320	7,341
1958	908	118	3,980	5,006
1959	1,722	148	2,930	4,700
Totals	5,540	377	11,230	17,147

Table 17c. --Potential yield to food fishery had this haddock been fished only with 4-1/2-inch net, in 1,000 pounds

Year / Fishery	Industrial	Animal	Silver Hake	Total
1957	5,800	220	8,650	14,670
1958	1,820	240	7,980	10,040
1959	3,440	300	5,860	9,600
Totals	11,060	760	22,490	34,310