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**Results of the 1975 and 1976 Federal Republic of Germany Young Herring
Surveys in ICNAF-Subareas 4 and 5**

by

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Introduction

Following a STACRES recommendation the Federal Republic of Germany continued the Young Herring Surveys in ICNAF-Divisions 4X and 5Z in 1975(March 11-26 by WALTHER HERWIG)and 1976(March 2-19 by R.V. ANTON DOHRN)in order to determine, among other things, the abundance of recruiting herring year-classes. As in former years, in both cruises US scientists from the National Marine Fisheries Service, Woods Hole, Massachusetts, participated. The surveys in 1976 was scheduled to begin on February 18 by the RV ANTON DOHRN but was delayed due to engine repairs.

Methods

The sampling pattern for both surveys was based on the stratified random sampling design (Figure 1) developed for the USA bottom trawl surveys (Grosslein, 1969). The number of stations per stratum were selected according to an optimum allocation scheme using the variances of the last four ALBATROSS IV spring surveys. Variance

information from the ALBATROSS IV was used as it was the only vessel with complete area coverage. In the different strata 90 fishing stations were done in March 1975 and 43 in March 1976, respectively (Figure 2 and 3). Occasionally fishing stations had to be omitted due to rough bottom. In that case, new positions close to the omitted stations were arbitrarily selected. No tows were directed toward concentrations of herring. At each fishing station a 30-minute haul was attempted at 3.5 knots using a 180-foot herring bottom trawl rigged with rollers and a small-meshed inside-cod-end as in previous years. Due to actual or potential hang-ups or ship malfunction, towing time was occasionally less or greater than 30 minutes. In these cases, catches were corrected to correspond to half an hour. Most of the hauls were made during daylight hours. Catches were worked up by weighing and measuring all fish if practicable. Large catches were subsampled. The total length was measured to the nearest half centimeter below. Representative samples of fish were frozen for further analysis, especially ageing, to be made in the laboratories of Woods Hole and Hamburg.

Besides widespread hydrographical surveys by means of Nansen-casts and BT-records, ichthyoplankton-samples were taken in both years. Sampling occurred primarily during night-hours ~~at~~, as far as possible, the standard ICNAF Larval Herring stations with paired bongo-nets, and also during the 1975 survey with a Neuston-net.

Results

Herring 1975

Two areas of herring concentration were found during the survey: 1. Near $41^{\circ}N67^{\circ}30'W$, with catches from 1000 - 2500 kg /30 minutes. 2. Howell-/Franklin-Swell with a maximum catch of 2500 kg /30 minutes (Figure 4). In total, however, the number of herring caught per tow was less than that of both 1973 and 1974 (Table 1). Catches of the 1972 and 1971 year classes (age 3 and 4) were very low in both Blocks 3 (Georges Bank) and 4 (Southern New England). As already stated for 1974 (Anderson and Dornheim, 1974)

no strong incoming year-class could be observed in 1975. Neither the 1971 5.3% -20.1% depending on whether the German or USA age length key is used) nor the 1972 (9.1%-8.49% depending on which age-length key is used) year-classes contributed enough to increase the stock size in the Georges-Bank area (Tables 2 and 3). Again, in 1975 as in 1974 the greatest amount of survey catches came from the 1970 year-class (76.4%-71.1% depending on which age-length key was used) which was already dominant in both research vessel catches (90%) and in commercial catches (87.4%) in 1974 (Dornheim 1975).

As stated in the Report of the Herring Working Group (ICNAF Summ. Doc. 75/19) sampling by the WALTHER HERWIG in Div. 4X is too sparse to provide a reliable measure of year-class abundance. Nevertheless, survey results (Table 4) indicate the predominance of the youngest year-classes 1973 (51%) and 1972 (34.9%), respectively, in this area. Furthermore it can clearly be seen by these results that the net used is capable of catching herring, at least as small as 10 cm.

Herring 1976

Compared to previous surveys the 1976 survey was the first in which no large herring concentrations could be detected (Figure 5). A total of only 2885 herring were caught, of which 1587 were measured and 376 specimen were aged. Results (Tables 5 and 6) indicate that in contrast to the 1974 and 1975 surveys in which catches almost exclusively were of the 1970 year-class, the percentage contribution of this year-class declined to 47.1% in 1976 according to the German age-length key and to 34.9% according to the USA age-length key. The 1973 year-class accounted for 23.1%-36.8% of the catches in the 1976 survey (Tables 5 and 6) but the catch per tow was the poorest at age 3 of all year classes in the surveys (1973-1976) in Block 3 and next to the poorest in Block 4. This suggests that although the 1973 year-class is very poor in 1976 the 1973 year-class is not as poor as the 1971 and 1972 year-classes. It also suggests that both the 1971 and 1972 year-classes are considerably less abundant than the 1970 year-class in 1976.

Mackerel 1975

Catches were not nearly as heavy as in the 1974 survey (Anderson and Dornheim 1974). In 26 of 90 hauls 12391 specimens of mackerel were found totalling 2824.6 kg.

As in 1974, most of the fish (maximum 950 kg/30 min.) were caught on the southern parts of Georges-Bank in the warmer slope-water. Length measurements (Table 7) indicate the presence of several year-classes. No age-determinations were carried out.

Mackerel 1976

The 1976 survey predominately took place in colder (10°C) water masses than in 1975. Therefore, catches of mackerel were made only at 13 of 43 stations totaling 16780 specimens with a weight of only 797 kg. Though the number of hauls in 1975 was nearly twice that of 1976, the total catch of mackerel in numbers was greater in 1976 and the total catch in weight was higher in 1975 (1975:2824.6 kg, 1976:797 kg.) than in 1976. This fact, is explained by the length frequency data (Table 7) which suggest the existence of several year-classes during the 1975 survey while during the 1976 cruise only the youngest year-classes were caught.

By-catch 1975

Compared to the 1974 survey, cod, haddock and pollock occurred in greater numbers in 1975 in the catches. This is especially true for haddock which were caught in larger quantities at the northeast edge of Georges (maximum 1000 kg/30 min.) and on Brown's Bank (maximum 2500 kg/30 min.). Most of these fish were in pre-spawning condition (especially in Division 4X) Pollock were caught in larger quantities in 1975 than in 1974 also, (maximum 6000 kg/30 min.), mainly, at the northeast edge of Georges-Bank. Cod were uniformly spread over the investigation area.

Squid catches (maximum 600 kg/30 min.) consisted almost exclusively of Loligo pealii measuring 9 to 13 cm mantle-length. Most were caught in the warmer slope-water on the southern part of Georges in depths between 60 and 200 metres.

By-catch 1976

In contrast to the 1975 survey, cod, haddock, pollock, silver hake and squid were far less abundant in both number and weight in the 1976 catches. Results of

haddock catches, however, suggest that during the next few years there might be an improvement of the haddock stock situation in Division 5Z. This is indicated by larger catches (maximum 250 kg/30 min.) of juvenile haddock with mean lengths between 22 and 25 cm.

Larvae investigations

Results of herring larvae investigations during the two cruises were to be published as ICNAF Research-Documents at the Szczecin meeting.

Hydrographical studies 1975 (Figures 6-14)

On Georges-Bank water temperatures between 4 and 5°C and salinities of about 33⁰/oo were predominant. On the southern slopes of the Bank, however, warmer Gulf Stream water masses with temperatures of over 13°C and salinity values of 35⁰/oo and more were observed. On Brown's Bank which is influenced by branches of the Labrador Current, temperatures were below 2°C with a salinity of 31 to 32⁰/oo.

Hydrographical studies 1976

The 1976 cruise did not provide enough data to describe the hydrographical situation well due to the limited investigation time. Results of measurements did indicate a strong vertical mixture, temperatures between 5.3 and 5.6°C and salinity values of 32.6 to 32.8⁰/oo. North of Georges-Bank the influence of deeper water masses from the Fundian Channel (t = 6°C, S = 33-34⁰/oo) was observed. At the deep bottom stations, the influence of Gulf Stream water was apparent with temperatures up to 10°C and salinities up to 34.8⁰/oo .

Literature cited

Anderson, E. D. and H. Dornheim, 1974 A preliminary report on the joint FRG-US Juvenile Herring Survey by RV WÄLTER HERWIG in ICNAF Division 4X and 5Z in March-April

1974 with a comparison with the 1973 FRG Juvenile Herring Survey.

Dornheim, H. 1975 Kein starker Jungheringsjahrgang auf der Georges-Bank in Sicht. Infn. Fischw. 22 (3/4): 81-82.

Grosslein, M. D. 1969 Groundfish survey program at BCF Woods Hole, U.S. Fish. Wildl. Serv., Comm. Fish. Rev. 31(8-9): 22-35.

ICNAF, 1975 Report of the Herring Working Group, April 1975, ICNAF Summ. Doc. 75/19, Serial No. 3499.

Table 1. Stratified numbers per 30 minute tow of herring caught by the R/V WALTHER HERWIG (ANTON DOHRN in 1976) during the Young Herring Surveys in the Spring (generally March) from 1973-1976.

(1) Blocks	Year	Age in years						Total	Number of Tows
		2	3	4	5	6+			
1	1973	1.74	10.52	0.74	0	0	13.00	2	
	1974	3.59	150.90	135.38	0.48	1.08	291.43	7	
	1975	69.38	18.67	13.10	8.36	0.14	109.65	6	
2	1973	263.31	14.05	0.11	0	0	277.47	14	
	1974	-	-	-	-	-	-	-	
	1975	3.17	1.31	1.00	1.65	0.21	7.34	6	
3	1973	7.84	3,232.43	4.26	1.66	0.27	3,246.46	25	
	1974	0.01	924.05	9,916.07	20.61	1.62	10,862.36	39	
	1975	0.91	27.26	30.32	823.11	76.70	958.30	50	
	1976	0	4.06	0.61	5.24	8.71	14.12	33	
4	1973	1.64	1,056.22	4.07	1.91	0.72	1,064.56	16	
	1974	8.21	607.66	1,108.76	0.25	0	1,724.88	14	
	1975	0.03	2.32	5.70	133.50	8.44	149.96	25	
	1976	0	11.22	0.93	2.50	63.04	77.69	7	
5	1973	0	7.16	1.30	0.90	0.42	9.78	13	

(1) The areas defined as Blocks are indicated in Figure 1.

Table 2. The 1975 age-length key and length composition by Germany (F.R.) from the Young Herring Surveys in Division 5Z from the R/V Walther Herring.

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES
AGE/LENGTH TABLE FOR SPECIES REPORTED IN 1-CM LENGTH GROUPS
(Age/Length Key is to be Quarterly Combination of Age Samples)

Year: 1975	Country: FR Germany	Species: Herring
Quarter: 1	Gear: Trawl	Division: 5Z
Research, Exploratory or Commercial Fishing: Research	Catches or Landings: Catch	Sex (where applicable):
Structures Used in Ageing: Scales + Otoliths		Reported by: Inst. f. Seefischerei

Insert first digit of length group	NUMBER SAMPLED BY YEAR-CLASS AND AGE (IN QUARTER)											No. of Ages Read	LENGTH COMPOSITION PER MILLE	
	19	24	25	22	21	20	69	68	67	66	66		Months in Quarter	Mar
0														
1														
2														
3														
4														
5														
6														
7														
8														
9														+
20														1
1				4								4		2
2				6								6		7
3				25								25		13
4				22								22		23
5				15	3							18		27
6				2	3	2						8		16
7				17	26							43		19
8				14	14							28		10
9				6	25	1						32		13
20					14	3	1					18		13
1					30	11	3	2				46		16
2					9	14	17	3	1			44		27
3						1	7	2	-	1		11		11
4							5	1	-	1		7		3
5								1	1			2		1
6														+
7														
8														
9														
0														
1														
2														
3														
4														
5														
6														
7														
8														
9														
0														
TOTALS				74	43	62	30	33	8	2	2		813	1000
Number of Length Samples														30
Number of Fish Measured in Each Month														6158
Mean Length of Fish in Each Month (millimetres)														236
Mean Weight of Fish in Each Month (grams)														138
Range of Depths in Each Month (metres)														
Mesh or Hook Size (mm)														

AGE COMPOSITION (PER MILLE)

Age	19	24	25	22	21	20	69	68	67	66	66	TOTAL
Month	1	2	3	4	5	6	7	8	9	9	9	
Mar	-	-	91	53	264	37	41	10	2	2		1000

Table 3. The 1975 age-length key and length composition by the USA from the Young Herring Surveys in Division 5Ze from the R/V Walther Herring.

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

AGE/LENGTH TABLE FOR SPECIES REPORTED IN 1-CM, 2-CM or 3-CM LENGTH GROUPS

(Age/Length Key is to be Quarterly Combination of Age Samples)

Year: 1975	Country: FRG	Species: Sea Herring
Quarter: 1	Gear: Other trawl	Division: 5Ze (Block 3)
Research, Exploratory or Commercial Fishing: Research	Catches or Landings: Catches	Sex (where applicable): combined
Check method of measuring fish (✓) Fork length	Total length	Greatest total
		Other
		To nearest centimeter
		To cm. below
Structures Used in Ageing: otoliths	Reported by: G. Waring	

Check Length Group Used	NUMBER SAMPLED BY YEAR-CLASS AND AGE (IN QUARTER)							No. of Ages Read	LENGTH COMPOSITION OF CATCH PER MILE Months in Quarter
	1 cm	2 cm	3 cm	1	2	3	4		
1 18- 18-									
2 20- 21-									
3 22- 24-									
4 24- 27-									
5 26- 30-									
6 28- 33-									
7 30- 36-									
8 32- 39-									
9 34- 42-									
10 36- 45-									
1 38- 48-				1				1	1
2 40- 51-				4				4	6
3 42- 54-				8				8	10
4 44- 57-				13				13	15
5 46- 57-				7	1			8	14
6 48- 60-				6				6	15
7 50- 66-				5	6			11	50
8 52- 69-				3	16			19	230
9 54- 72-					14			14	242
10 56- 75-					8			8	243
1 58- 78-					1			1	36
2 60- 81-									14
3 62- 84-						1		1	2
4 64- 87-									7
5 66- 90-									
6 68- 93-									
7 70- 96-									
8 72- 99-									
9 74- 102-									
10 76- 105-									
1 78- 108-									
2 80- 111-									
3 82- 114-									
4 84- 117-									
5 86- 120-									
TOTALS				39	9	45		94	1000
Number of age samples in quarter	Number of Length Samples								
	Number of Fish Measured in Each Month								
	Mean Length of Fish in Each Month (millimetres)								352.3
	Mean Weight of Fish in Each Month (grams)								278
	Range of Depths in Each Month (metres)								
	Mesh or Hook Size (mm)								

AGE COMPOSITION OF LANDINGS (PER MILE)

Age	1973	1972	1971	1970	1969	TOTAL
Month	2	3	4	5	6	
March		84	201	111	4	1000

Sampling Form 1 (Rev. 12/75)

Table 4. The 1975 age-length key and length composition by Germany (F.R.) from the Young Herring Surveys in Division 4X from the R/V Walther Herring.

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES
AGE/LENGTH TABLE FOR SPECIES REPORTED IN 1-CM LENGTH GROUPS
(Age/Length Key is to be Quarterly Combination of Age Samples)

Year: 1975	Country: FR Germany	Species: Herring
Quarter: 1	Gear: Trawl	Division: 4 X
Research, Exploratory or Commercial Fishing: Research	Catches or Landings: Catch	Sex (where applicable):
Structures Used in Ageing: Scales & Otoliths		Reported by: Juel. f. Seefischer

Insert first digit of length group	NUMBER SAMPLED BY YEAR-CLASS AND AGE (IN QUARTER)											No. of Ages Read	LENGTH COMPOSITION PER MILLE		
	19	74	73	72	71	70	69	68	67	66	65		Months in Quarter	Mar	
10			4									4	21		
1			25									25	65		
2			37									37	269		
3			18									18	111		
4			8									8	5		
15			8									8	26		
6			1									1	2		
7			1									1	2		
8															
9															
20												3	7		
1				3								3	12		
2				7								7	80		
3				18								18	24		
4				24								24	124		
25				12	2							14	94		
6				1	4							5	52		
7				1	4							9	28		
8				1	4	9						10	40		
9					2	2						2	33		
20					2							2	9		
1															
2															
3															
4															
5															
6															
7															
8															
9															
0															
1															
2															
3															
4															
5															
6															
7															
8															
9															
0															
TOTALS				98	67	10	17					192	1000		
Number of age samples in quarter	2	Number of Length Samples												3	
		Number of Fish Measured in Each Month												424	
		Mean Length of Fish in Each Month (millimetres)												189	
		Mean Weight of Fish in Each Month (grams)												67	
		Range of Depths in Each Month (metres)													
		Mesh or Hook Size (cm)													

		AGE COMPOSITION (PER MILLE)											TOTAL
Month	Age	19	74	73	72	71	70	69	68	67	66	65	TOTAL
				1	2	3	4	5	6	7	8	9	
Mar				510	349	52	89						1000

Table 5. The 1976 age-length key and length composition by Germany (F.R.) from the Young Herring Surveys in Division 5Ze from the R/V Anton Dohrn.

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES
 AGE/LENGTH TABLE FOR SPECIES REPORTED IN 1-CM LENGTH GROUPS
 (Age/Length Key is to be Quarterly Combination of Age Samples)

Year: 1976	Country: Germany	Species: Herring
Quarter: I	Gear: Trawl	Division: 5Ze
Research, Exploratory or Commercial Fishing: Research		Catches or Landings: Catches
Structures Used in Ageing: Scales + Otoliths		Sex (where applicable):
Reported by: Jnst. f. Seefischerey		

Insert first digit of length group	NUMBER SAMPLED BY YEAR-CLASS AND AGE (IN QUARTER)								No. of Ages Read	LENGTH COMPOSITION PER MILLE PER MONTH IN QUARTER	
	19	73	72	71	70	69	68				
1-cm Age	3	4	5	6	7	8				Mar	
0											
1											
2											
3											
4											
5											
6											
7											
8											
19		1							1	1	
20											
21		11							11	10	
22		19							19	54	
23		21							21	103	
24		22							22	25	
25		3	6						9	42	
26		7	1						8	43	
27		11	3						14	25	
28		12	15	12					39	45	
29			12	21	5				38	95	
30			1	16	16	2			35	204	
31				2	13	5			20	227	
32				1	1	2			4	21	
33						1			1	8	
34										2	
3											
6											
7											
8											
9											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
0											
TOTALS		87	36	32	177	34	10		376	1000	
Number of age samples in quarter	4										
		Number of Length Samples									8
		Number of Fish Measured in Each Month									1587
		Mean Length of Fish in Each Month (millimetres)									285
		Mean Weight of Fish in Each Month (grams)									158
		Range of Depths in Each Month (metres)									
		Mesh or Hook Size (mm)									

AGE COMPOSITION (PER MILLE)									
Month	Age	19	73	72	71	70	69	68	TOTAL
Mar			231	96	85	471	20	27	1000

Table 6. The 1976 age-length key and length composition by the USA from the Young Herring Surveys in Division 5Ze from the R/V Anton Dohrn.

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

AGE/LENGTH TABLE FOR SPECIES REPORTED IN 1-CM, 2-CM or 3-CM LENGTH GROUPS

(Age/Length Key is to be Quarterly Combination of Age Samples)

Year: 1976	Country: FRG	Species: Sea Herring
Quarter: 1	Gear: Otter-trawl	Division: 5Ze (Block 3)
Research, Exploratory or Commercial Fishing: Research	Catches or Landings: catches	Sex (where applicable): Combined
Check method of measuring fish (✓) Fork length	Total length	Greatest total Other
Structures Used in Ageing: otoliths		Reported by: G. Wörny
To nearest centimeter	To cm. below ✓	

Check Length Group Used	NUMBER SAMPLED BY YEAR-CLASS AND AGE (IN QUARTER)							No. of Ages Read	LENGTH COMPOSITION OF CATCH PER MILLE Months in Quarter					
	1 cm	2 cm	3 cm	1	2	3	4			5	6	7		
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11	18-	18-												
2	20-	21-												
3	22-	24-												
4	24-	27-												
5	26-	30-												
6	28-	33-												
7	30-	36-												
8	32-	39-												
9	34-	42-												
20	36-	45-												
1	38-	48-				2				2		26		
2	40-	51-				7				9		103		
3	42-	54-				9				9		109		
4	44-	57-				10				10		57		
5	46-	60-				7				7		26		
6	48-	63-				2				2		12		
7	50-	66-												
8	52-	69-					1			2		41		
9	54-	72-				3				4		67		
10	56-	75-					2			5		164		
1	58-	78-					4			9		221		
2	60-	81-					4			7		116		
3	62-	84-					3			3		37		
4	64-	87-										11		
5	66-	90-										4		
6	68-	93-												
7	70-	96-												
8	72-	99-												
9	74-	102-												
10	76-	105-												
1	78-	108-												
2	80-	111-												
3	82-	114-												
4	84-	117-												
5	86-	120-												
TOTALS						39	4	8	10			61	1000	
Number of age samples in quarter	Number of Length Samples													
4	Number of Fish Measured in Each Month												17	
	Mean Length of Fish in Each Month (millimetres)													893
	Mean Weight of Fish in Each Month (grams)													
	Range of Depths in Each Month (metres)													
	Mesh or Book Size (mm)													

AGE COMPOSITION OF LANDINGS (PER MILLE)

Month	Age	3	4	5	6	TOTAL
MARCH		23	32	21	20	77
		3	4	5	6	18
		328	64	219	349	770

Sampling Form 1 (Rev. 12/75)

Table 7. Length frequency data of mackerel from the Federal Republic of Germany Juvenile Herring Survey catches in Division 5Z, March 1975 and 1976.

cm	<u>1975</u>		<u>1976</u>	
	n	%	n	%
10	-	-	-	-
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	2	0.2
15	-	-	18	1.5
6	30	1.4	124	10.0
7	164	7.9	140	11.3
8	295	14.2	145	11.7
9	166	8.0	188	15.2
20	79	3.8	235	19.0
1	50	2.4	191	15.4
2	27	1.3	65	5.3
3	30	1.4	14	1.1
4	8	0.4	13	1.1
25	27	1.3	25	2.0
6	119	5.7	32	2.6
7	186	8.9	29	2.3
8	136	6.5	11	0.9
9	81	3.9	2	0.2
30	42	2.0	-	-
1	65	3.1	1	0.1
2	104	5.0	-	-
3	93	4.5	-	-
4	83	4.0	-	-
35	76	3.7	1	0.1
6	66	3.2	-	-
7	58	2.8	-	-
8	34	1.6	-	-
9	26	1.3	-	-
40	21	1.0	-	-
1	10	0.5	1	0.1
2	3	+	-	-
3	1	+	-	-
4	1	+	-	-
45	-	-	-	-
total	2081	99.8	1237	100.1

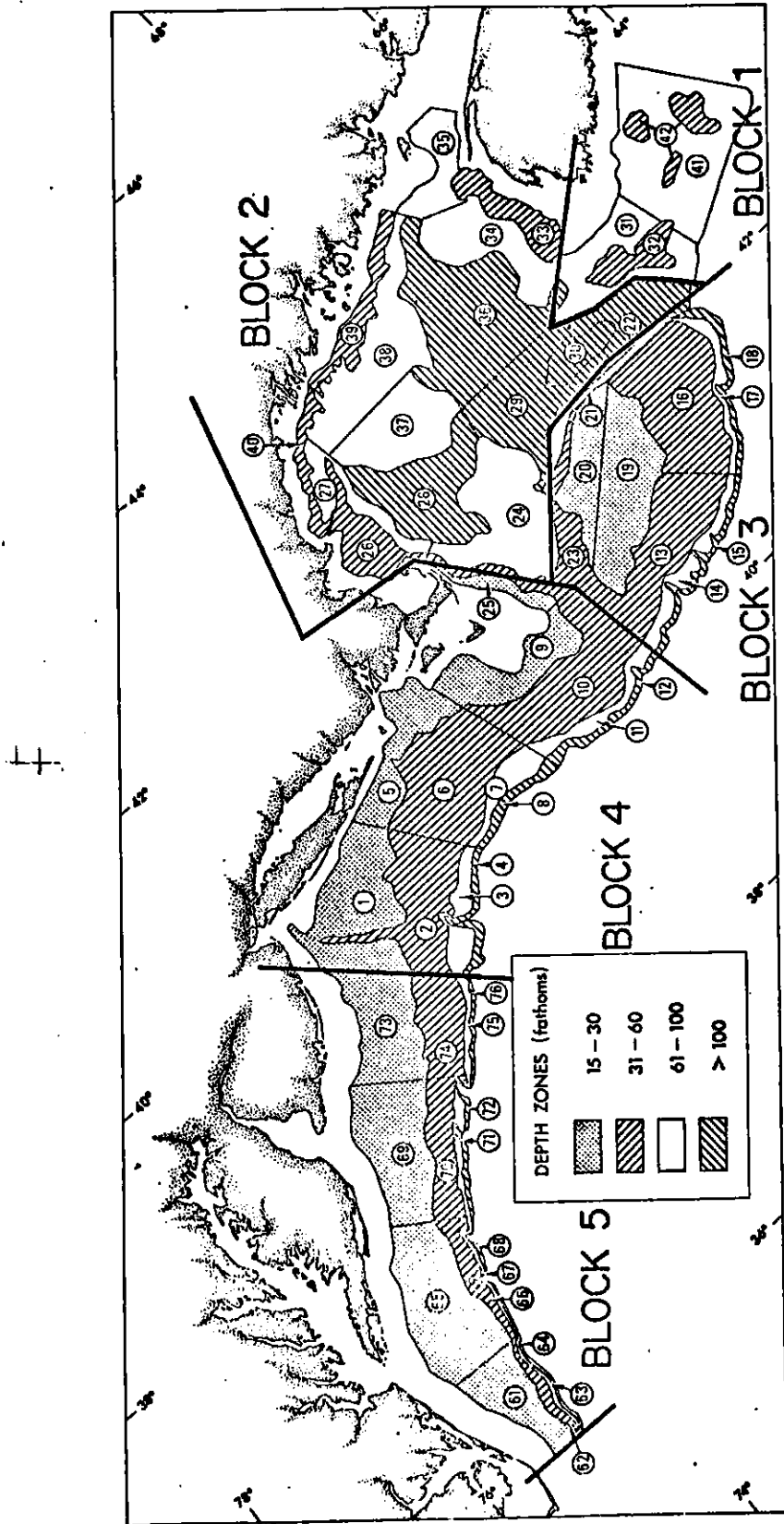


Figure 1. Bottom trawl survey sampling strata and blocks used for estimating relative indices of herring abundance.

GERMAN R/V WALTHER HERWIG &
JUVENILE HERRING SURVEY
SPRING 1975
MARCH 11-26

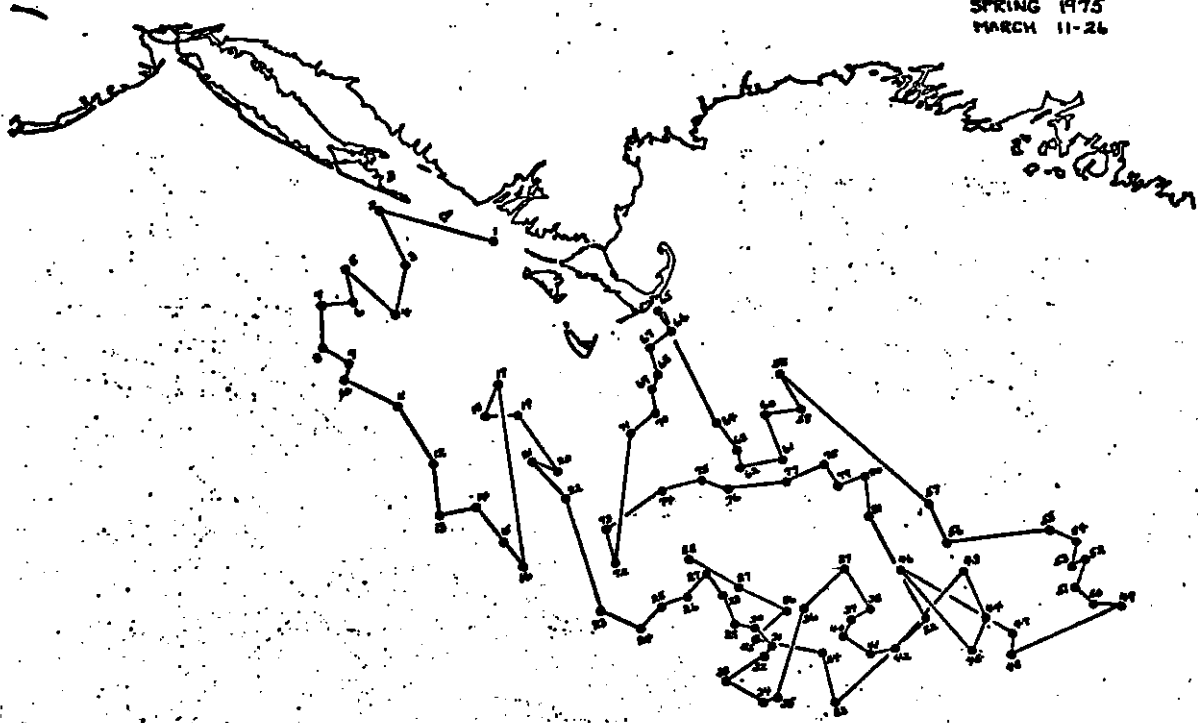


Figure 2. Cruise track of the R/V WALTHER HERWIG in 1975 while conducting the Young Herring Surveys.

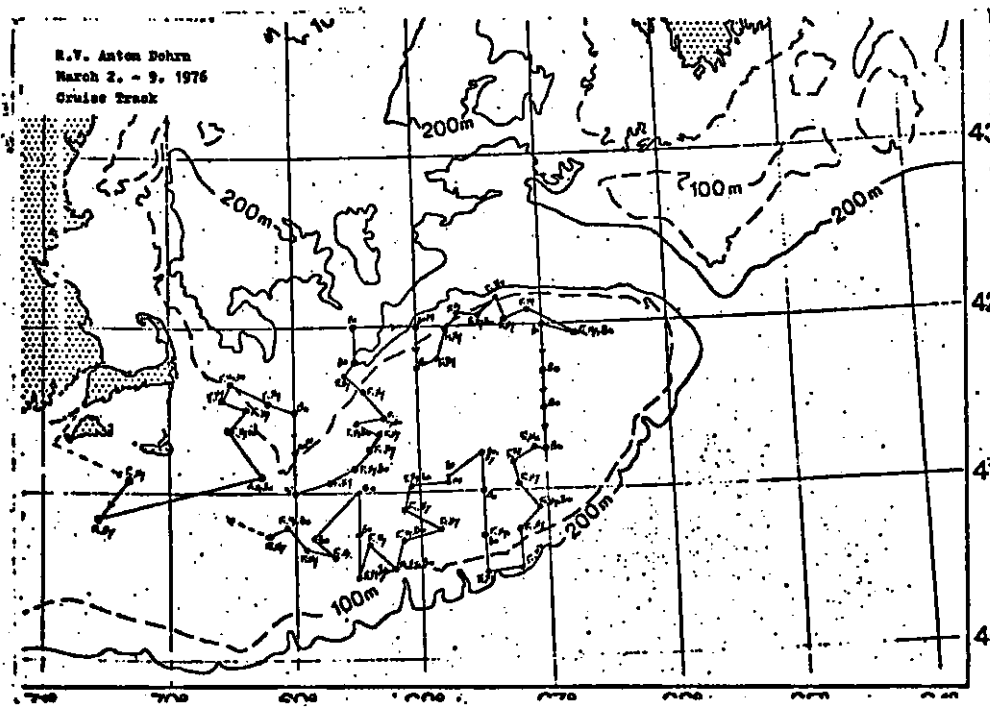


Figure 3. Cruise track of the R/V ANTON DOHRN in 1976 while conducting the Young Herring Surveys.

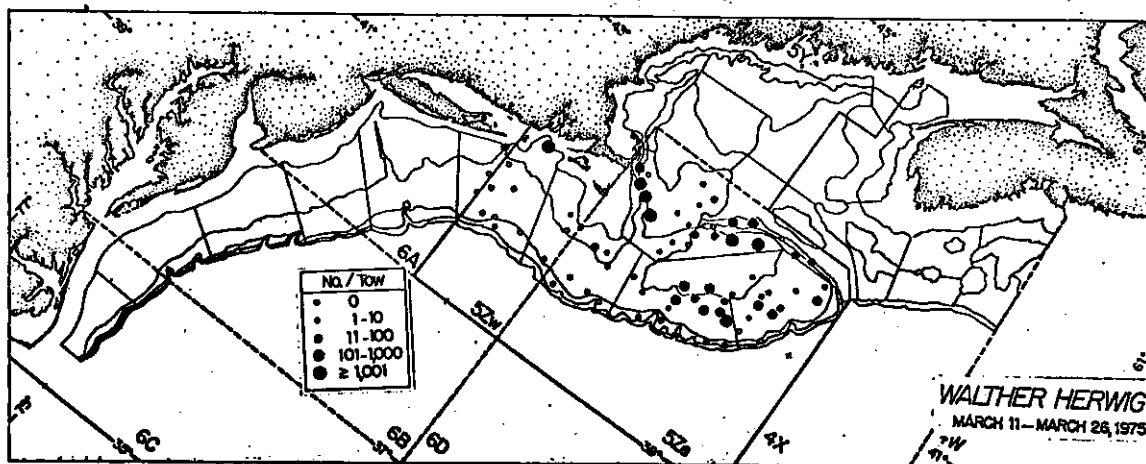


Figure 4. Distribution of herring catches (no./tow) during the 1975 WALTHER HERWIG Young Herring Surveys.

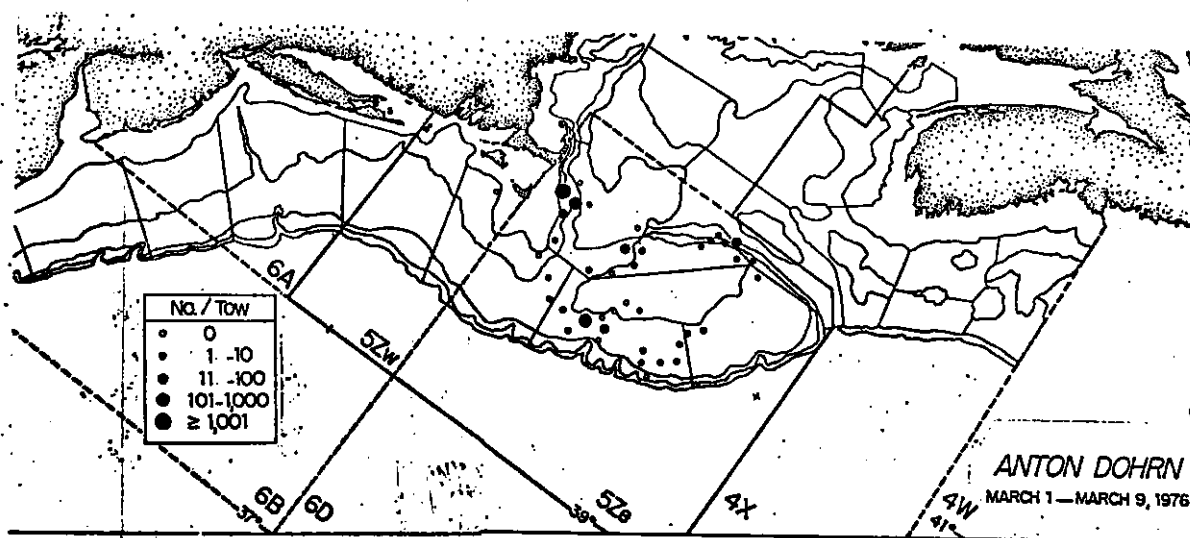


Figure 5. Distribution of herring catches (no./tow) during the 1976 WALTHER HERWIG Young Herring Surveys.

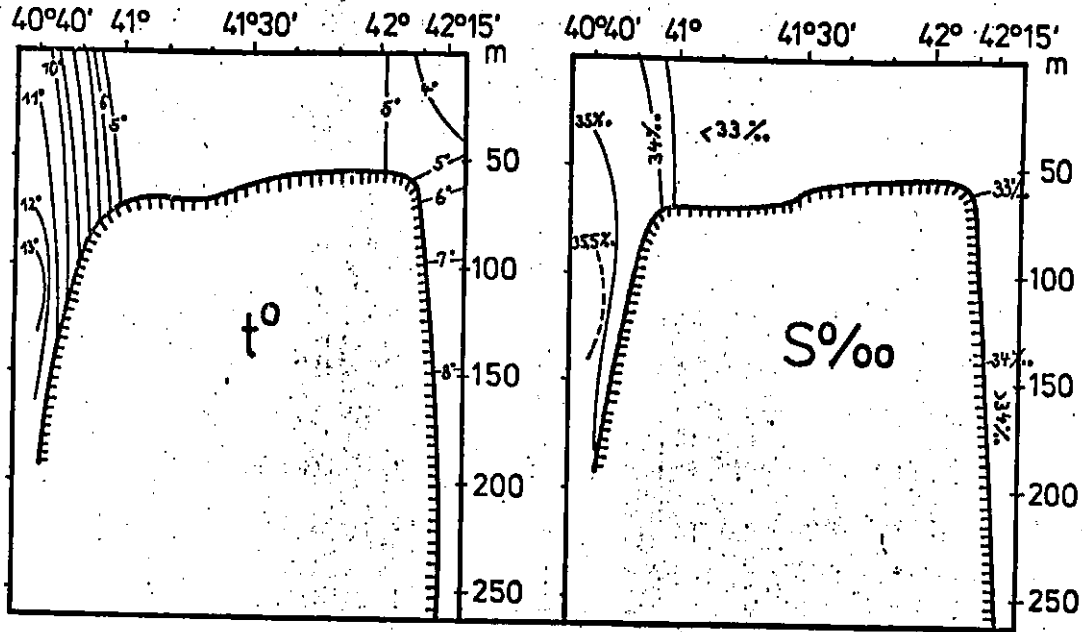


Figure 6. Vertical profiles of temperature ($^{\circ}\text{C}$) and Salinity (‰) at 67°W by the 1975 WALTHER HERWIG Young Herring Surveys.

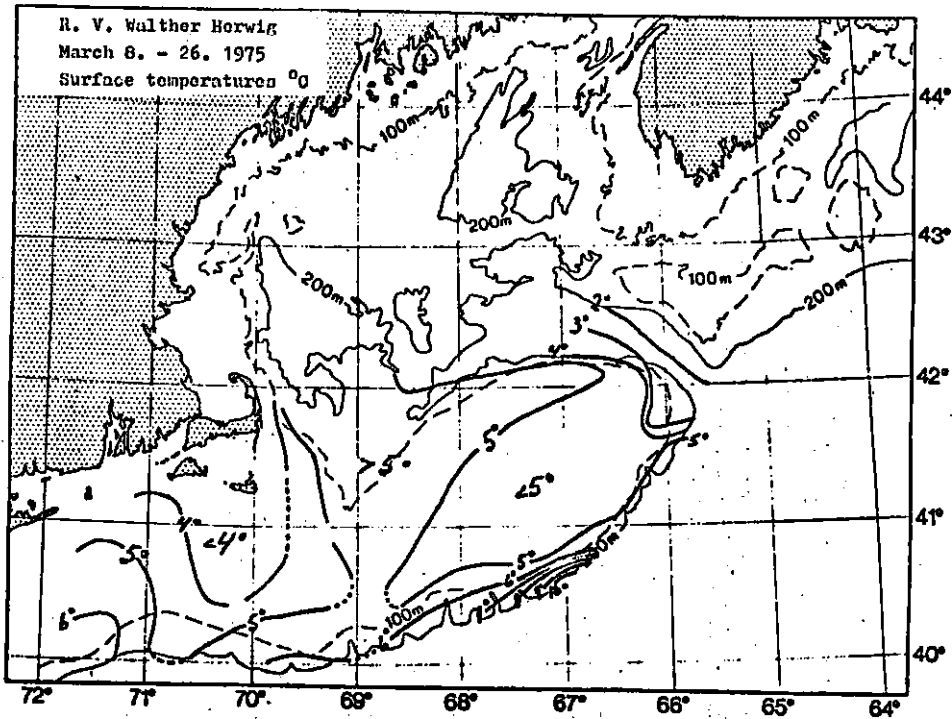


Figure 7. Surface water temperature ($^{\circ}\text{C}$) isotherms from the 1975 WALTHER HERWIG Young Herring Surveys.

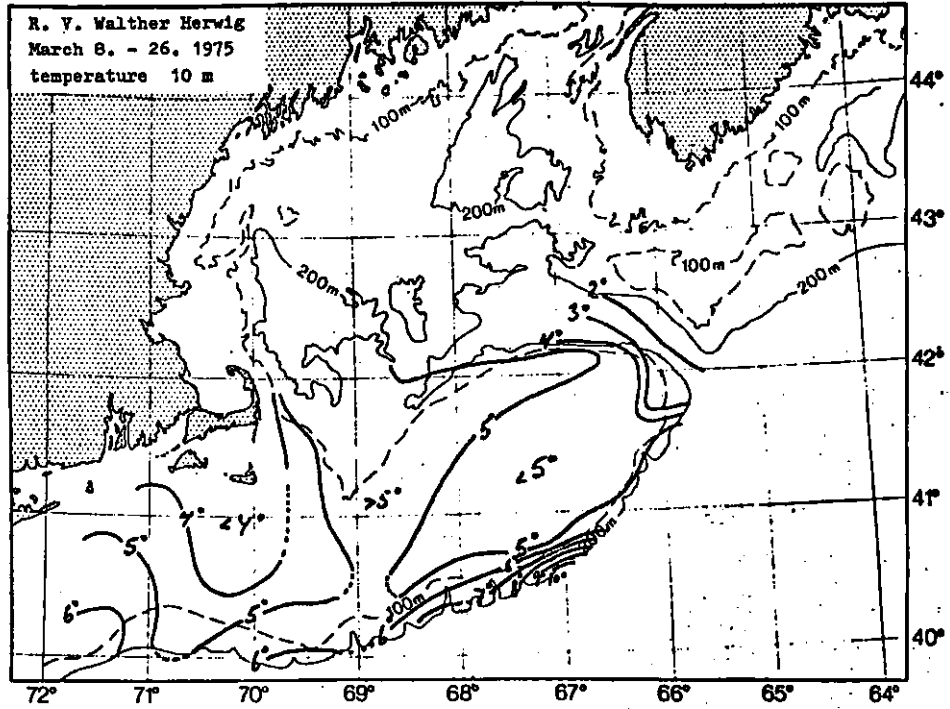


Figure 8. Water temperature ($^{\circ}\text{C}$) isotherms at 10 meters from the 1975 WALTHER HERWIG Young Herring Surveys.

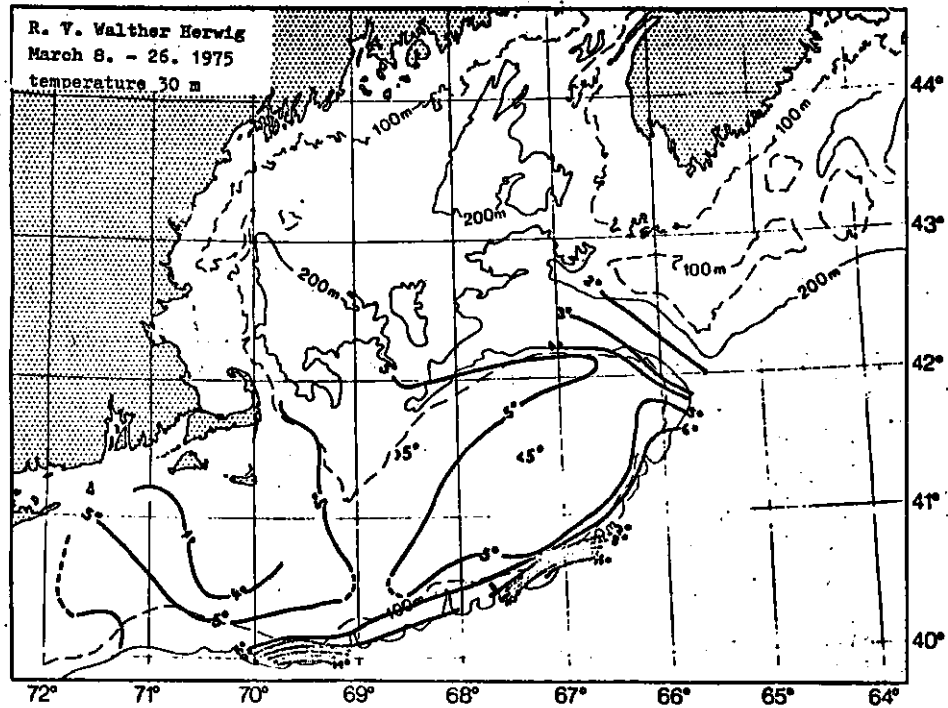


Figure 9. Water temperature ($^{\circ}\text{C}$) isotherms at 30 meters from the 1975 WALTHER HERWIG Young Herring Surveys.

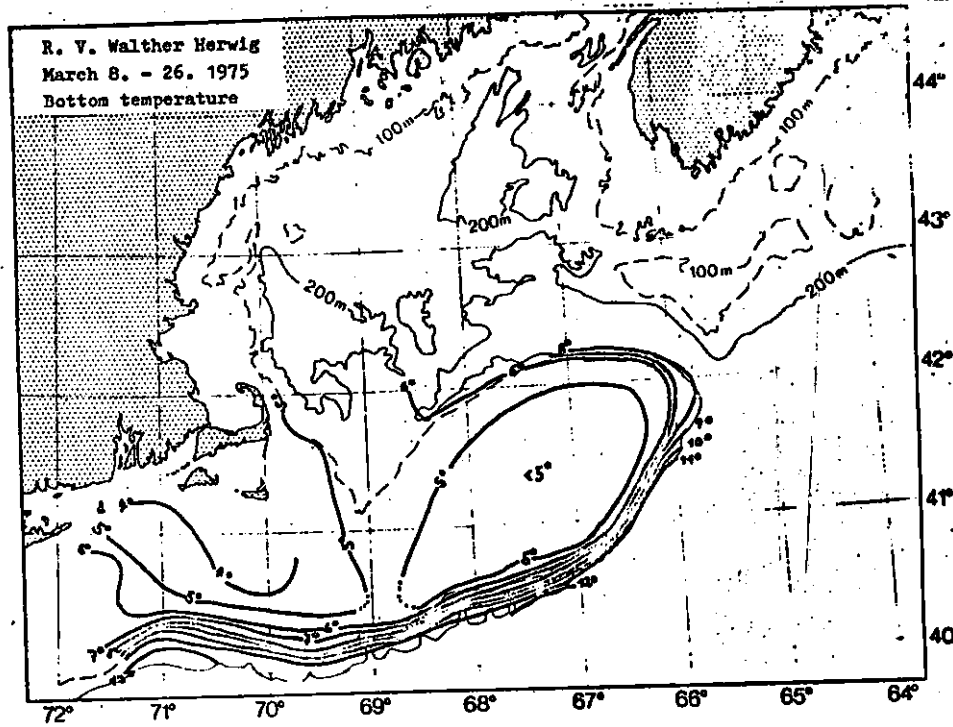


Figure 10. Bottom water temperature ($^{\circ}\text{C}$) isotherm from the 1975 WALTHER HERWIG Young Herring Surveys.

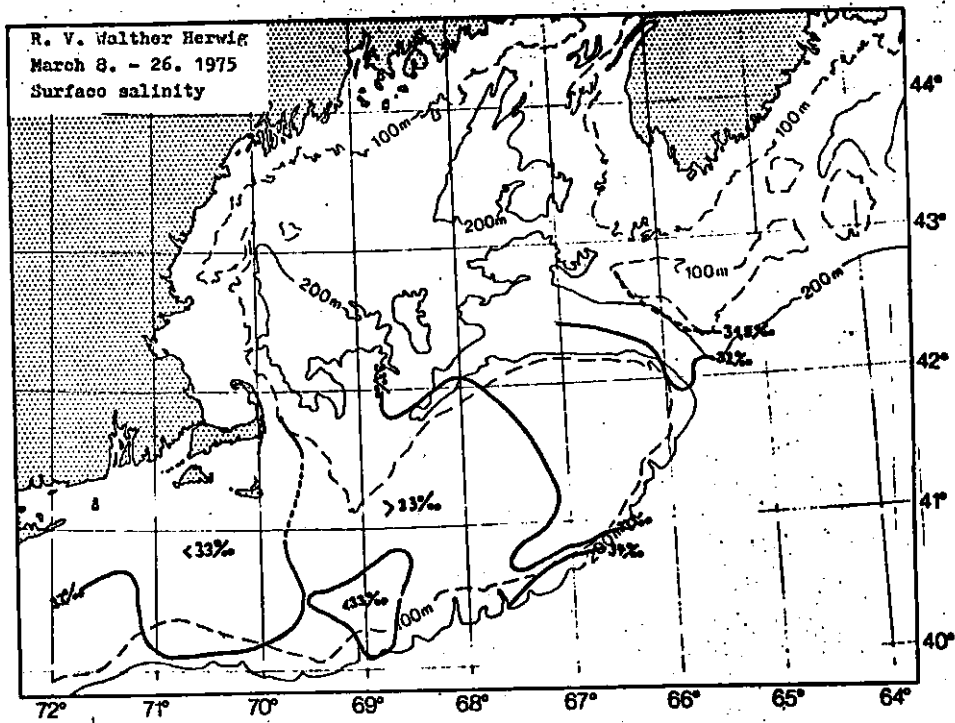


Figure 11. Surface salinity (‰) isogram from the 1975 WALTHER HERWIG Young Herring Survey.

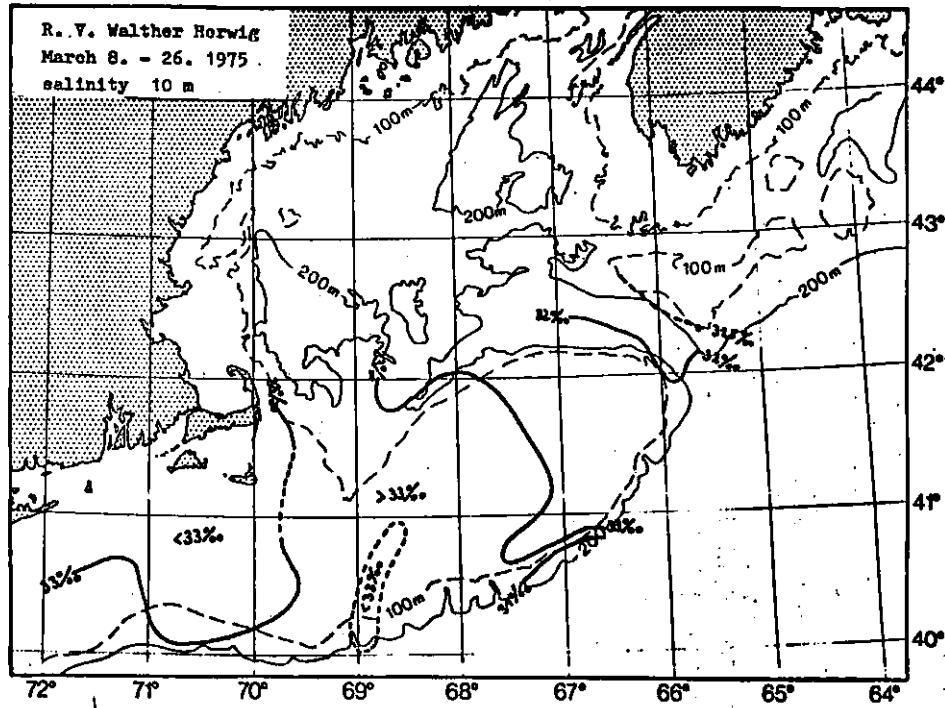


Figure 12. Salinity (‰) isogram at 10 meters from the 1975 WALTHER HERWIG Young Herring Surveys.

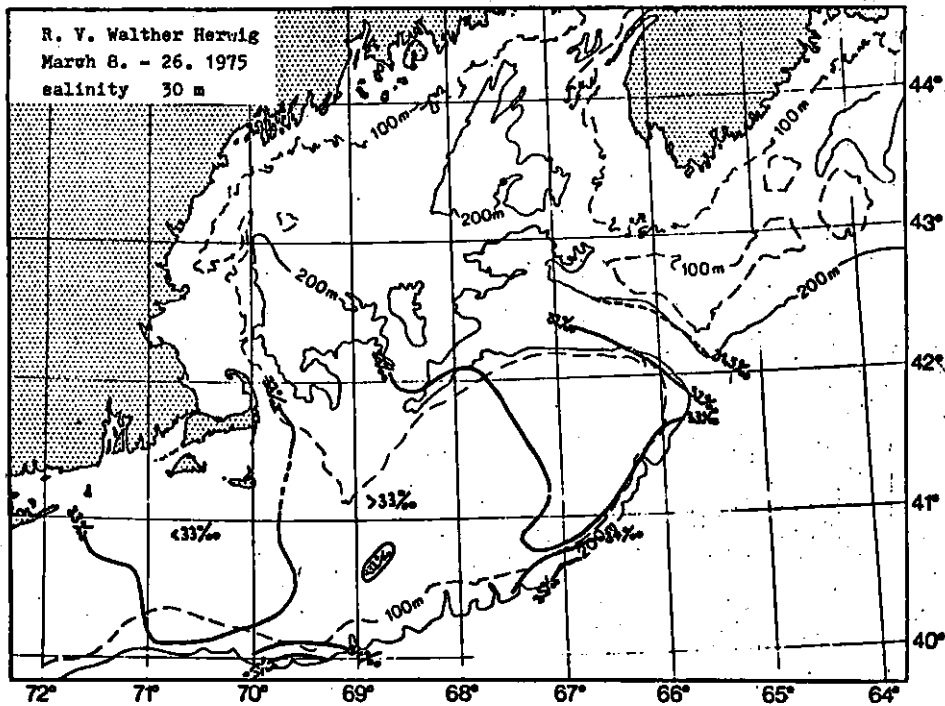


Figure 13. Salinity (‰) isogram at 30 meters from the 1975 WALTHER HERWIG Young Herring Surveys.

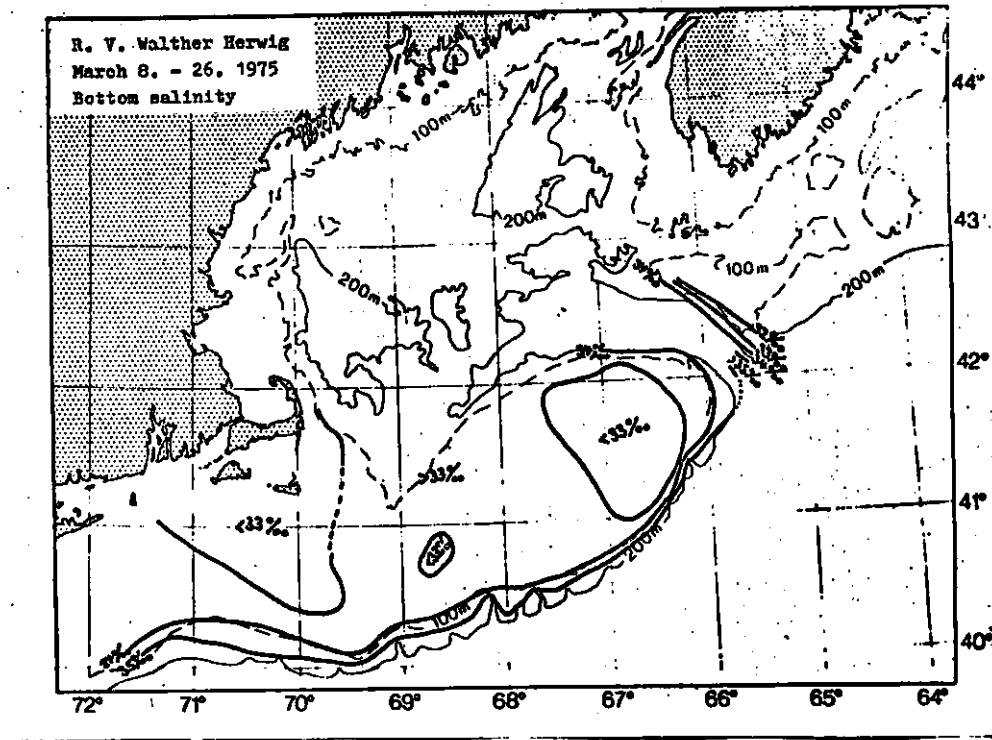


Figure 14. Bottom salinity (‰) isogram from the 1975 WALTHER HERWIG Young Herring Survey.

