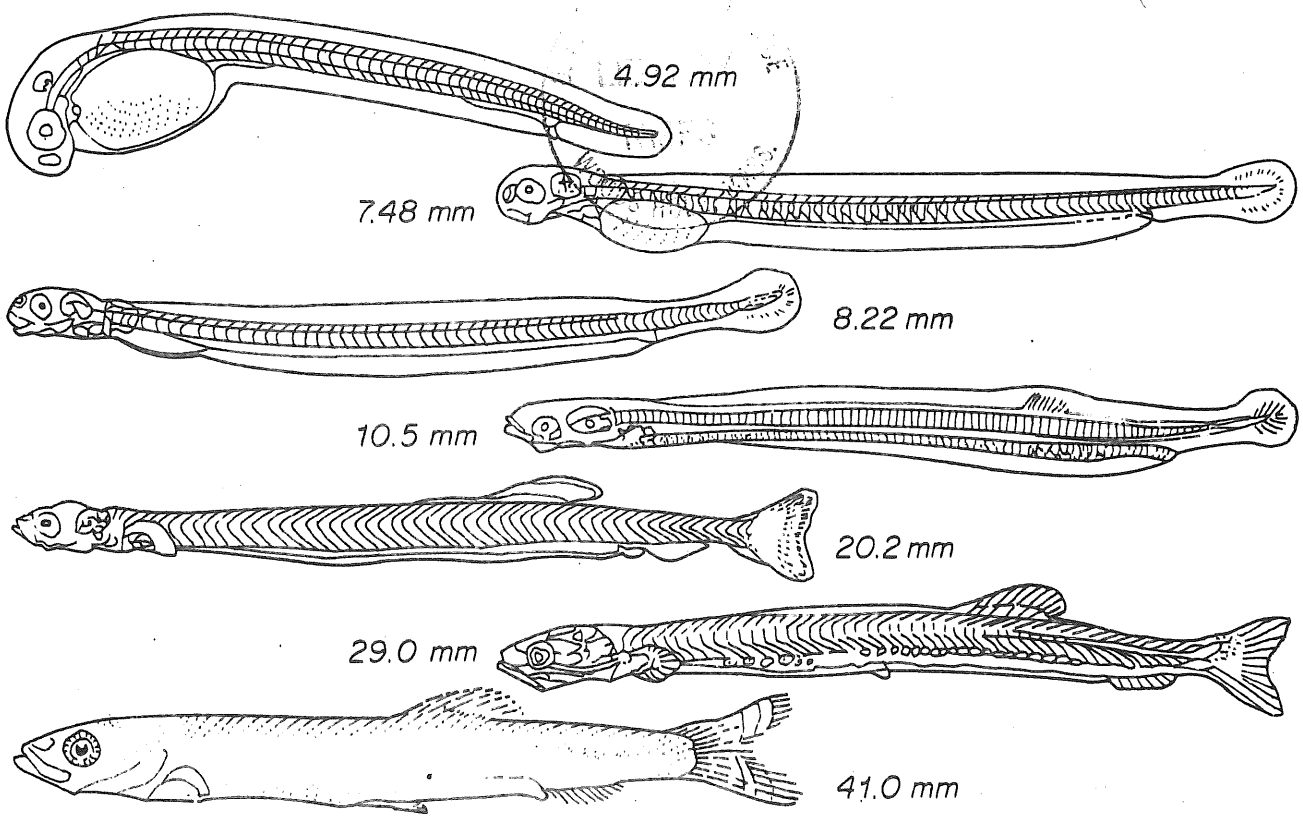
LARVAL HERRING SURVEY DATA 1968/1978

GEORGES BANK & GULF OF MAINE

CLUPEA HARENGUS L.

LAB REFERENCE 79-60



AUTHORS · R. GREGORY LOUGH · GEORGE R. BOLZ

NATIONAL MARINE FISHERIES SERVICE · NORTHEAST FISHERIES CENTER

WOODS HOLE LABORATORY · WOODS HOLE, MA 02543

LABORATORY REFERENCE DOCUMENT NO. 79-60

A DESCRIPTION OF THE SAMPLING METHODS, AND LARVAL HERRING (*CLUPEA HARENGUS* L.) DATA REPORT FOR SURVEYS CONDUCTED FROM 1968-1978 IN THE GEORGES BANK AND GULF OF MAINE AREAS

by

R. Gregory Lough and George R. Bolz

U.S. DEPT. OF COMMERCE
LIBRARY
NMFS
WOODS HOLE, MASS.

✓	Approved for Distribution
✓	Distribute to F/NWC, F/SWC, F/SEC, F/NWR1, & F/NEC (Technical Writer-Editor)

Signature R. Gregory Lough

Date April 11, 1980

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole Laboratory
Woods Hole, Massachusetts 02543

TABLE OF CONTENTS

	Page
LIST OF TABLES	I-V
LIST OF FIGURES	VI-XVI
INTRODUCTION	1
FIELD SAMPLING METHODS	1
1968-1970 Surveys	2
1971 ICNAF Surveys	2
1972-1978 Surveys	3
1978 Patch Study	4
1979 to Date	4
SAMPLE PROCESSING	4
PRESENTATION OF DATA	6
DISCUSSION	6
REFERENCES	9

LIST OF TABLES

Table		Page
1.	Summary of cruise data, 1968-78, used in the abundance estimates of larval herring in the Georges Bank - Gulf of Maine area.	14,15
2.	Summary of cruise estimated abundance of herring larvae by length classes for the Georges Bank - Nantucket Shoals area, 1968-77 seasons.	16
3.	Summary of cruise estimated abundance of herring larvae by length classes for the Western Gulf of Maine, 1969-77 seasons	17
4.	Summary of cruise estimated abundance of herring larvae by length classes for the Eastern Gulf of Maine (Scotian Shelf), 1969-77 seasons.	18
5.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 68-17, 28 October-26 November 1968	19
6.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 69-11, 27 October-23 November 1969.	20
7.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 70-06, 15 October-21 November 1970.	21
8.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Cryos* cruise 71-01, 09-24 September 1971.	22
9.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Delaware II* cruise 71-04, 21 September-04 October 1971	23
10.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Viandra* cruise 71-01, 09-25 October 1971	24
11.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Walther Herwig* cruise 71-01, 28 October-12 November 1971.	25
12.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 71-07, 02-17 December 1971.	26

LIST OF TABLES - Cont'd.

Table		Page
13.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Lucille B.* cruise 72-01, 02-06 September 1972.	27
14.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 72-07, 21-24 September 1972.	28
15.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Argus* cruise 72-01, 22-30 September 1972	29
16.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 72-01, 02-28 October 1972	30
17.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Argus* cruise 72-02, 12-28 October 1972	31
18.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Duchess II* cruise 72-01, 18-22 October 1972.	32
19.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Anton Dohrn* cruise 72-01, 31 October-12 November 1972. . .	33
20.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Duchess II* cruise 72-02, 06-12 November 1972	34
21.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 72-09, 02-20 December 1972	35
22.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Cryos* cruise 73-01, 16-28 September 1973	36
23.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 73-40, 28 September-20 October 1973	37

LIST OF TABLES - Cont'd.

Table		Page
24.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Belogorsk* cruise 73-01, 15 October-01 November 1973	38
25.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Walther Herwig* cruise 73-43, 28 October-08 November 1973. .	39
26.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 73-08, 30 October-20 November 1973. . .	40
27.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 73-09, 04-20 December 1973.	41
28.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 74-02, 11-22 February 1974.	42
29.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Cryos* cruise 74-04, 07-24 September 1974.	43
30.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Duchess II* cruise 74-01, 09-14 September 1974	44
31.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 74-01, 27 September-18 October 1974.	45
32.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Delaware II* cruise 74-12, 08-16 October 1974.	46
33.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Prognoz* cruise 74-01, 18-30 October 1974.	47
34.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 74-11, 30 October-12 November 1974 . . .	48

LIST OF TABLES - Cont'd.

Table		Page
35.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Anton Dohrn* cruise 74-01, 16-23 November 1974.	49
36.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 74-13, 04-19 December 1974	50
37.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 75-02, 12-28 February 1974	51
38.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Challenge* cruise 75-01, 04-09 September 1975	52
39.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Delaware II* cruise 75-15, 23 September-02 October 1975 . . .	53
40.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Belogorsk* cruise 75-02, 25 September-08 October 1975	54
41.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 75-12II, 07-23 October 1975.	55
42.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Belogorsk* cruise 75-03, 17-30 October 1975	56
43.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Anton Dohrn* cruise 75-187, 01-18 November 1975	57
44.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 75-12III, 07-18 November 1975.	58
45.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 75-14, 05-17 December 1975	59

LIST OF TABLES - Cont'd.

Table		Page
46.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 76-01, 10-25 February 1976.	60
47.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Annandale* cruise 76-01, 01-18 October 1976.	61
48.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 76-03, 14 October-03 November 1976	62
49.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 76-09, 09-23 November 1976.	63
50.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Anton Dohrn* cruise 76-02, 15-29 November 1976	64
51.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Researcher* cruise 76-01, 27 November-11 December 1976 . . .	65
52.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Mt. Mitchell* cruise 77-01, 13-24 February 1977.	66
53.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 77-06, 04-24 October 1977.	67
54.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Argus* cruise 77-01, 15 October-11 November 1977	68
55.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Anton Dohrn* cruise 77-03, 01-18 November 1977	69
56.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Delaware II* cruise 77-13, 08-20 December 1977	70
57.	Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 78-02, 14 February-8 March 1978	71

LIST OF FIGURES

Figure		Page
1.	The Gulf of Maine. (Depths are in meters)	72
2.	Station plot for ICNAF larval herring surveys with a standard cruise track drawn for the Georges Bank - Nantucket area	73
3.	Geographical subdivisions of Georges Bank, Nantucket Shoals, Western Gulf of Maine, and Eastern Gulf of Maine used for abundance estimates of larval herring	74
4.	*Albatross IV* 68-17, 28 October-26 November 1968, Larval Herring Survey, cruise track	75
5.	*Albatross IV* 68-17, 28 October-26 November 1968, *Clupea harengus*, <10 mm larvae per 10 m^2	76
6.	*Albatross IV* 68-17, 28 October-26 November 1968, *Clupea harengus*, total larvae per 10 m^2	77
7.	*Albatross IV* 69-11, 27 October-23 November 1969, Larval Herring Survey, cruise track	78
8.	*Albatross IV* 69-11, 27 October-23 November 1969, *Clupea harengus*, <10 mm larvae per 10 m^2	79
9.	*Albatross IV* 69-11, 27 October-23 November 1969, *Clupea harengus*, total larvae per 10 m^2	80
10.	*Albatross IV* 70-06, 15 October-21 November 1970, Larval Herring Survey, cruise track	81
11.	*Albatross IV* 70-06, 15 October-21 November 1970, *Clupea harengus*, <10 mm larvae per 10 m^2	82
12.	*Albatross IV* 70-06, 15 October-21 November 1970, *Clupea harengus*, total larvae per 10 m^2	83
13.	*Rorqual* cruises, Fall 1971, Larval Herring Survey, cruise track	84
14.	*Rorqual* R-4-71, 09-16 September 1971, *Clupea harengus*, <10 mm larvae per 10 m^2	85
15.	*Rorqual* R-4-71, 09-16 September 1971, *Clupea harengus*, total larvae per 10 m^2	86

LIST OF FIGURES - Cont'd.

Figure		Page
16.	Cryos 71-01, 09-24 September 1971, Larval Herring Survey, cruise track.	87
17.	Cryos 71-01, 09-24 September 1971, Clupea harengus, <10 mm larvae per 10 m^2	88
18.	Cryos 71-01, 09-24 September 1971, Clupea harengus, total larvae per 10 m^2.	89
19.	Delaware II 71-04, 21 September-04 October 1971, Larval Herring Survey, cruise track	90
20.	Delaware II 71-04, 21 September-04 October 1971, Clupea harengus, <10 mm larvae per 10 m^2.	91
21.	Delaware II 71-04, 21 September-04 October 1971, Clupea harengus, total larvae per 10 m^2	92
22.	Rorqual R-5-71, 22 September-01 October 1971, Clupea harengus, <10 mm larvae per 10 m^2	93
23.	Rorqual R-5-71, 22 September-01 October 1971, Clupea harengus, total larvae per 10 m^2.	94
24.	Viandra 71-01, 09-25 October 1971, Larval Herring Survey, cruise track.	95
25.	Viandra 71-01, 09-25 October 1971, Clupea harengus, <10 mm larvae per 10 m^2	96
26.	Viandra 71-01, 09-25 October 1971, Clupea harengus, total larvae per 10 m^2.	97
27.	Rorqual R-6-71, 13-25 October 1971, Clupea harengus, <10 mm larvae per 10 m^2	98
28.	Rorqual R-6-71, 13-25 October 1971, Clupea harengus, total larvae per 10 m^2.	99
29.	Rorqual R-7-71, 27 October-08 November 1971, Clupea harengus, <10 mm larvae per 10 m^2	100
30.	Rorqual R-7-71, 27 October-08 November 1971, Clupea harengus, total larvae per 10 m^2.	101

LIST OF FIGURES - Cont'd.

Figure		Page
31.	Walther Herwig 71-01, 29 October-12 November 1971, Larval Herring Survey, cruise track.	102
32.	Walther Herwig 71-01, 28 October-12 November 1971, Clupea harengus, <10 mm larvae per 10 m^2	103
33.	Walther Herwig 71-01, 28 October-12 November 1971, Clupea harengus, total larvae per 10 m^2.	104
34.	Albatross IV 71-07, 2-17 December 1971, Larval Herring Survey, cruise track	105
35.	Albatross IV 71-07, 2-17 December 1971, Clupea harengus, <10 mm larvae per 10 m^2.	106
36.	Albatross IV 71-07, 2-17 December 1971, Clupea harengus, total larvae per 10 m^2	107
37.	Lucille B. 72-01, 02-06 September 1972, Larval Herring Survey, station positions.	108
38.	Lucille B. 72-01, 02-06 September 1972, Clupea harengus, <10 mm larvae per 10 m^2.	109
39.	Lucille B. 72-01, 02-06 September 1972, Clupea harengus, total larvae per 10 m^2	110
40.	Albatross IV 72-07, Duchess II 72-01, Duchess II 72-02, Fall 1972, Larval Herring Survey, station positions.	111
41.	Albatross IV 72-07, 21-24 September 1972, Clupea harengus, <10 mm larvae per 10 m^2.	112
42.	Albatross IV 72-07, 21-24 September 1972, Clupea harengus, total larvae per 10 m^2	113
43.	Argus 72-01, 22-30 September 1972, Larval Herring Survey, cruise track	114
44.	Argus 72-01, 22-30 September 1972, Clupea harengus, <10 mm larvae per 10 m^2.	115
45.	Argus 72-01, 22-30 September 1972, Clupea harengus, total larvae per 10 m^2	116

LIST OF FIGURES - Cont'd.

Figure		Page
46.	Wieczno 72-01, 02-28 October 1972, Larval Herring Survey, cruise track.	117
47.	Wieczno 72-01, 02-28 October 1972, Clupea harengus, <10 mm larvae per 10 m^2	118
48.	Wieczno 72-01, 02-28 October 1972, Clupea harengus, total larvae per 10 m^2.	119
49.	Argus 72-02, 12-28 October 1972, Larval Herring Survey, cruise track.	120
50.	Argus 72-02, 12-28 October 1972, Clupea harengus, <10 mm larvae per 10 m^2	121
51.	Argus 72-02, 12-28 October 1972, Clupea harengus, total larvae per 10 m^2.	122
52.	Duchess II 72-01, 18-22 October 1972, Clupea harengus, <10 mm larvae per 10 m^2	123
53.	Duchess II 72-01, 18-22 October 1972, Clupea harengus, total larvae per 10 m^2.	124
54.	Anton Dohrn 72-01, 31 October-12 November 1972, Larval Herring Survey, cruise track	125
55.	Anton Dohrn 72-01, 31 October-12 November 1972, Clupea harengus, <10 mm larvae per 10 m^2.	126
56.	Anton Dohrn 72-01, 31 October-12 November 1972, Clupea harengus, total larvae per 10 m^2	127
57.	Duchess II 72-02, 06-12 November 1972, Clupea harengus, <10 mm larvae per 10 m^2	128
58.	Duchess II 72-02, 06-12 November 1972, Clupea harengus, total larvae per 10 m^2.	129
59.	Albatross IV 72-09, 02-20 December 1972, Larval Herring Survey, cruise track.	130
60.	Albatross IV 72-09, 02-20 December 1972, Clupea harengus, <10 mm larvae per 10 m^2	131

LIST OF FIGURES - Cont'd.

Figure		Page
61.	Albatross IV 72-09, 02-20 December 1972, Clupea harengus, total larvae per 10 m^2.	132
62.	Cryos 73-01, 16-28 September 1973, Larval Herring Survey, cruise track.	133
63.	Cryos 73-01, 16-28 September 1973, Clupea harengus, <10 mm larvae per 10 m^2	134
64.	Cryos 73-01, 16-28 September 1973, Clupea harengus, total larvae per 10 m^2.	135
65.	Wieczno 73-40, 29 September-20 October 1973, Larval Herring Survey, cruise track.	136
66.	Wieczno 73-40, 29 September-20 October 1973, Clupea harengus, <10 mm larvae per 10 m^2	137
67.	Wieczno 73-40, 29 September-20 October 1973, Clupea harengus, total larvae per 10 m^2.	138
68.	Belogorsk 73-01, 15 October-01 November 1973, Larval Herring Survey, cruise track.	139
69.	Belogorsk 73-01, 15 October-01 November 1973, Clupea harengus, <10 mm larvae per 10 m^2	140
70.	Belogorsk 73-01, 15 October-01 November 1973, Clupea harengus, total larvae per 10 m^2.	141
71.	Walther Herwig 73-43, 28 October-08 November 1973, Larval Herring Survey, cruise track	142
72.	Walther Herwig 73-43, 28 October-08 November 1973, Clupea harengus, <10 mm larvae per 10 m^2.	143
73.	Walther Herwig 73-43, 28 October-08 November 1973, Clupea harengus, total larvae per 10 m^2	144
74.	Albatross IV 73-08, 30 October-20 November 1973, Larval Herring Survey, cruise track.	145
75.	Albatross IV 73-08, 30 October-20 November 1973, Clupea harengus, <10 mm larvae per 10 m^2	146

LIST OF FIGURES - Cont'd.

Figure		Page
76.	Albatross IV 73-08, 30 October-20 November 1973, Clupea harengus, total larvae per 10 m^2	147
77.	Albatross IV 73-09, 04-20 December 1973, Larval Herring Survey, cruise track	148
78.	Albatross IV 73-09, 04-20 December 1973, Clupea harengus, <10 mm larvae per 10 m^2	149
79.	Albatross IV 73-09, 04-20 December 1973, Clupea harengus, total larvae per 10 m^2	150
80.	Albatross IV 74-02, 11-22 February 1974, Larval Herring Survey, cruise track	151
81.	Albatross IV 74-02, 11-22 February 1974, Clupea harengus, <10 mm larvae per 10 m^2	152
82.	Albatross IV 74-02, 11-22 February 1974, Clupea harengus, total larvae per 10 m^2	153
83.	Cryos 74-04, 07-24 September 1974, Larval Herring Survey, cruise track	154
84.	Cryos 74-04, 07-24 September 1974, Clupea harengus, <10 mm larvae per 10 m^2	155
85.	Cryos 74-04, 07-24 September 1974, Clupea harengus, total larvae per 10 m^2	156
86.	Duchess II 74-01, 09-14 September 1974, Larval Herring Survey, station positions	157
87.	Duchess II 74-01, 09-14 September 1974, Clupea harengus, <10 mm larvae per 10 m^2	158
88.	Duchess II 74-01, 09-14 September 1974, Clupea harengus, total larvae per 10 m^2	159
89.	Wieczno 74-01, 27 September-18 October 1974, Larval Herring Survey, cruise track	160
90.	Wieczno 74-01, 27 September-18 October 1974, Clupea harengus, <10 mm larvae per 10 m^2	161

LIST OF FIGURES - Cont'd.

Figure		Page
91.	Wieczno 74-01, 27 September-18 October 1974, Clupea harengus, total larvae per 10 m^2.	162
92.	Delaware II 74-12, 08-16 October 1974, Larval Herring Survey, cruise track.	163
93.	Delaware II 74-12, 08-16 October 1974, Clupea harengus, <10 mm larvae per 10 m^2	164
94.	Delaware II 74-12, 08-16 October 1974, Clupea harengus, total larvae per 10 m^2.	165
95.	Prognoz 74-01, 18-30 October 1974, Larval Herring Survey, cruise track.	166
96.	Prognoz 74-01, 18-30 October 1974, Clupea harengus, <10 mm larvae per 10 m^2	167
97.	Prognoz 74-01, 18-30 October 1974, Clupea harengus, total larvae per 10 m^2.	168
98.	Albatross IV 74-11, 30 October-14 November 1974, Larval Herring Survey, cruise track.	169
99.	Albatross IV 74-11, 30 October-14 November 1974, Clupea harengus, <10 mm larvae per 10 m^2	170
100.	Albatross IV 74-11, 30 October-14 November 1974, Clupea harengus, total larvae per 10 m^2.	171
101.	Anton Dohrn 74-01, 16-23 November 1974, Larval Herring Survey, cruise track.	172
102.	Anton Dohrn 74-01, 16-23 November 1974, Clupea harengus, <10 mm larvae per 10 m^2	173
103.	Anton Dohrn 74-01, 16-23 November 1974, Clupea harengus, total larvae per 10 m^2.	174
104.	Albatross IV 74-13, 04-19 December 1974, Larval Herring Survey, cruise track.	175
105.	Albatross IV 74-13, 04-19 December 1974, Clupea harengus, <10 mm larvae per 10 m^2	176
106.	Albatross IV 74-13, 04-19 December 1974, Clupea harengus, total larvae per 10 m^2.	177

LIST OF FIGURES - Cont'd.

Figure		Page
107.	Albatross IV 75-02, 12-28 February 1975, Larval Herring Survey, cruise track.	178
108.	Albatross IV 75-02, 12-28 February 1975, *Clupea harengus*, total larvae per 10 m^2.	179
109.	Challenge 75-01, 04-09 September 1975, Larval Herring Survey, station positions	180
110.	Challenge 75-01, 04-09 September 1975, *Clupea harengus*, <10 mm larvae per 10 m^2	181
111.	Challenge 75-01, 04-09 September 1975, *Clupea harengus*, total larvae per 10 m^2.	182
112.	Delaware II 75-15, 23 September-02 October 1975, Larval Herring Survey, station positions, Gulf of Maine.	183
113.	Delaware II 75-15, 23 September-02 October 1975, Larval Herring Survey, station positions, Scotian Shelf.	184
114.	Delaware II 75-15, 23 September-02 October 1975, *Clupea harengus*, <10 mm larvae per 10 m^2	185
115.	Delaware II 75-15, 23 September-02 October 1975, *Clupea harengus*, total larvae per 10 m^2.	186
116.	Belogorsk 75-02, 25 September-08 October 1975, Larval Herring Survey, cruise track.	187
117.	Belogorsk 75-02, 25 September-08 October 1975, *Clupea harengus*, <10 mm larvae per 10 m^2	188
118.	Belogorsk 75-02, 25 September-08 October 1975, *Clupea harengus*, total larvae per 10 m^2.	189
119.	Albatross IV 75-12, 07 October-18 November 1975, Larval Herring Survey, cruise track.	190
120.	Albatross IV 75-12, 07 October-18 November 1975, *Clupea harengus*, <10 mm larvae per 10 m^2	191
121.	Albatross IV 75-12, 07 October-18 November 1975, *Clupea harengus*, total larvae per 10 m^2.	192

LIST OF FIGURES - Cont'd.

Figure		Page
122.	Belogorsk 75-03, 17-30 October 1975, Larval Herring Survey, cruise track.	193
123.	Belogorsk 75-03, 17-30 October 1975, Clupea harengus, <10 mm larvae per 10 m^2	194
124.	Belogorsk 75-03, 17-30 October 1975, Clupea harengus, total larvae per 10 m^2.	195
125.	Anton Dohrn 75-187, 01-18 November 1975, Larval Herring Survey, cruise track.	196
126.	Anton Dohrn 75-187, 01-18 November 1975, Clupea harengus, <10 mm larvae per 10 m^2	197
127.	Anton Dohrn 75-187, 01-18 November 1975, Clupea harengus, total larvae per 10 m^2.	198
128.	Albatross IV 75-14, 05-17 December 1975, Larval Herring Survey, cruise track.	199
129.	Albatross IV 75-14, 05-17 December 1975, Clupea harengus, <10 mm larvae per 10 m^2	200
130.	Albatross IV 75-14, 05-17 December 1975, Clupea harengus, total larvae per 10 m^2.	201
131.	Albatross IV 76-01, 10-25 February 1976, Larval Herring Survey, cruise track.	202
132.	Albatross IV 76-01, 10-25 February 1976, Clupea harengus, total larvae per 10 m^2.	203
133.	Annandale 76-01, 01-18 October 1976, Larval Herring Survey, station positions	204
134.	Annandale 76-01, 01-18 October 1976, Clupea harengus, <10 mm larvae per 10 m^2	205
135.	Annandale 76-01, 01-18 October 1976, Clupea harengus, total larvae per 10 m^2.	206
136.	Wieczno 76-03, 14 October-03 November 1976, Larval Herring Survey, cruise track.	207

LIST OF FIGURES - Cont'd.

Figure		Page
137.	Wieczno 76-03, 14 October-03 November 1976, Clupea harengus, <10 mm larvae per 10 m^2	208
138.	Wieczno 76-03, 14 October-03 November 1976, Clupea harengus, total larvae per 10 m^2	209
139.	Albatross IV 76-09, 09-23 November 1976, Larval Herring Survey, station positions	210
140.	Albatross IV 76-09, 09-23 November 1976, Clupea harengus, total larvae per 10 m^2	211
141.	Anton Dohrn 76-02, 15-29 November 1976, Larval Herring Survey, cruise track	212
142.	Anton Dohrn 76-02, 15-29 November 1976, Clupea harengus, total larvae per 10 m^2	213
143.	Researcher 76-01, 27 November-11 December 1976, Larval Herring Survey, cruise track	214
144.	Researcher 76-01, 27 November-11 December 1976, Clupea harengus, total larvae per 10 m^2	215
145.	Mt. Mitchell 77-01, 13-24 February 1977, Larval Herring Survey, cruise track	216
146.	Mt. Mitchell 77-01, 13-24 February 1977, Clupea harengus, total larvae per 10 m^2	217
147.	Wieczno 77-06, 04-24 October 1977, Larval Herring Survey, cruise track	218
148.	Wieczno 77-06, 04-24 October 1977, Clupea harengus, <10 mm larvae per 10 m^2	219
149.	Wieczno 77-06, 04-24 October 1977, Clupea harengus, total larvae per 10 m^2	220
150.	Argus 77-01, 15 October-12 November 1977, Larval Herring Survey, cruise track	221

LIST OF FIGURES - Cont'd.

Figure Page

151. Argus 77-01, 25 October-12 November 1977, Clupea harengus, <10 mm larvae per 10 m^2. 222

152. Argus 77-01, 25 October-12 November 1977, Clupea harengus, total larvae per 10 m^2 223

153. Anton Dohrn 77-03, 01-18 November 1977, Larval Herring Survey, cruise track 224

154. Anton Dohrn 77-03, 01-18 November 1977, Clupea harengus, <10 mm larvae per 10 m^2. 225

155. Anton Dohrn 77-03, 01-18 November 1977, Clupea harengus, total larvae per 10 m^2 226

156. Delaware II 77-13, 09-19 December 1977, Larval Herring Survey, cruise track 227

157. Delaware II 77-13, 09-19 December 1977, Clupea harengus, total larvae per 10 m^2 228

158. Albatross IV 78-02, 14-22 February 1978, Larval Herring Survey, cruise track 229

159. Albatross IV 78-02, 14-22 February 1978, Clupea harengus, total larvae per 10 m^2 230

INTRODUCTION

The National Marine Fisheries Service (NMFS), Northeast Fisheries Center (NEFC) has been involved in a major international cooperative research effort over the last decade on the early life history of sea herring (Clupea harengus L.) in the Georges Bank - Gulf of Maine area. Objectives of the program and sampling scheme were developed by the International Commission for the Northwest Atlantic Fisheries (ICNAF). The initial surveys were designed to measure the size of various spawning groups and larval dispersal from major spawning sites. Later, more intensive sampling was focused on Georges Bank in an attempt to identify biological and physical mechanisms controlling larval growth and survival in the first six months of life and to evaluate their importance on eventual recruitment. As the program evolved the seasonal coverage was expanded and additional kinds of biological and physical data were collected. So far only a portion of the total data base has been analyzed, and for the most part only preliminary reports have been made chiefly as ICNAF and ICES documents. The most comprehensive treatment to date of the larval herring data is given by Lough, et al. (1979) and Lough and Bolz (1979), using the results from the 0.505 mm mesh bongo samples. Boyar et al. (1973) summarized larval herring data and other studies for the period 1962-1970.

The purpose of this report is to provide a description of the sampling methods and basic larval herring data base for the overall ICNAF survey program and for data collected prior to and following the ICNAF surveys. The report documents field sampling methods and sorting protocols and summarizes larval herring data primarily for the 61-cm bongos, 0.505 mm mesh, for the period 1971-1978. Also included are larval herring catches taken in 20-cm bongos during autumn groundfish surveys by NEFC from 1968 to 1970. Data presented for each survey include:

1) Cruise track
2) Larval herring abundance plots for two size groups
3) Estimated length frequency of larval herring population by 1 mm intervals in each of three subareas
4) Larval abundance estimates by 5 mm length intervals in three subareas

Catch data for larval herring and other fish larvae and zooplankton from 0.333 mm mesh samples will be summarized in other reports. The entire series may be published as special data reports of the North Atlantic Fisheries Organization, depending upon decisions by the NAFO larval herring task force which meets in April 1980.

FIELD SAMPLING METHODS

Vessels, cruise dates, and other pertinent information are listed in chronological order in Table 1 for the 57 surveys included in this study from 1968 to 1978. The station pattern, gear, and towing procedures have been modified over the course of this study and sampling designs can be

grouped into four periods: (1) 1968-1970, plankton tows made on NEFC's groundfish surveys, (2) 1971, initial ICNAF larval herring surveys with step-oblique tows, (3) 1972-1974, ICNAF surveys over the whole region using the continuous oblique tow profile, and (4) 1975-1978, ICNAF surveys with concentration of sampling effort in the Georges Bank - Nantucket Shoals area.

1968-1970 Surveys

In 1968, 1969, and 1970, plankton hauls were made concurrently on NEFC groundfish surveys (stratified-random station design) conducted each autumn in the Georges Bank and Gulf of Maine area. A 20-cm bongo sampler (0.505 mm mesh nets) was hauled at 3.5 knots (6.5 km/hr) in a step-oblique manner during each 30-minute bottom trawl haul. Only a surface tow of 5-15 minutes was made in water less than 27 m depth. In water greater than 27 m, a step-oblique tow was made from a depth of 40 to 55 m with 3- to 5-minute steps of 50 m, 25 m, and surface. Step-oblique hauls, as opposed to integrated double-oblique profiles, can seriously bias larval abundance estimates if the larvae are vertically stratified in the water column. Herring larvae are known to migrate extensively in the water column, especially the older larvae, and ongoing studies at NEFC are looking critically at this problem. Also, there is evidence to suggest that larvae can escape the smaller bongos (20 cm) more effectively than the larger bongos (61 cm). In addition, because of only a single survey conducted each autumn, and the relatively wide station spacing, the 1968-1970 surveys could easily have missed high-density aggregations of early stage larvae in known major spawning areas. Although this data is questionable and fragmentary for the reasons above, we have included it in our data base as an order-of-magnitude estimate of larval abundance at a time when the spawning stocks were still at a moderately high level.

1971 ICNAF Surveys

When the ICNAF larval herring surveys were initiated in 1971, the plan was to cover the entire Georges Bank - Gulf of Maine with a standard grid of sampling stations 15-20 miles apart, at least once a month from September through December (Figure 2). At least five ICNAF countries have participated (Federal Republic of Germany, France, Poland, USA, USSR). Each survey usually required 15-20 days at sea and averaged about 6-8 stations per day depending on weather and amount of hydrographic and special sampling. Minimum sampling at each station included a bongo net haul and temperature-salinity profiles. A 3.5 knot double-oblique haul was made on station using a 61 cm bongo net sampler (0.505 and 0.333 mm mesh). A Braincon V-fin depressor (122 cm) was used to achieve the desired wire angle of 45° for the relatively high towing speed and a Bendix or Benthos time-depth recorder was attached to the wire near the bongo for a permanent trace of the haul profile. General Oceanics flow meters were tied in the mouths of each bongo net to calibrate the amount of water strained. A figure of the gear configuration and other details can be found in Smith and Richardson (1977, p. 20). The bongo gear was deployed at 50 m/min to a maximum depth of 200 m or to within 5 m of the bottom in shoaler areas. The rate of retrieval was at 20 m/min up to 40 m depth and changed to a step-oblique profile up to the surface sampling 20 2 m steps, 1 min at each step. On ALBATROSS IV 71-07, the bongo gear was retrieved continuously at 10 m/min in the upper 40 m.

1972-1978 Surveys

Beginning in 1972, the tow profile was changed such that the maximum depth of tow was only to 100 m and a continuous retrieval rate of 10 m/min was used from maximum depth of tow to the surface. In a standard ICNAF bongo haul ranging in duration from approximately 5 to 25 min, each 61-cm bongo net filters between 100 and 1000 m^3 of water, depending on the duration (maximum depth) of the haul.

Extrusion of small larvae through the mesh and escapement of large larvae are two possible sources of errors in the larval herring sampling. Extrusion can be a significant problem for the retention of relatively small organisms, especially at high towing speeds (Smith and Richardson 1977). Theoretical measurements of larval herring skull widths vs the mesh diagonal indicate that minimum lengths for complete retention could be 9.0 and 7.5 mm for 0.505 and 0.333 mm mesh, respectively (Colton and Green 1975). The extent of extrusion of the small larvae has not yet been estimated adequately from the samples. Graham and Chenoweth (1973) found no evidence of extrusion of recently hatched herring larvae (4-9 mm) through mesh sizes of 0.253, 0.333, 0.366, and 0.505 mm made from high-speed tows (5 knots). However, abundance estimates made in this paper indicate that most of the 4-6 m larvae are not represented in the 0.505 mm mesh samples. Therefore extrusion of small larvae is probably a source of bias in estimates of recently hatched herring larvae; another probable bias is the fact that samplers do not normally get closer than 5 m to the bottom and thus may miss the smallest-size larvae as noted by Colton and Green (1975) and Wood (1975).

The size of herring larvae at which significant escapement occurs from the 61 cm bongos at 3.5 knots has not been determined. Analysis of night/day catches so far has not provided any significant diel differences during the first 6 months. Escapement does not appear to be a major problem even as late as March, but some night/day adjustment probably will be made when all the data are analyzed. The larval herring towing speed of 3.5 knots is a compromise between slow hauls to minimize extrusion of small larvae and fast hauls to minimize escapement of larger larvae.

In February 1974 the USA (NEFC) began a series of February surveys to examine the overwinter survival of herring larvae. In June 1974 an ICNAF Environmental Working Group recommended more intensive studies of factors controlling the recruitment process of sea herring. A small bongo sampler (20 cm) with fine mesh nets (0.165 and 0.053 mm mesh; the 0.053 mm net was replaced with a 0.253 mm net the following year) was added to the 61 cm bongo array starting in autumn 1974. Since the 1975 season, sampling effort has been concentrated on the Georges Bank - Nantucket Shoals area (Figure 2) so that more frequent and intensive surveys could be made in this area of traditionally heavy spawning. A finer grid of plankton stations was employed in areas of heavy spawning aggregation, and more complete hydrographic coverage, as well as measures of nutrients, chlorophyll, and primary production were added when possible.

Neuston surface hauls (10 min duration) using a 1x2-m or ½x1-m hollow aluminum rectangular frame (0.505-mm mesh) generally were made at the same time as the bongo tows during the 1974-76 seasons.

1978 Patch Study

The ICNAF larval herring program culminated in 1978 with the multidisciplinary Georges Bank Larval Herring Patch Study (Lough 1979; Wright and Lough 1979). The objective of this study was to identify and follow a relatively small (<15 km) patch of recently hatched herring larvae to provide short-term (hours and days), fine-scale estimates of growth, mortality, and dispersal of a uniform age larval population in relation to similar scale variations in their physical and biological environment. Results learned from this special study will be used to evaluate larval population and environmental events observed from the standard mesoscale larval surveys. Strategies for combining microscale and mesoscale observations in larval fish studies have been developed in an ICES Report of the Working Group on the Distribution of Larval Fish (Anon. 1979).

1979 to Date

MARMAP ichthyoplankton surveys have supplanted the ICNAF larval herring surveys since 1979. The MARMAP program has provided at least six 30-day surveys per year since fall 1976 covering the coastal region between Cape Hatteras and the Scotian Shelf. During each survey approximately 135 stations are sampled, 25-35 km apart, with the standard array of large and small bongo nets described previously. In contrast to the ICNAF haul profile, the smooth-oblique ca. 1.5 kt bongo MARMAP hauls sample to a maximum depth of 200 m and are retrieved at a rate of 20 m/min.

SAMPLE PROCESSING

Each participating country initially was responsible for sorting and measuring herring larvae from the 0.505 mm mesh samples and reporting standardized summaries and results as ICNAF Research Documents in time for the annual meetings. The 0.333-mm mesh samples were supposed to have been saved for future sorting to provide a more refined analysis of larval herring as well as other ichthyoplankton, particularly for small larvae that may have been extruded through the coarser mesh (.505-mm). Also selected samples from the .333-mm series were to be processed for dominant zooplankton to describe the distribution and abundance of the larger planktonic prey organisms of larval fish.

Despite protocols to standardize the laboratory processing of the 0.505-mm mesh samples, various subsampling methods and length conventions (standard length, total length, nearest mm, mm below) have been used in sorting and measuring the larvae by the participants (see Table 1). These problems and their effect on larval length frequency distributions were examined by Lough (1975a). Usually all larval herring were removed from the

entire 0.505 sample; subsampling was required on samples of high larval densities. The size of the aliquot for counting and measuring larvae was not reported in most cases. The US typically measured up to 100 larvae per sample. Most of the 0.505 mm mesh larval herring measurements used in this report represent standard length to the nearest millimeter. Cruises using other measurement conventions have been corrected based on regression relationships from the literature. The corrected length-frequencies probably lie within $\pm$ 0.5 mm of the standard length to the nearest millimeter for preserved larvae.

Larval herring data in this report were processed from the 0.505 mm mesh, 61-cm bongo samples, representing 52 of the 57 cruises. Of the remaining five cruises, the 0.505 mm, 20-cm bongo samples were used from the three ALBATROSS IV cruises of the 1968-70 seasons, and the 0.333 mm, 61-cm bongo samples were used from the ANTON DOHRN 77-03 and ALBATROSS IV 78-02 cruises. As of January 1980, the total ichthyoplankton has been processed from all the 0.333 mm mesh, 61-cm bongo samples, 1971-76 seasons (29 cruises), by the Polish Sorting Center (Morski Instytut Rybacki) Szczecin, Poland, established in 1974. Standard MARMAP sorting protocols have been used on the 0.333 samples (Sherman et al. 1976; Sherman and Colton 1976) which should eliminate the subsampling and measurement inconsistencies of the 0.505 samples and reduce errors incurred from possible extrusion through the coarser mesh. Larval herring data from both the 0.333- and 0.505 mm mesh samples will be used in future analyses as soon as quality control on the .333 mm data is completed.

Basic station, haul, and standardized larval data from each cruise were processed through the MARMAP Biostatistical Unit, NEFC Narragansett, RI, and presented to us in the form of various standard computer summaries and plots (Station Activity Summary, Net Tow Data, Plankton Summary-station abundance of larvae by length categories). Examples of these computer outputs can be found in Lough (1976b). Various internal audits have been incorporated into the computer routines to provide quality control of the data in addition to the initial quality control procedures prior to computer entry. However, some discrepancies between the paired 0.333- and 0.505 sample series still have to be resolved. In some cases, pre-sorting of 0.333 mm samples (before shipment to the Polish Sorting Center) precludes their use for abundance estimates. In other cases 0.333 mm samples are missing. Consequently a mixture of 0.333- and 0.505 mm samples must be used for some surveys.

Preliminary temperature and salinity plots have been completed for most of the cruises and are available through Dr. W. Redwood Wright, Fishery Oceanography Investigation, NEFC, Woods Hole, MA. Information on the status of nutrients and primary production measurements made in recent years can be obtained from Dr. Marvin D. Grosslein, NEFC, Ecosystems Dynamics Investigation, as well as the status of zooplankton processing on samples from the same series.

PRESENTATION OF DATA

Larval herring catches were first standardized to numbers per m^2 sea surface area by 1 mm and 5 mm length classes and total numbers, and expanded to the average rectangular area ($1.16 \times 10^9 m^2$) represented by each standard station on the original sampling grid according to the following formula:

$$N = \frac{CZ}{Z} A$$

where N = number of larvae per square meter sea surface represented by station
C = catch of larvae
Z = depth of tow in meters
V = volume filtered by net in cubic meters
A = area in square meters represented by station.

When more than one sampling station was located within a standard rectangular area, an average larval abundance estimate was calculated.

The study area was divided into four subareas so that the larval data could be consolidated into the main spawning stocks or sites (Figure 3). For convenience, the Western Gulf of Maine larval herring subarea corresponds with ICNAF statistical subarea 5Y; the Eastern Gulf of Maine corresponds with the northwestern part of ICNAF subarea 4X; and the Georges Bank - Nantucket Shoals subarea, combined in this report, corresponds approximately to the northern part of ICNAF subarea 5Ze and 5Zw. For each cruise and subarea larval abundance was estimated by various length classes. Tables 2-4 summarize abundance of herring larvae by 5 mm length classes and total numbers for the Georges Bank - Nantucket Shoals, Western Gulf of Maine, and Eastern Gulf of Maine. Tables 5-57 list in chronological order individual cruise-subarea larval herring length frequency abundances by 1 mm size classes, sample mean length, standard deviation, and 95% confidence limits. Length frequency summary tables by 1 mm size classes for the 1971 season's RORQUAL cruises, Western Gulf of Maine are not included in this report as the data was available only as >10 mm, 10-15 mm, >15 mm length classes (Graham et al. 1972b, NEFC unpublished data). For each of the 57 cruises, the cruise track, stations sampled, and the number of larvae per 10 m^2 at each station for larvae less than 10 mm length and total larvae are plotted in Figures 4-159. Plots of larval abundance by other 5 mm length categories are not included here.

DISCUSSION

Herring, which have demersal eggs, typically spawn on gravelly or red algal substrate at a mean depth of 40 m or less, in waters characterized by strong mixing processes (Drapeau 1973, Cooper et al. 1975). Hatching of larvae at 4-6 mm occurs 8-9 days after spawning at a temperature of 10^oC (Cooper et al. 1975). Station abundance estimates of larvae less than 10 mm

length represent the recently hatched larvae and by noting their location and change in abundance between successive cruises, one can define major spawning sites and the general shape of the spawning curve for the various subareas. Spawning typically occurs progressively later from north to south in the study area. Recently hatched larvae (<10 mm length) are found from September-early October along the southwestern Scotian Shelf, particularly Lurcher Shoals, and along the coastal Western Gulf of Maine. The northeastern part of Georges Bank is another major spawning area where recently hatched larvae normally attain maximum abundance by late October. The Nantucket Shoals spawn hatch 1-2 weeks later than those on Georges Bank and typically peak in abundance by early November. Larvae from these spawning areas disperse rapidly and can be found at times in the Central Gulf of Maine and in the Slope Water south of Georges, but generally the bulk of the population is found throughout the season within the 100 m contour, the shoaler waters in which they originated. There is evidence to suggest that larvae from spawning sites along the southwestern Scotian Shelf are transported into the Bay of Fundy and may mix to some extent with larval populations from the Western Gulf of Maine. Larvae originating on northeastern Georges Bank typically disperse to the southwest across Georges at the rate of 1-2 miles per day (Bumpus 1976) and intermix with larvae originating from the Nantucket Shoals. There is little evidence from these data to suggest any significant cross transport of larvae between Georges Bank and Browns Bank, nor between coastal Western Gulf of Maine and Nantucket Shoals, at least as larvae during their first six months of life.

Survey coverage of the Georges Bank - Nantucket Shoals stations where larvae occurred was virtually complete from September through December for the 1971 and 1972 seasons, and from September through February for the 1973 through 1977 seasons (Table 2). A fairly even progression of larval abundance by successively larger size classes can be noted from cruise to cruise each season. The Georges Bank - Nantucket Shoals area represents our most complete and intensive time series of data. However, the shoal waters (<25 m) of Nantucket Shoals have not been sampled adequately in all years and this area may be an important nursery ground for larvae as well as juveniles. Also, at times the surveys have not been able to extend their coverage far enough off the southern edge of the shelf and, also at times, the most western limit of Southern New England waters to encompass the larval population through the course of their early life. Other possible sources of error in the estimation of larval abundance are discussed by Lough, et al. (1979).

Coverage of the Western Gulf of Maine is much less complete in terms of surveys encompassing entire spawning seasons, and stations occupied, and especially so for the Eastern Gulf of Maine (Tables 3 and 4). Sampling was done only on the southwestern Scotian Shelf which leaves the possibility that larvae observed there may have been transported into this area from the northeastern Scotian Shelf. The inshore Western Gulf of Maine area was covered fairly intensively when a cruise was mounted but a series of back-to-back cruises was not carried out in most years to provide a time series of data comparable to that for the Georges Bank - Nantucket Shoals area. The 1971, 1972, and 1974 seasons provide the best seasonal sampling coverage for the coastal Western Gulf of Maine and the 1971, 1973, 1974, and 1975 seasons, for the Eastern Gulf of Maine.

Preliminary analyses on various parts of the larval herring data base have been made by participating scientists primarily in ICNAF or ICES Research Documents, notably by Graham, et al. (1972a, b, 1973), Schnack (1974a, b, 1975), Bumpus (1976), and Lough (1976b) with a recent preliminary analysis of the entire time series by Lough, et al. (1979) and Lough and Bolz (1979). Supplementary data on the older herring larvae collected during winter-spring cruises in the Georges Bank area have been reported by Joakimsson (1976), Davis (1975), Davis and Morris (1976), and Grimm (1977). Additional data is available through NEFC from spring groundfish and MARMAP plankton sampling in the form of data tables. Most of the winter-spring larval herring data are fragmentary in terms of timing and coverage, and on the MARMAP cruises somewhat different sampling methods were used. Preliminary larval herring otolith aging analysis has been reported by Rosenberg and Lough (1976) and larval herring gut content and condition factor analyses by Damkaer and Au (1974) and Cohen and Lough (1979). Studies of the ichthyoplankton community or, on larval species other than herring utilizing parts of the ICNAF larval herring data base, have been reported by Colton and Byron (1977), Colton, et al. (1978), Smith, et al. (1978, 1979), Grimm (1978), Joakimsson (1978), and Bolz, et al. (1979). Zooplankton studies have been reported by Drzyeimski, et al. (1974) and Dubé, et al. (1977). Georges Bank phytoplankton species have been enumerated by Ringer (1978). Nutrients, chlorophyll, and primary production studies have been reported by Cohen and Wright (1978, 1979), Cohen, et al. (1979), and O'Reilly and Busch (1979). Summaries of hydrographic observations have been made by Barinov and Bryantsev (1971), Furtak (1973), Bryantsev (1974), Sigaev (1974), Schlitz (1975), Pawlowski and Schlitz (1976), Schlitz (1976), Wright (1977), Furtak (1978), and Sigaev (1978). A correlation of water temperature with spawning times for Georges Bank herring was made by Berenbeim and Sigaev (1978).

The last comprehensive review of the status of the ICNAF larval herring data base was held 20-23 June 1977 at the Polish Sorting Center in Szczecin. A detailed report of the workshop (Grosslein 1977) is available upon request. The next meeting of the Larval Herring Program Task Force to undertake the analyses of the extensive data base will be held 28 April-2 May 1980 in Woods Hole, Massachusetts (see NAFO Circular Letter 80/3).

REFERENCES

Anon. 1979. Report of the Working Group on the Distribution of Larval Fish, Copenhagen, Denmark, 16 to 19 May 1978, and Woods Hole, Massachusetts, USA, 6 April 1979. ICES C.M. 1979/L:10.

Barinov, A. A., and V. A. Bryantsev. 1971. A volumetric statistical analysis of the Nova Scotia Shelf and Georges Bank water masses. ICNAF Res. Doc. 71/41.

Berenbeim, D. Y., and I. K. Sigaev. 1978. On the correlation between water temperature and the spawning times for Georges Bank herring. ICNAF Selected Papers No. 3, 57-59.

Bolz, G. R., R. G. Lough, and D. C. Potter. 1980. Autumn and winter abundance and distribution of ichthyoplankton on Georges Bank and Nantucket Shoals, 1974-1976, with special emphasis on dominant species. In ICES Symposium on the Early Life History of Fish. Woods Hole, Mass. 2-5 April 1979. ICNAF Spec. Publ. (Abstract in press).

Boyar, H. C., R. R. Marak, F. E. Perkins, and R. A. Clifford. 1973. Seasonal distribution and growth of larval herring (*Clupea harengus* L.) in the Georges Bank-Gulf of Maine area from 1962 to 1970. J. Cons. Int. Explor. Mer 35:36-51.

Bryantsev, V. A. 1974. Water temperatures in the Nova Scotian Shelf and Georges Bank areas, 1960-68. ICNAF Res. Doc. 74/52.

Bumpus, D. F. 1976. Review of the physical oceanography of Georges Bank. ICNAF Res. Bull. No. 13:11-134.

Cohen, E. B., and W. R. Wright. 1978. Changes in the plankton on Georges Bank in relation to the physical and chemical environment during 1975-76. ICES C.M. 1978/L:27.

Cohen, E. B., M. D. Grosslein, M. P. Sissenwine, and F. Steimle. 1979. An energy budget of Georges Bank. Presented at a workshop on "Multispecies approaches to fisheries management." St. John's, Newfoundland, 26-30 Nov. 1979. 36 p. ms.

Cohen, E. B., and W. R. Wright. 1979. Primary productivity on Georges Bank with an explanation of why it is so high. NMFS, Northeast Fisheries Center, Woods Hole Lab. Ref. No. 79-53, 7 p.

Cohen, R. E., and R. G. Lough. 1979. Laboratory and data processing methods recommended for larval fish gut content and condition factor analysis studies using larval sea herring (*Clupea harengus* L.) as a prototype. NMFS, Northeast Fisheries Center, Woods Hole Lab. Ref. No. 79-39. 64 p.

Colton, J. B., Jr., and J. R. Green. 1975. Progress report on analysis of samples and behavior-related variation in the catch of larval herring on ICNAF larval herring surveys. ICNAF Res. Doc. 75/108.

Colton, J. B., Jr., and R. Byron. 1977. Gulf of Maine-Georges Bank ichthyoplankton collected on ICNAF larval herring surveys, September 1971-February 1975. NOAA Tech. Rep. NMFS SSRF-717, 35 p.

Colton, J. B., Jr., W. Smith, A. Kendall, P. Berrien, and M. Fahay. 1978. Principal spawning areas and times of marine fishes, Cape Sable to Cape Hatteras. Fish. Bull. 76:911-915.

Cooper, R. A., J. R. Uzmann, R. A. Clifford, and K. J. Pecci. 1975. Direct observations of herring egg beds on Jeffreys Ledge, Gulf of Maine in 1974. ICNAF Res. Doc. 75/93.

Damkaer, D. M., and D. W. K. Au. 1974. A preliminary investigation of the food of larval herring from Georges Bank. ICNAF Res. Doc. 74/68.

Davis, C. W. 1975. Preliminary results of juvenile fish survey on Georges Bank and Nantucket Shoals by ALBATROSS IV, 12-33 May 1975. ICNAF Res. Doc. 75/118.

Davis, C. W., and T. L. Morris. 1976. Preliminary report on the distribution, catches, and sizes of Age I herring in the Gulf of Maine, Georges Bank, and Nantucket Shoals during the spring of 1976. ICNAF Res. Doc. 76/VI/114.

Drapeau, E. 1973. Sedimentology of herring spawning grounds on Georges Bank. ICNAF Res. Bull. No. 10:151-162.

Drzyeimski, I., B. Kaczmaruk, and J. Kleniewski. 1976. Distribution of zooplankton on the fishing grounds of Georges Bank, Browns Bank, and the Gulf of Maine, Autumn 1974. ICNAF Res. Doc. 76/VI/97.

Dubé, G. P., R. G. Lough, and R. E. Cohen. 1977. Comparison of Georges Bank zooplankton community in relation to growth and mortality of herring larvae during two winters. ICES C.M. 1977/L:27.

Furtak, A. 1973. Environmental conditions in the region of Georges Bank, Gulf of Maine, Nantucket Shoal, and the western part of the Nova Scotia Shelf, 2-28 October 1972. ICNAF Res. Doc. 73/21.

Graham, J. J., and S. B. Chenoweth. 1973. Distribution and abundance of larval herring, Clupea harengus harengus Linnaeus, over egg beds on Georges Bank. ICNAF Res. Bull. No. 10:141-149.

Graham, J. J., S. B. Chenoweth, and C. W. Davis. 1972a. Abundance, distribution movements, and lengths of larval herring along the western coast of the Gulf of Maine. Fish. Bull. 70:307-321.

Graham, J. J., C. W. Davis, S. B. Chenoweth, and B. C. Bickford. 1972b. Autumnal distribution, abundance, and dispersion of larval herring, Clupea harengus harengus Linnaeus, along the western coast of the Gulf of Maine in 1971. ICNAF Res. Doc. 72/7.

Graham, J. J., C. W. Davis, and B. C. Bickford. 1973. Autumnal distribution, abundance, and dispersion of larval herring, Clupea harengus harengus Linnaeus, along the western coast of the Gulf of Maine in 1972. ICNAF Res. Doc. 73/12.

Grimm, S. 1977. Distribution abundance, growth, and mortality of herring larvae on Nantucket Shoals and Georges Bank in Spring 1976 -Region 5Z. Sea Fisheries Institute, Gdynia, Poland. (Unpub. MS).

Grimm, S. 1978. Composition of Georges Bank ichthyoplankton community in October 1977. ICES C.M. 1978/L:16.

Grosslein, M. D. 1977. Report of a workshop on Georges Bank larval herring studies, Szczecin, Poland, 20-23 June 1977. NMFS, Northeast Fisheries Center, Woods Hole Lab. (unpub. rept).

Joakimsson, G. 1976. Report of larval herring catches from the cruises of R/V WALTHER HERWIG and R/V ANTON DOHRN in March 1973-1976. ICNAF Res. Doc. 76/VI/79.

Joakimsson, G. 1978. On the occurrence and distribution of fish larvae on Georges Bank and Nantucket Shoals in November 1972-1977 (1976 excluded). ICES C.M. 1978/L:39.

Lough, R. G. 1976a. Analysis of various length measurements on larvae collected by the ICNAF larval herring surveys. ICNAF Res. Doc. 76/VI/58.

Lough, R. G. 1976b. The distribution and abundance, growth and mortality of Georges Bank - Nantucket Shoals herring larvae during the 1975-76 winter period. ICNAF Res. Doc. 76/VI/123.

Lough, R. G. 1979. Larval herring patch study. ICNAF Res. Doc. 79/VI/116.

Lough, R. G., and G. R. Bolz. 1979. Abundance and distribution of sea herring (Clupea harengus L.) larvae in relation to spawning stock size and recruitment in the Gulf of Maine region, 1968-1978. NMFS, Northeast Fisheries Center, Woods Hole Lab. Ref. No. 79-50, 25 p.

Lough, R. G., G. R. Bolz, M. D. Grosslein, and D. C. Potter. 1979. Abundance and survival of sea herring (Clupea harengus L.) larvae in relation to environmental factors, spawning stock size, and recruitment for the Georges Bank area, 1968-1977 seasons. ICNAF Res. Doc. 79/VI/112.

O'Reilly, J. E., and D. A. Busch. 1979. Summary of primary productivity on MARMAP surveys (Belogorsk 78-01, 78-03, 78-04). NMFS, Northeast Fisheries Center, Sandy Hook Lab. Ref. No. 79-09.

Pawlowski, R. J., and R. J. Schlitz. 1976. A preliminary report of data collected on a co-operative hydrographic investigation of the Northeast Channel, 1975. ICNAF Res. Doc. 76/VI/77.

Ringer, F. 1978. Results of phytoplankton studies on Georges Bank - Nantucket Shoals in 1976-1977. ICES C.M. 1978/L:13.

Rosenberg, A. S., and R. G. Lough. 1977. Preliminary report on the age and growth of larval herring (Clupea harengus) from daily growth increments in otoliths. ICES Res. Doc. C.M. 1977/L:26.

Schlitz, R. 1975. A preliminary summary of hydrographic data collected on ICNAF larval herring surveys, 1971-1973. ICNAF Res. Doc. 75/111.

Schlitz, R. J. 1976. Horizontal temperature sections from data collected on ICNAF larval herring surveys, fall-winter 1975. ICNAF Res. Doc. 76/VI/78.

Schnack, D. 1974a. Notes on ICNAF joint larval herring surveys in Georges Bank-Gulf of Maine area in 1971 and 1975. ICNAF Res. Doc. 74/15.

Schnack, D. 1974b. Summary report of the 1973 ICNAF joint larval herring survey in Georges Bank-Gulf of Maine area. ICNAF Res. Doc. 74/105.

Schnack, D. 1975. Summary of the ICNAF joint larval herring surveys in Georges Bank-Gulf of Maine areas, September-December 1974. ICNAF Res. Doc. 75/112.

Sherman, K., and J. B. Colton, Jr. 1976. Interim sorting protocol for ICNAF zooplankton samples. ICNAF Res. Doc. 76/VI/84.

Sherman, K., J. Green, and E. Cohen. 1976. Variation in subsampling of zooplankton from the ICNAF area. ICNAF Res. Doc. 76/VI/81.

Sigaev, I. K. 1974. Characteristic features of the hydrological conditions on the Nova Scotia Shelf and Georges Bank, 1972. ICNAF Res. Doc. 74/51.

Sigaev, I. K. 1978. Intra-year variability of geostrophic circulation on the continental shelf off New England and Nova Scotia. ICNAF Selected Papers No. 3, 97-107.

Smith, P. E., and S. Richardson. 1977. Standard techniques for pelagic fish egg and larvae surveys. FAO Fish. Tech. Paper No. 175, 100 p.

Smith, W. G., M. Pennington, P. Berrien, J. Sibunka, M. Konieczna, M. Baranowski, and E. Meller. 1979. Annual changes in the distribution and abundance of Atlantic cod and haddock larvae off the northeastern United States between 1973-74 and 1977-78. ICES C.M. 1979/G:47.

Smith, W. G., L. Sullivan, and P. Berrien. 1978. Fluctuations in production of sand lance larvae in coastal waters off the northeastern United States. ICES C.M. 1978/L:30.

Wood, R. J. 1975. On catches of small herring larvae. ICES C.M. 1975/H:23.

Wright, W. R. 1977. High salinity in the Georges Bank region in February 1977. ICES Annales Biologiques 34:34-35.

Wright, W. R., and R. G. Lough. 1979. The Georges Bank larval herring patch study of 1978. A preliminary report. ICES C.M. 1979/L:36.

Table 1. Summary of cruise data, 1968-78, used in the abundance estimates of larval herring in the Georges Bank - Gulf of Maine area.

Vessel	Cruise Number	Survey type	Dates	Geographical Area Code	Gear	Mesh size sorted (microns)	Number of stations sorted	Larval herring length measurement convention
			1968					
1) ALBATROSS IV	68-17	GF II,III	28 Oct.-26 Nov.	1-6	20 cm bongo	505	134	TL, Nmm
			1969					
2) ALBATROSS IV	69-11	GF II,III	27 Oct.-23 Nov.	1-6	20 cm bongo	505	113	TL, Nmm
			1970					
3) ALBATROSS IV	70-06	GF II,III	15 Oct.-21 Nov.		20 cm bongo	505	180	TL, Nmm
			1971					
4) RORQUAL	R-4-71	LH	09-16 Sept.	6	60 cm bongo	505	49	TL, Nmm
5) CRYOS	71-01	LH	09-24 Sept.	1,2,4,6,7	60 cm bongo	505	116	?TL, Nmm
6) DELAWARE II	71-04	LH	21 Sept.-04 Oct.	1,2,4,6,7	60 cm bongo	505	123	SL, Nmm
7) RORQUAL	R-5-71	LH	22 Sept.-01 Oct.	6	60 cm bongo	505	47	TL, Nmm
8) VIANDRA	71-01	LH	09-25 Oct.	1,2,4-6	60 cm bongo	505	107	?SL, mmB
9) RORQUAL	R-6-71	LH	13-25 Oct.	6	60 cm bongo	505	48	TL, Nmm
10) RORQUAL	R-7-71	LH	27 Oct.-08 Nov.	6	60 cm bongo	505	47	TL, Nmm
11) WALTHER HERWIG	71-01	LH	28 Oct.-12 Nov.	1,2,4,6,7	60 cm bongo	505	118	SL, mmB
12) ALBATROSS IV	71-07	LH	02 - 17 Dec.	1,2,4-7	60 cm bongo	505	155	SL, Nmm
			1972					
13) LUCILLE B	72-01	LH	02-06 Sept.	6	60 cm bongo	505	11	TL, Nmm
14) ALBATROSS IV	72-07	LH	21-24 Sept.	6	60 cm bongo	505	63	SL, Nmm
15) ARGUS	72-01	LH	22-30 Sept.	1,4	60 cm bongo	505	70	SL, Nmm
16) WIECZNO	72-01	LH	02-28 Oct.	1,2,4-7	60 cm bongo	505	130	TL, Nmm
17) ARGUS	72-02	LH	12-28 Oct.	1,2,4,6,7	60 cm bongo	505	111	SL, Nmm
18) DUCHESS II	72-01	LH	18-22 Oct.	6	60 cm bongo	505	63	TL, Nmm
19) ANTON DOHRN	72-01	LH	31 Oct.-12 Nov.	1,2,4,6,7	60 cm bongo	505	105	TL, mmB
20) DUCHESS II	72-02	LH	06-12 Nov.	6	60 cm bongo	505	63	TL, Nmm
21) ALBATROSS IV	72-09	LH	02-20 Dec.	1,2,4-7	60 cm bongo	505	127	SL, Nmm
			1973					
22) CRYOS	73-01	LH	16-28 Sept.	1,2,4	60 cm bongo	505	76	TL, Nmm
23) WIECZNO	73-40	LH	28 Sept.-20 Oct.	1,2,4-7	60 cm bongo	505	140	SL, mmB
24) BELOGORSK	73-01	LH	15 Oct.-01 Nov.	1,2,4,6,7	60 cm bongo	505	119	?TL, mmB
25) WALTHER HERWIG	73-43	LH	28 Oct.-08 Nov.	1,2,4,6,7	60 cm bongo	505	121	SL, mmB
26) ALBATROSS IV	73-08	GF III	30 Oct.-20 Nov.	4,6,7	60 cm bongo	505	53	SL, Nmm
27) ALBATROSS IV	73-09	LH	04-20 Dec.	1,2,7	60 cm bongo	505	111	SL, Nmm
28) ALBATROSS IV	74-02	LH	11-22 Feb.	1,2	60 cm bongo	505	58	SL, Nmm

Table 1. continued

			1974					
29) CRYOS	74-04	LH	07-24 Sept.	1,2,4,7	60 cm bongo	505	115	SL, Nmm
30) DUCHESS	74-01	LH	09-14 Sept.	6	60 cm bongo	505	20	SL, Nmm
31) WIECZNO	74-01	LH	27 Sept.-18 Oct.	1,2,4-7	60 cm bongo	505	145	SL, mmB
32) DELAWARE II	74-12	LH	08-16 Oct.	6	60 cm bongo	505	56	SL, Nmm
33) PROGNOZ	74-01	LH	18-30 Oct.	1,2	60 cm bongo	505	90	TL, mmB
34) ALBATROSS IV	74-11	GF III	30 Oct.-12 Nov.	4,5,6,7	60 cm bongo	505	52	SL, Nmm
35) ANTON DOHRN	74-01	LH	16-23 Nov.	1,2	60 cm bongo	505	75	SL, mmB
36) ALBATROSS IV	74-13	LH	04-19 Dec.	1,2,5,7	60 cm bongo	505	108	SL, Nmm
37) ALBATROSS IV	75-02	LH	12-28 Feb.	1,2	60 cm bongo	505	86	SL, Nmm
			1975					
38) CHALLENGE	75-01	LH	04-09 Sept.	6	60 cm bongo	505	22	SL, Nmm
39) DELAWARE II	75-15	LH	23 Sept.-02 Oct.	6,7	60 cm bongo	333	77	SL, Nmm
40) BELOGORSK	75-02	LH	25 Sept.-08 Oct.	1,2	60 cm bongo	505	90	?SL, mmB
41) ALBATROSS IV	75-12	GF II	07-23 Oct.	6	60 cm bongo	505	16	SL, Nmm
42) BELOGORSK	75-03	LH	17-30 Oct.	1,2	60 cm bongo	505	85	?SL, mmB
43) ANTON DOHRN	75-187	LH	01-18 Nov.	1,2,7	60 cm bongo	505	143	SL, mmB
44) ALBATROSS IV	75-12	GF III	07-18 Nov.	4-7	60 cm bongo	505	32	SL, Nmm
45) ALBATROSS IV	75-14	LH	05-17 Dec.	1,2	60 cm bongo	505	94	SL, Nmm
46) ALBATROSS IV	76-01	LH	10-25 Feb.	1,2	60 cm bongo	505	116	SL, Nmm
			1976					
47) ANNANDALE	76-01	LH	01-18 Oct.	6,7	60 cm bongo	505	80	SL, Nmm
48) WIECZNO	76-03	LH	14 Oct.-03 Nov.	1,2,7	60 cm bongo	505	112	SL, Nmm
49) ALBATROSS IV	76-09	GF III	09-23 Nov.	4-6	60 cm bongo	505	22	SL, Nmm
50) ANTON DOHRN	76-02	LH	15-29 Nov.	1,2,7	60 cm bongo	505	134	SL, Nmm
51) RESEARCHER	76-01	LH	27 Nov.-11 Dec.	1,2,7	60 cm bongo	505	110	SL, Nmm
52) MT MITCHELL	77-01	LH	13-24 Feb.	1,2,7	60 cm bongo	505	118	SL, Nmm
			1977					
53) WIECZNO	77-06	LH	04-24 Oct.	1,2,7	60 cm bongo	505	148	SL, Nmm
54) ARGUS	77-01	LH	15 Oct.-11 Nov.	4-6	60 cm bongo	505	23	SL, Nmm
55) ANTON DOHRN	77-03	LH	01-18 Nov.	1,2	60 cm bongo	333	115	SL, Nmm
56) DELAWARE II	77-13	LH	08-20 Dec.	1,2	60 cm bongo	505	62	SL, Nmm
			1978					
57) ALBATROSS IV	78-02	LH	14 Feb.-8 Mar.	1,2	60 cm bongo	333	105	SL, Nmm
					Total		5106	

GF = Groundfish
LH = Larval herring

Geographical Area Code

1 = Georges Bank
2 = Nantucket Shoals
3 = Southern New England
4 = Eastern Gulf of Maine (Scotian Shelf)
5 = Central Gulf of Maine
6 = Western Gulf of Maine
7 = Jeffreys Ledge
8 = Bay of Fundy

SL, Nmm = Standard Length, nearest mm
SL, mmB = Standard Length, mm Below
TL, Nmm = Total length, Nearest mm
TL, mmB = Total length, mm Below

Table 2. Summary of estimated abundance of herring larvae by length classes for each cruise in the Georges Bank-Nantucket Shoals area, 1968-77 seasons.

Year	Vessel	Cruise No.	Middate of cruise	Area Surveyed ($m^2 \times 10^9$)	Percentage positive area for larvae	Cruise Estimated Abundance (No. Larvae x 10^{-9}) By Size Class (mm) <10	10-15	15-20	20-25	25-30	30-35	35-40	>40	Total
1968	Albatross IV	68-17	28 Oct.	63.80	54.55	117.70	165.30	139.50	15.60	1.10				439.20
1969	Albatross IV	69-11	01 Nov.	61.48	41.51	12.50	539.50	427.20	32.50	7.20	0.30			1019.20
1970	Albatross IV	70-60	22 Oct.	76.56	51.52	416.90	535.90	51.90	11.00					1015.70
1971	Cryos	71-01	16 Sep.	78.88	17.65	224.23	14.78							239.01
	Delaware II	71-04	27 Sep.	82.36	26.76	395.15	64.34	27.30	0.26	0.06				487.11
	Viandra	71-01	17 Oct.	77.14	60.15	322.21	260.48	155.87	67.45	16.10	0.24			822.35
	Walther Herwig	71-01	05 Nov.	81.20	47.14	99.64	332.25	85.13	31.57	7.29	1.34			557.22
	Albatross IV	71-07	09 Dec.	83.52	55.56	3.11	28.26	214.29	103.59	4.21	0.32			353.78
1972	Argus	72-01	26 Sep.	52.20	17.78	64.35	48.12	2.50	0.12					115.09
	Wieczno	72-01	14 Oct.	92.80	46.25	313.14	394.25	116.58	3.42	0.75				828.14
	Argus	72-02	20 Oct.	87.00	58.67	807.91	322.25	314.41	21.61					1466.18
	Anton Dohrn	72-01	05 Nov.	90.48	66.67	258.61	214.05	57.32	10.29	0.16				540.43
	Albatross IV	72-09	10 Dec.	93.96	61.73	1.01	73.51	80.92	24.08	2.38	0.24			182.14
1973	Cryos	73-01	19 Sep.	51.04	13.64	136.22	5.26							141.48
	Wieczno	73-40	09 Oct.	92.80	42.50	2661.04	600.80	121.82	8.01					3391.67
	Belogorsk	73-01	23 Oct.	93.96	70.37	6557.43	1495.71	808.18	52.27	0.32	0.16			8917.07
	Walther Herwig	73-43	02 Nov.	92.80	77.50	2624.32	779.52	517.92	88.29	10.75				4020.80
	Albatross IV	73-09	13 Dec.	95.12	86.59	105.87	136.09	476.69	269.75	9.60	0.65			998.65
1974	Albatross IV	74-02	14 Feb.	66.12	54.39	0.40	0.43	7.99	21.90	16.96	2.97			50.65
1974	Wieczno	74-01	07 Oct.	96.28	24.10	1524.46	5.96	0.92						1531.34
	Prognoz	74-01	24 Oct.	91.64	72.15	4635.68	833.94	53.11	1.98					5524.71
	Anton Dohrn	74-01	19 Nov.	81.20	81.43	1196.33	648.14	429.29	41.90	1.24				2316.82
	Albatross IV	74-13	13 Dec.	96.28	74.70	16.37	523.21	454.60	201.42	17.54	0.68			1213.82
1975	Albatross IV	75-02	14 Feb.	91.64	48.10			1.32	16.30	37.68	14.66	0.96	0.19	71.11
1975	Belogorsk	75-02	01 Oct.	93.96	15.43	65.02	0.47	0.63						66.12
	Belogorsk	75-03	23 Oct.	95.12	60.37	2426.26	529.40	14.19						2969.85
	Anton Dohrn	75-187	09 Nov.	100.92	70.11	497.71	854.27	241.66	2.20					1595.84
	Albatross IV	75-14	09 Dec.	96.28	62.65	7.02	31.91	125.52	42.05	4.06	0.17			210.73
1976	Albatross IV	76-01	16 Feb.	99.76	45.35				1.95	44.47	86.14	16.13		148.69
1976	Wieczno	76-03	24 Oct.	96.28	15.36	2.39	23.84	5.89	0.12					32.24
	Anton Dohrn	76-02	22 Nov.	96.28	20.48		0.30	3.49	8.01	0.40				12.20
	Researcher	76-01	04 Dec.	84.68	31.85		0.15	2.49	7.10	1.11				10.85
1977	Mt. Mitchell	77-01	18 Feb.	95.12	23.48					1.55	3.72	1.77		7.04
1977	Wieczno	77-06	14 Oct.	63.80	21.79	306.48	77.62	5.69	2.56					392.35
	Anton Dohrn	77-03	09 Nov.	93.96	49.38	16.40	111.70	215.53	2.42					346.05
	Delaware II	77-13	14 Dec.	68.44	34.75		7.96	0.90	5.97	2.21				17.04
1978	Albatross IV	78-02	24 Feb.	96.28	16.87				0.30	1.25	2.13	2.16	0.43	6.27

Table 3. Summary of estimated abundance of herring larvae by length classes for each cruise in the Western Gulf of Maine, 1969-77 seasons.

Year	Vessel	Cruise No.	Middate of Cruise	Area Surveyed ($m^2 \times 10^9$)	Percentage Positive Area for Larvae	Cruise Estimated Abundance (No. Larvae $\times 10^{-9}$) by Size Class (mm)								
						<10	10-15	15-20	20-25	25-30	30-35	35-40	>40	Total
1969	ALBATROSS IV	69-11	01 Nov.	25.76	21.74	-	0.50	2.50	-	-	-	-	-	3.00
1970	ALBATROSS IV	70-06	22 Oct.	28.00	48.00	4.20	1.55	1.90	2.10	0.50	-	-	-	10.25
1971	RORQUAL[1]	R-4-71	12 Sep.	21.84	46.15	31.70	40.29	8.76	-	-	-	-	-	80.75
	RORQUAL[1]	R-5-71	26 Sep.	21.84	66.67	29.21	38.33	53.01	-	-	-	-	-	120.55
	VIANDRA	71-01	18 Oct.	19.04	35.29	-	0.71	0.91	0.92	0.26	-	-	-	2.80
	RORQUAL[1]	R-6-71	19 Oct.	21.84	100.00	353.04	50.50	35.00	-	-	-	-	-	438.54
	RORQUAL[1]	R-7-71	02 Nov.	21.84	100.00	4.95	31.28	45.23	-	-	-	-	-	81.46
	WALTHER HERWIG	71-01	04 Nov.	15.68	28.57	-	0.11	1.00	1.22	0.11	-	-	-	2.44
	ALBATROSS IV	71-07	10 Dec.	36.96	24.24	-	-	1.05	2.80	0.96	0.52	-	-	5.33
1972	LUCILLE B.	72-01	04 Sep.	25.20	22.22	43.74	13.22	0.75	-	-	-	-	-	57.71
	ALBATROSS IV	72-07	22 Sep.	25.20	75.56	73.23	98.00	35.60	2.40	0.14	-	-	-	209.37
	WIECZNO	72-01	16 Oct.	19.04	47.06	-	2.70	2.50	2.20	1.00	-	-	-	8.40
	DUCHESS II	72-01	20 Oct.	25.20	100.00	91.60	99.10	49.50	30.60	7.00	-	-	-	277.80
	ARGUS	72-02	21 Oct.	12.32	45.45	0.30	2.70	4.20	1.40	0.50	-	-	-	9.10
	ANTON DOHRN	72-01	06 Nov.	12.32	63.64	5.30	2.80	1.90	1.70	0.20	0.30	-	-	12.20
	DUCHESS II	72-02	10 Nov.	25.20	100.00	0.91	19.70	61.60	48.70	13.10	2.50	0.40	-	146.91
	ALBATROSS IV	72-09	10 Dec.	15.68	57.14	-	-	0.50	3.90	1.10	0.30	-	-	5.80
1973	CRYOS	73-01	23 Sep.	4.48	50.00	-	0.60	1.50	0.30	-	-	-	-	2.40
	WIECZNO	73-40	09 Oct.	20.16	27.78	-	-	2.50	1.20	-	-	-	-	3.70
	BELOGORSK	73-01	24 Oct.	15.68	42.86	1.90	1.30	2.30	0.50	0.90	-	-	-	6.90
	WALTHER HERWIG	73-43	02 Nov.	17.92	50.00	-	0.20	3.70	3.70	0.50	-	-	-	3.10
	ALBATROSS IV	73-08	09 Nov.	17.92	62.50	13.70	2.30	8.00	3.90	3.30	0.60	-	-	31.80
1974	DUCHESS	74-01	12 Sep.	12.32	81.82	69.70	57.10	18.10	0.60	0.60	-	-	-	146.10
	WIECZNO	74-01	07 Oct.	29.12	46.15	2.40	6.70	7.80	3.20	0.50	-	-	-	20.60
	DELAWARE II	74-12	13 Oct.	25.20	88.89	345.00	147.00	59.30	22.60	1.40	-	-	-	575.30
	ALBATROSS IV	74-11	05 Nov.	21.28	78.95	132.10	49.30	57.80	26.40	3.90	-	-	-	269.50
	ALBATROSS IV	74-13	12 Dec.	17.92	87.50	0.40	1.50	7.30	4.90	0.20	-	-	-	14.30
1975	CHALLENGE	75-01	07 Sep.	13.44	66.67	153.20	18.10	5.50	0.40	-	-	-	-	177.20
	DELAWARE II	75-15	28 Sep.	28.00	64.00	1021.40	29.00	34.70	36.20	0.94	-	-	-	1122.40
	ALBATROSS IV	75-12 II	16 Oct.	29.12	50.00	15.20	9.70	7.40	1.00	0.20	-	-	-	33.50
1976	ANNANDALE	76-01	10 Oct.	28.00	92.00	46.60	336.90	148.80	10.80	2.10	0.20	-	-	545.40
	ALBATROSS IV	76-09	17 Nov.	13.44	50.00	-	1.30	19.50	2.40	0.40	-	-	-	23.60
1977	ARGUS	77-01	03 Nov.	20.16	38.89	1.00	82.40	28.20	3.60	-	-	-	-	115.20

[1]For RORQUAL cruises, the 15-20 column should read >15.

Table 4. Summary of estimated abundance of herring larvae by length classes for each cruise in the Eastern Gulf of Maine (Scotian Shelf), 1969-77 seasons.

Year	Vessel	Cruise No.	Middate of Cruise	Area Surveyed ($m^2 \times 10^9$)	Percentage Positive Area for Larvae	Cruise Estimated Abundance (No. Larvae x 10^{-9}) by Size Class (mm)								
						<10	10-15	15-20	20-25	25-30	30-35	35-40	>40	Total
1969	ALBATROSS IV	69-11	01 Nov.	28.00	16.00		0.20	1.10	0.80		-	-	-	2.10
1970	ALBATROSS IV	70-06	22 Oct.	34.72	16.13	0.40	4.30	3.70	0.90	1.50	-	-	-	10.30
1971	CRYOS	71-01	16 Sep.	28.00	16.00	32.06	8.05	0.46	0.30	0.12	-	-	-	40.99
	DELAWARE II	71-04	27 Sep.	29.12	15.38	50.45	117.38	13.31	0.89	-	-	-	-	182.03
	VIANDRA	71-01	18 Oct.	21.28	15.79	0.23	0.45	1.18	-	-	-	-	-	1.86
	WALTHER HERWIG	71-01	04 Nov.	28.00	28.00	0.12	5.57	5.43	1.07	0.17	-	-	-	12.36
	ALBATROSS IV	71-07	10 Dec.	30.24	29.63	-	13.78	37.58	10.91	.77	-	-	-	63.04
1972	WIECZNO	72-01	16 Oct.	31.36	42.86	6.70	41.50	47.70	20.10	1.1	-	-	-	117.10
	ARGUS	72-02	21 Oct.	23.52	33.33	-	3.20	2.20	1.00	-	-	-	-	6.40
	ANTON DOHRN	72-01	06 Nov.	14.56	15.38	-	0.24	0.23	-	-	-	-	-	0.47
	ALBATROSS IV	72-09	10 Dec.	24.10	51.12	-	0.70	8.40	16.50	2.40	0.30	-	-	28.30
1973	CRYOS	73-01	23 Sep.	29.12	34.62	105.60	128.10	28.70	1.80	-	-	-	-	264.20
	WIECZNO	73-40	09 Oct.	31.36	53.57	4.10	118.20	115.90	17.70	-	-	-	-	255.90
	BELOGORSK	73-01	24 Oct.	26.88	37.50	2.60	15.20	165.80	22.50	2.00	-	-	-	208.10
	WALTHER HERWIG	73-43	02 Nov.	28.00	64.00	2.20	6.80	12.50	1.30	-	-	-	-	22.80
	ALBATROSS IV	73-08	09 Nov.	20.16	72.22	3.50	14.00	19.30	3.40	-	-	-	-	40.20
1974	CRYOS	74-04	16 Sep.	29.12	19.23	200.00	14.20	1.60	0.50	-	-	-	-	216.30
	WIECZNO	74-01	07 Oct.	35.84	46.88	194.10	1170.00	162.50	17.60	0.20	-	-	-	1544.40
	ALBATROSS IV	74-11	05 Nov.	22.40	80.00	2.90	10.00	28.60	10.50	0.20	-	-	-	52.20
1975	DELAWARE II	75-15	28 Sep.	26.88	25.00	111.90	125.10	20.70	3.90	-	-	-	-	261.60
	ALBATROSS IV	75-12III	13 Nov.	11.20	80.00	1.10	38.70	22.30	1.30	0.30	-	-	-	63.70
1976	ALBATROSS IV	76-09	17 Nov.	12.32	36.36	-	1.60	7.30	0.50	-	-	-	-	9.40
1977	ARGUS	77-01	03 Nov.	5.60	20.00	0.60	-	3.00	-	-	-	-	-	3.60

Table 5. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 68-17, 28 October - 26 November 1968.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5	10.70		
6	15.40		
7	30.30		
8	27.40		
9	33.90		
10	38.30		
11	39.60		
12	32.10		
13	31.20		
14	24.10		
15	36.30		
16	29.40		
17	24.60		
18	20.30		
19	28.90		
20	7.10		
21	4.00		
22	2.40		
23	1.20		
24	0.90		
25	1.10		
Mean Length	12.60		
Standard Deviation	4.21		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	10.68-14.52		

Table 6. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 69-11, 27 October - 23 November 1969.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-	-	-
5	-	-	-
6	1.20	-	-
7	1.50	-	-
8	9.80	-	-
9	22.40	-	-
10	53.20	-	-
11	76.10	-	0.20
12	111.00	-	-
13	146.30	-	-
14	130.50	0.50	-
15	198.70	0.50	0.40
16	77.60	0.70	-
17	60.30	0.10	0.70
18	38.20	0.10	-
19	52.40	1.10	-
20	13.20	-	0.40
21	8.60	-	-
22	4.50	-	-
23	1.50	-	0.40
24	4.70	-	-
25	4.80	-	-
26	1.10	-	-
27	1.30	-	-
28	-	-	-
29	-	-	-
30	0.30	-	-
Mean Length	14.27	16.70	17.76
Standard Deviation	2.95	2.39	4.82
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	13.05-15.49	14.37-19.03	14.85-20.68

Table 7. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 70-6, 15 October - 21 November 1970.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	1.00	-	-
5	2.00	-	-
6	10.90	-	-
7	80.50	-	-
8	171.00	1.10	0.40
9	151.50	3.10	-
10	179.50	0.60	1.00
11	142.90	0.03	0.70
12	85.10	0.02	0.50
13	76.50	0.50	1.40
14	51.90	0.40	0.70
15	25.10	0.50	0.40
16	12.00	0.20	0.90
17	9.10	0.70	1.40
18	3.40	0.50	-
19	2.30	-	1.00
20	4.00	1.10	0.90
21	3.00	0.30	-
22	2.60	0.70	-
23	1.20	-	-
24	0.20	-	-
25		-	0.50
26		0.50	0.50
27			-
28			-
29			0.50
Mean Length	10.38	14.02	16.31
Standard Deviation	2.62	5.83	5.55
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	9.19-11.57	11.23-16.81	13.85-18.77

Table 8. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Cryos* cruise 71-01, 09-24 September 1971.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	0.45		-
5	13.49		0.59
6	30.73		3.49
7	45.58		4.51
8	75.61		14.10
9	58.37		9.37
10	9.33		5.41
11	1.57		1.34
12	2.29		0.77
13	1.50		0.47
14	0.09		0.06
15			
16			-
17			-
18			0.06
19			-
20			0.06
21			0.18
22			-
23			0.06
24			-
25			-
26			-
27			0.12
Mean Length	7.79		8.65
Standard Deviation	1.41		2.25
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	6.84-8.74		7.70-9.59

Table 9. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Delaware II* cruise 71-04, 21 September - 04 October 1971.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-		-
5	22.54		0.63
6	62.50		2.09
7	168.04		7.94
8	110.99		19.64
9	31.08		20.15
10	25.51		48.22
11	9.60		19.53
12	12.04		16.00
13	6.88		19.91
14	10.31		13.72
15	14.19		8.31
16	7.70		2.82
17	2.19		1.86
18	2.56		0.20
19	0.66		0.12
20	0.10		-
21	0.10		0.63
22	-		0.26
23	-		
24	0.06		
25	0.06		
Mean Length	8.23		10.85
Standard Deviation	2.61		2.47
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	7.04-9.42		9.62-12.08

Table 10. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Viandra* cruise 71-01, 09-25 October 1971.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	1.71	-	-
5	10.25	-	-
6	18.41	-	-
7	59.74	-	-
8	129.02	-	-
9	103.08	-	0.23
10	58.59	0.24	-
11	42.57	0.47	-
12	58.53	-	0.45
13	53.01	-	-
14	47.78	-	-
15	33.78	-	0.23
16	41.04	0.47	0.57
17	26.95	0.15	-
18	33.42	0.29	0.38
19	20.68	-	
20	23.05	0.77	
21	17.19	0.15	
22	13.21	-	
23	9.19	-	
24	4.81	-	
25	6.74	0.26	
26	5.17		
27	2.98		
28	0.80		
29	0.41		
30			
31	0.24		
Mean Length	12.33	17.11	14.45
Standard Deviation	4.84	5.55	4.28
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	10.46-14.21	13.95-20.27	11.39-17.51

Table 11. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Walther Herwig* cruise 71-01, 29 October - 12 November 1971.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-	-	-
5	-	-	0.06
6	14.58	-	-
7	37.47	-	0.06
8	27.39	-	-
9	20.20	-	-
10	46.30	-	0.44
11	70.50	-	0.81
12	97.25	-	1.18
13	70.99	-	1.38
14	47.21	0.11	1.76
15	26.13	0.22	2.13
16	20.01	0.34	1.61
17	17.64	0.11	0.00
18	12.01	0.11	0.38
19	9.34	0.22	0.41
20	9.80	0.20	0.36
21	6.54	0.19	0.31
22	4.44	0.20	0.17
23	6.94	0.41	0.23
24	3.85	0.22	-
25	3.05	-	0.17
26	1.95	0.11	
27	1.67		
28	0.45		
29	0.17		
30	1.22		
31	0.12		
Mean Length	12.67	19.78	15.06
Standard Deviation	4.05	4.45	3.41
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	11.07-14.27	17.09-22.47	13.03-17.09

Table 12. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 71-07, 02-17 December 1971.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		-	-
5		-	-
6	0.21	-	-
7		-	-
8	0.39	-	-
9	2.51	-	-
10	3.90	-	0.22
11	3.18	-	0.22
12	8.40	-	0.20
13	7.84	-	5.38
14	4.94	-	7.56
15	8.73	-	6.29
16	24.56	0.25	8.48
17	50.78	0.55	8.93
18	61.79	-	7.39
19	68.43	0.25	6.49
20	44.59	0.17	5.05
21	30.72	0.40	2.79
22	14.51	1.24	1.55
23	8.25	0.25	1.09
24	5.52	0.74	0.43
25	2.77	0.49	0.57
26	0.41	-	-
27	0.71	0.47	0.20
28	0.32	-	
29		-	
30	0.32	0.52	
Mean Length	18.28	22.74	17.03
Standard Deviation	2.87	4.18	2.84
95% C.L. ($\bar{x} \pm \bar{t}\sqrt{\frac{s^2}{n}}$)	17.10-19.47	20.43-25.05	15.62-18.44

Table 13. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Lucille B* cruise 72-01, 02-06 September 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		-	
5		-	
6		1.95	
7		19.83	
8		17.39	
9		4.57	
10		4.36	
11		3.69	
12		4.05	
13		0.84	
14		0.28	
15		0.67	
16		-	
17		-	
18		-	
19		0.08	
Mean Length		8.49	
Standard Deviaion		1.91	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		7.37-9.61	

Table 14. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 72-07, 21-24 September 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		0.10	
5		0.03	
6		1.40	
7		12.80	
8		19.60	
9		39.30	
10		49.40	
11		16.40	
12		7.10	
13		8.50	
14		16.60	
15		11.10	
16		8.10	
17		7.80	
18		4.80	
19		3.80	
20		0.60	
21		0.30	
22		0.90	
23		0.40	
24		0.20	
25		0.10	
26		0.04	
Mean Length		11.25	
Standard Deviation		3.29	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		9.83-12.67	

Table 15. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Argus* cruise 72-01, 22-30 September 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4			
5			
6	2.75		
7	9.80		
8	20.96		
9	30.84		
10	30.09		
11	14.20		
12	3.42		
13	0.41		
14			
15	1.33		
16	0.82		
17	0.35		
18			
19			
20			
21			
22	0.12		
Mean Length	9.33		
Standard Deviation	1.64		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	8.29-10.37		

Table 16. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 72-01 02-28 October 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-	-	-
5	-	-	0.40
6	5.77	-	0.20
7	61.51	-	1.00
8	141.51	-	2.00
9	104.35	-	3.10
10	69.53	-	4.50
11	90.12	-	3.20
12	89.44	0.80	11.00
13	81.10	1.20	6.30
14	64.06	0.70	16.50
15	39.89	0.30	15.10
16	24.35	0.70	5.80
17	30.54	0.70	8.60
18	11.08	0.50	9.40
19	10.72	0.30	8.80
20	3.42	0.30	8.20
21	-	0.60	0.90
22	-	0.20	2.00
23	-	1.10	4.20
24	-	-	4.80
25	-	0.20	0.40
26	-	0.60	0.70
27	-	0.20	
28	-		
29	0.75		
Mean Length	11.15	18.05	15.78
Standard Deviation	3.06	4.91	4.09
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	9.52-12.78	15.47-20.69	13.96-17.59

Table 17. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Argus* cruise 72-02, 12-28 October 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	0.74	-	-
5	0.74	-	-
6	15.59	-	-
7	96.02	-	-
8	414.24	-	-
9	280.58	-	-
10	120.78	0.30	-
11	70.92	-	0.80
12	34.09	-	1.60
13	38.49	-	0.40
14	57.97	-	0.40
15	93.77	0.40	0.40
16	96.12	0.30	0.60
17	65.57	0.40	0.20
18	31.89	0.70	1.00
19	27.06	0.90	-
20	12.74	0.80	0.20
21	3.41	0.70	0.20
22	5.46	0.80	0.20
23		0.40	-
24		1.50	0.40
25		0.40	
26		0.70	
27		0.30	
28		-	
29		-	
30		0.50	
Mean Length	10.85	21.44	15.31
Standard Deviation	3.62	4.51	4.16
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	9.40-12.31	19.38-23.50	12.91-17.71

Table 18. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Duchess II* cruise 72-01, 18-22 October 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
6		3.90	
7		24.50	
8		40.00	
9		23.20	
10		20.10	
11		17.90	
12		26.20	
13		20.50	
14		14.40	
15		13.50	
16		10.00	
17		8.60	
18		8.80	
19		8.60	
20		8.60	
21		7.00	
22		6.00	
23		5.00	
24		4.00	
25		3.00	
26		2.00	
27		1.00	
28		1.00	
Mean Length		12.88	
Standard Deviation		5.06	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		10.97-15.06	

Table 19. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Anton Dohrn* cruise 72-01, 31 October - 12 November 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
6	2.83	0.80	-
7	30.42	2.60	-
8	104.46	1.40	-
9	120.90	0.50	-
10	52.68	0.50	-
11	26.22	0.80	-
12	40.41	0.50	-
13	58.95	0.50	0.12
14	35.79	0.50	0.12
15	20.10	0.80	0.12
16	11.99	0.40	-
17	9.29	0.50	-
18	9.25	-	0.11
19	6.69	0.20	
20	4.66	0.60	
21	3.35	0.40	
22	1.33	0.50	
23	0.67	0.20	
24	0.28	-	
25	-	-	
26	0.08	0.10	
27	0.08	0.10	
28		-	
29		-	
30		0.30	
Mean Length	10.89	12.54	14.90
Standard Deviation	3.20	6.29	1.70
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	9.47-12.31	9.95-15.13	13.11-16.68

Table 20. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Duchess II* cruise 72-02, 06-12 November 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5		0.01	
6		-	
7		0.10	
8		0.10	
9		0.70	
10		2.10	
11		2.40	
12		4.20	
13		4.70	
14		6.30	
15		12.70	
16		11.10	
17		12.80	
18		13.40	
19		11.60	
20		14.90	
21		9.50	
22		11.90	
23		6.20	
24		6.20	
25		4.20	
26		2.80	
27		3.60	
28		1.40	
29		1.10	
30		0.70	
31		0.40	
32		0.80	
33		0.50	
34		0.10	
35		0.30	
36		0.10	
Mean Length		19.01	
Standard Deviation		4.52	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		17.38-20.64	

Table 21. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 72-09, 02-20 December 1972.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
6	0.37	-	-
7	-	-	-
8	-	-	-
9	0.64	-	-
10	4.70	-	-
11	17.19	-	0.10
12	24.02	-	0.30
13	15.49	-	0.20
14	12.11	-	0.10
15	11.04	-	0.50
16	18.63	-	0.70
17	19.40	-	1.90
18	17.67	0.30	2.40
19	14.18	0.20	2.90
20	8.49	0.80	4.20
21	6.44	1.30	4.10
22	4.69	0.60	4.10
23	3.36	0.50	3.10
24	1.10	0.70	1.00
25	1.04	0.60	0.80
26	0.78	0.50	0.90
27	0.14	-	0.50
28	0.42	-	0.10
29	-	-	0.10
30	0.24	0.30	0.30
Mean Length	15.73	22.59	20.68
Standard Deviation	3.67	3.06	3.13
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	14.22-17.25	20.74-24.44	19.22-22.14

Table 22. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Cryos* cruise 73-01, 16-23 September 1973.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	0.69	-	-
5	5.30	-	-
6	19.33	-	12.30
7	52.64	-	36.30
8	43.30	-	38.60
9	14.96	-	18.40
10	4.20	-	26.10
11	1.06	-	44.80
12	-	0.60	40.60
13	-	-	11.60
14	-	-	5.00
15	-	-	9.30
16	-	0.60	9.20
17	-	0.30	2.90
18	-	0.30	5.80
19	-	0.30	1.50
20	-	-	1.10
21	-	-	0.70
22	-	-	-
23	-	0.30	-
Mean Length	7.41	16.63	10.48
Standard Deviation	1.13	4.44	3.03
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	6.46-8.36	13.81-19.43	8.87-12.09

Table 23. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 73-40, 29 September - 20 October 1973.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	126.66	-	-
5	905.77	-	-
6	1043.71	-	-
7	345.09	-	0.70
8	113.24	-	2.30
9	126.57	-	1.10
10	147.35	-	2.80
11	185.38	-	8.40
12	136.96	-	21.90
13	90.31	-	38.10
14	40.80	-	47.00
15	22.89	0.40	28.70
16	35.80	0.40	22.10
17	37.70	1.10	30.20
18	13.93	0.20	24.10
19	11.50	0.40	10.80
20	5.61	0.80	8.50
21	0.21	0.20	4.40
22	2.19	0.20	2.20
23			2.30
24			0.30
Mean Length	7.33	18.08	15.15
Standard Deviation	3.07	2.35	2.78
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	5.85-8.81	16.12-20.04	13.77-16.53

Table 24. Larval herring (Clupea harengus) length-frequency summary for three subareas in the Gulf of Maine collected by Belogorsk cruise 73-01, 15 October -01 November 1973.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5	237.97	0.20	-
6	1766.67	0.40	0.20
7	3075.72	0.70	0.20
8	1077.86	0.50	-
9	399.21	0.10	2.20
10	294.92	0.10	0.70
11	405.41	0.20	0.20
12	402.94	0.10	2.20
13	225.34	0.60	4.00
14	167.10	0.30	8.10
15	232.60	0.90	22.30
16	263.66	0.30	41.20
17	186.88	0.60	35.60
18	89.63	-	42.10
19	35.41	0.50	24.60
20	18.56	-	16.20
21	14.11	-	4.00
22	12.31	-	0.10
23	7.20	0.30	2.20
24	3.09	0.20	-
25	0.19	0.50	2.00
26	0.13	0.20	-
27	-	0.20	-
28	-	-	-
29	-	-	-
30	0.16	-	-
Mean Length	8.68	14.84	17.10
Standard Deviation	3.32	6.93	2.31
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	7.34-10.02	11.85-17.83	16.02-18.18

Table 25. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Walther Herwig* cruise 73-43, 28 October - 08 November 1973.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5	25.80	-	-
6	1215.17	-	-
7	773.57	-	0.30
8	371.63	-	1.20
9	238.15	-	0.70
10	228.04	-	0.70
11	175.51	-	1.40
12	130.57	-	1.40
13	128.39	0.10	1.80
14	117.01	0.10	1.50
15	98.95	-	2.20
16	101.72	0.40	3.10
17	135.55	1.30	3.50
18	116.71	1.10	2.70
19	64.99	0.90	1.00
20	39.88	1.70	0.50
21	21.19	0.90	0.40
22	13.53	0.60	0.40
23	9.19	0.50	
24	4.50	-	
25	7.49	0.20	
26	2.34	0.10	
27	0.61	-	
28	0.16	0.20	
29	0.15		
Mean Length	9.45	19.62	14.85
Standard Deviation	4.20	2.90	3.51
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	7.71-11.18	18.08-21.16	12.98-16.72

Table 26. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 73-08, 30 October - 20 November 1973.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5		1.70	-
6		5.50	-
7		5.00	-
8		1.40	1.20
9		0.10	2.30
10		0.50	3.70
11		0.30	3.60
12		0.20	1.60
13		0.90	1.50
14		0.40	3.60
15		0.90	2.70
16		0.90	4.10
17		3.10	5.30
18		2.00	4.60
19		1.10	2.60
20		1.10	1.80
21		1.10	1.30
22		0.10	0.10
23		0.40	0.20
24		1.20	-
25		1.00	-
26		0.50	-
27		0.10	-
28		1.40	-
29		0.30	-
30		-	-
31		0.60	-
Mean Length		14.04	14.79
Standard Deviation		7.79	3.68
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		10.95-17.13	12.84-16.74

Table 27. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 73-09, 04-20 December 1973.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	0.94		
5	18.65		
6	29.49		
7	16.65		
8	19.12		
9	21.02		
10	18.33		
11	13.79		
12	26.70		
13	35.30		
14	41.97		
15	73.31		
16	115.15		
17	102.21		
18	101.05		
19	84.97		
20	111.77		
21	75.14		
22	48.87		
23	23.79		
24	10.18		
25	1.45		
26	2.37		
27	1.86		
28	2.48		
29	1.44		
30	0.48		
31	-		
32	-		
33	0.17		
Mean Length	16.53		
Standard Deviation	4.53		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	14.84-18.22		

Table 28. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 74-02, 11-22 February 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5	0.20		
6	0.20		
7	-		
8	-		
9	-		
10	0.20		
11	-		
12	-		
13	0.23		
14	-		
15	0.23		
16	1.08		
17	2.98		
18	1.54		
19	2.16		
20	3.36		
21	3.70		
22	5.43		
23	2.83		
24	6.58		
25	4.70		
26	4.45		
27	2.74		
28	2.51		
29	2.56		
30	2.00		
31	0.20		
32	0.14		
33	0.63		
Mean Length	23.26		
Standard Deviation	4.31		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	21.62-24.90		

Table 29. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Cryos* cruise 74-04, 07-24 September 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4			5.40
5			50.80
6			48.10
7			41.50
8			42.20
9			12.00
10			4.50
11			1.80
12			4.00
13			1.70
14			2.20
15			0.40
16			0.50
17			0.20
18			0.50
19			-
20			0.30
21			-
22			0.20
Mean Length			6.95
Standard Deviation			2.12
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)			5.93-7.97

Table 30. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Duchess* cruise 74-01, 09-14 September 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
6		1.10	
7		8.70	
8		24.90	
9		35.00	
10		15.70	
11		11.30	
12		10.90	
13		12.20	
14		7.00	
15		5.40	
16		3.70	
17		4.90	
18		3.30	
19		0.80	
20		0.50	
21		0.10	
22		-	
23		-	
24		-	
25		0.60	
Mean Length		10.78	
Standard Deviation		3.10	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		9.33-12.23	

Table 31. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Wieczno* cruise 74-01, 27 September - 18 October 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	186.25	-	0.20
5	507.38	-	0.50
6	537.53	0.10	1.10
7	243.97	0.90	39.10
8	40.63	0.10	38.80
9	8.70	1.30	114.40
10	3.54	0.20	301.80
11	1.51	0.50	280.60
12	0.60	0.70	321.20
13	0.16	1.80	126.40
14	0.15	3.50	140.00
15	-	2.20	73.90
16	-	2.20	55.30
17	0.75	1.20	24.60
18	-	1.00	3.20
19	0.17	1.20	5.50
20	-	0.60	6.50
21	-	0.40	1.80
22	-	1.60	4.80
23	-	0.30	3.00
24	-	0.30	1.50
25	-	0.10	-
26	-	0.40	-
27	-	-	0.20
Mean Length	5.68	15.52	11.75
Standard Deviation	1.09	4.44	2.41
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	5.12-6.24	13.50-17.54	9.87-13.63

Table 32. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Delaware II* cruise 74-12, 08-16 October 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		0.50	
5		4.20	
6		32.70	
7		166.30	
8		121.60	
9		19.70	
10		29.00	
11		29.30	
12		24.90	
13		30.10	
14		33.70	
15		17.10	
16		7.70	
17		8.30	
18		13.00	
19		13.20	
20		11.50	
21		3.90	
22		3.30	
23		2.30	
24		1.60	
25		0.70	
26		0.60	
27		0.10	
Mean Length		10.12	
Standard Deviation		4.12	
95% C.L. ($\bar{x} \pm \bar{t}\sqrt{\frac{s^2}{n}}$)		8.38-11.86	

Table 33. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Prognoz* cruise 74-01, 18-30 October 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	4.21		
5	42.56		
6	656.42		
7	1628.40		
8	1647.00		
9	657.09		
10	417.75		
11	157.40		
12	150.13		
13	59.19		
14	49.47		
15	24.75		
16	14.19		
17	7.64		
18	5.95		
19	0.58		
20	1.13		
21	0.14		
22	0.57		
23	-		
24	0.14		
Mean Length	7.34		
Standard Deviation	2.71		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	6.11-8.57		

Table 34. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by *Albatross IV* cruise 74-11, 30 October - 12 November 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
5		0.10	-
6		3.90	-
7		40.50	0.70
8		72.60	1.60
9		15.00	0.60
10		3.40	1.00
11		7.70	2.60
12		12.30	3.20
13		12.90	1.10
14		13.00	2.10
15		9.00	5.10
16		8.40	5.40
17		13.20	6.10
18		13.50	7.70
19		13.70	4.30
20		10.30	3.80
21		6.70	3.60
22		4.40	1.70
23		3.00	1.40
24		2.00	-
25		1.60	0.20
26		1.20	
27		0.70	
28		-	
29		0.40	
Mean Length		12.24	16.24
Standard Deviation		5.21	3.77
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		10.09-14.39	14.60-18.24

Table 35. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ANTON DOHRN cruise 74-01, 16-23 November 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-		
5	4.15		
6	182.82		
7	696.79		
8	218.40		
9	94.17		
10	89.15		
11	102.13		
12	130.56		
13	160.79		
14	165.51		
15	161.24		
16	109.92		
17	83.66		
18	46.45		
19	27.94		
20	21.37		
21	12.74		
22	4.78		
23	1.93		
24	1.08		
25	1.01		
26	0.23		
Mean length	10.55		
Standard Deviation	3.99		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	8.78-12.32		

Table 36. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 74-13, 04-19 December 1974.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-	-	
5	-	-	
6	2.10	-	
7	1.47	-	
8	2.04	-	
9	10.76	0.40	
10	40.61	-	
11	82.86	0.20	
12	117.07	-	
13	136.93	0.60	
14	145.74	0.70	
15	116.57	1.60	
16	85.07	1.60	
17	84.11	1.10	
18	90.90	0.90	
19	77.95	2.10	
20	72.72	1.50	
21	55.88	0.60	
22	37.07	1.30	
23	20.90	0.40	
24	14.85	1.10	
25	8.38	0.20	
26	2.97	-	
27	3.99	-	
28	0.78	-	
29	1.42	-	
30	0.68	-	
Mean Length	15.73	18.15	
Standard Deviation	3.77	3.72	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	14.18-17.29	16.24-20.06	

Table 37. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 75-02, 12-28 February 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
16	0.36		
17	0.32		
18	0.16		
19	0.48		
20	0.16		
21	1.66		
22	2.70		
23	4.21		
24	7.57		
25	6.24		
26	9.35		
27	6.87		
28	8.46		
29	6.76		
30	6.61		
31	4.00		
32	1.61		
33	1.25		
34	1.19		
35	0.96		
36	-		
37	-		
38	-		
39	-		
40	-		
41	0.19		
Mean Length	26.87		
Standard Deviation	3.35		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	25.30-28.44		

Table 38. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by CHALLENGE cruise 75-01, 04-09 September 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		-	
5		0.30	
6		11.00	
7		58.20	
8		72.40	
9		11.30	
10		2.40	
11		4.50	
12		5.50	
13		3.50	
14		2.20	
15		3.20	
16		0.30	
17		1.40	
18		0.40	
19		0.20	
20		-	
21		-	
22		-	
23		-	
24		0.40	
Mean Length		8.28	
Standard Deviation		2.21	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		7.25-9.31	

Table 39. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by DELAWARE II cruise 75-15, 23 September-02 October 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		-	-
5		0.10	3.80
6		272.60	30.60
7		732.80	9.10
8		14.00	19.80
9		1.90	48.60
10		2.90	30.70
11		4.90	17.60
12		10.40	33.40
13		6.90	27.20
14		3.90	16.20
15		15.30	6.70
16		13.50	2.70
17		3.70	1.60
18		1.20	7.70
19		1.00	2.00
20		13.50	1.60
21		21.50	0.70
22		0.70	1.60
23		0.20	-
24		0.30	-
25		0.40	-
26		0.20	-
27		0.30	-
28		-	-
29		0.04	-
Mean Length		7.64	10.60
Standard Deviation		3.06	3.29
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		6.38-8.90	8.96-12.24

Table 40. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by BELOGORSK cruise 75-02, 25 September-08 October 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-		
5	5.13		
6	35.96		
7	22.84		
8	0.65		
9	0.44		
10	-		
11	-		
12	-		
13	0.12		
14	0.35		
15	0.19		
16	0.17		
17	0.14		
18	0.13		
Mean Length	6.46		
Standard Deviation	1.34		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	5.69-7.23		

Table 41. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV, cruise 75-12II, 07-23 October 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		-	
5		0.80	
6		5.90	
7		6.50	
8		0.70	
9		1.30	
10		1.30	
11		2.60	
12		2.50	
13		2.30	
14		1.00	
15		0.40	
16		2.40	
17		2.40	
18		1.70	
19		0.50	
20		0.20	
21		0.40	
22		0.10	
23		0.20	
24		0.10	
25		0.20	
Mean Length		11.03	
Standard Deviation		4.76	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		8.86-13.20	

Table 42. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by BELOGORSK cruise 75-03, 17-30 October 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-		
5	0.66		
6	205.78		
7	1161.14		
8	936.97		
9	121.71		
10	134.43		
11	142.38		
12	167.40		
13	67.34		
14	17.85		
15	9.11		
16	2.81		
17	0.88		
18	1.07		
19	0.32		
Mean Length	8.16		
Standard Deviation	1.81		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	7.15-9.16		

Table 43. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ANTON DOHRN cruise 75-187, 01-18 November 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	0.80		
5	51.84		
6	131.98		
7	128.62		
8	92.24		
9	92.23		
10	159.06		
11	162.37		
12	173.93		
13	171.40		
14	187.51		
15	132.90		
16	70.89		
17	25.59		
18	7.12		
19	5.16		
20	1.59		
21	0.48		
22	0.13		
Mean Length	11.07		
Standard Deviation	3.25		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	9.51-12.64		

Table 44. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 75-12 III, 07-18 November 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
9			1.10
10			4.00
11			1.10
12			6.30
13			11.40
14			15.90
15			9.60
16			6.10
17			4.20
18			1.70
19			0.70
20			1.30
21			-
22			-
23			-
24			-
25			0.30
Mean Length			14.11
Standard Deviation			2.32
95% C.L. $(\bar{x} \pm t\sqrt{\frac{s^2}{n}})$			12.92-15.30

Table 45. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 75-14, 05-17 December 1975.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4	-		
5	0.16		
6	0.30		
7	1.84		
8	3.40		
9	1.32		
10	3.93		
11	4.42		
12	4.43		
13	7.47		
14	11.66		
15	15.51		
16	21.66		
17	28.44		
18	33.47		
19	26.44		
20	19.49		
21	10.56		
22	6.28		
23	3.21		
24	2.51		
25	1.32		
26	1.17		
27	0.77		
28	0.65		
29	0.15		
30	0.17		
Mean Length	17.17		
Standard Deviation	3.54		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	15.74-18.61		

Table 46. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 76-01. 10-25 February 1976.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
20	0.14		
21	-		
22	0.14		
23	-		
24	1.67		
25	2.99		
26	5.19		
27	10.66		
28	11.21		
29	14.42		
30	22.45		
31	18.42		
32	17.52		
33	16.50		
34	11.25		
35	8.53		
36	5.09		
37	1.26		
38	1.11		
39	0.14		
Mean Length	30.83		
Standard Deviation	2.91		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	29.38-32.28		

Table 47. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ANNANDALE cruise 76-01, 01-18 October 1976.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
4		0.30	
5		0.90	
6		3.40	
7		11.80	
8		13.00	
9		17.20	
10		36.00	
11		58.20	
12		84.40	
13		80.90	
14		77.40	
15		69.30	
16		37.80	
17		25.30	
18		11.00	
19		5.40	
20		4.20	
21		1.90	
22		3.20	
23		0.10	
24		1.40	
25		0.70	
26		0.50	
27		0.20	
28		0.20	
29		0.50	
30		0.20	
Mean Length		13.17	
Standard Deviation		2.93	
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		12.01-14.33	

Table 48. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by WIECZNO cruise 76-03, 14 October-03 November 1976.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
7	0.32		
8	0.35		
9	1.72		
10	4.16		
11	4.45		
12	5.37		
13	6.07		
14	3.79		
15	2.67		
16	1.06		
17	1.13		
18	0.75		
19	0.28		
20	-		
21	0.12		
Mean Length	12.68		
Standard Deviation	2.56		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	11.31-14.04		

Table 49. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 76-09, 09-23 November 1976.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
13		-	0.50
14		1.30	1.10
15		4.50	1.60
16		4.90	1.10
17		6.30	1.20
18		1.90	0.70
19		1.90	2.70
20		1.40	0.50
21		1.00	-
22		-	-
23		-	-
24		-	-
25		-	-
26		0.40	-
Mean Length		16.99	16.79
Standard Deviation		2.16	2.21
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		15.68-18.30	14.99-18.59

Table 50. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ANTON DOHRN cruise 76-02, 15-29 November 1976.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
11	0.30		
12	-		
13	-		
14	-		
15	0.14		
16	0.30		
17	1.67		
18	0.73		
19	0.65		
20	2.32		
21	1.91		
22	2.59		
23	0.68		
24	0.51		
25	0.14		
26	-		
27	0.26		
Mean Length	20.16		
Standard Deviation	2.89		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	18.68-21.65		

Table 51. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by RESEARCHER cruise 76-01, 27 November-11 December 1976.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
12	0.15		
13	-		
14	-		
15	0.37		
16	-		
17	-		
18	0.52		
19	1.60		
20	1.38		
21	1.71		
22	1.26		
23	1.38		
24	1.37		
25	0.26		
26	0.70		
27	0.15		
Mean Length	21.36		
Standard Deviation	2.90		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	19.81-22.90		

Table 52. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by MT. MITCHELL cruise 77-01, 13-24 February 1977.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
25	0.12		
26	0.50		
27	0.13		
28	0.36		
29	0.44		
30	0.87		
31	0.32		
32	0.87		
33	0.80		
34	0.86		
35	0.99		
36	0.21		
37	0.37		
38	0.20		
Mean Length	32.01		
Standard Deviation	3.49		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	30.13-33.89		

Table 53. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by WIECZNO cruise 77-06, 04-24 October 1977.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
6	7.06		
7	51.62		
8	137.76		
9	110.04		
10	44.11		
11	24.96		
12	3.96		
13	2.77		
14	1.82		
15	0.42		
16	3.91		
17	0.16		
18	0.48		
19	0.72		
20	0.95		
21	1.00		
22	0.22		
23	0.39		
Mean Length	8.84		
Standard Deviation	1.87		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	7.91-9.77		

Table 54. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ARGUS cruise 77-01, 25 October-12 November 1977.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
8		0.50	-
9		0.50	0.60
10		2.80	-
11		11.20	-
12		16.20	-
13		24.50	-
14		27.70	-
15		10.60	0.60
16		7.10	1.20
17		4.80	-
18		1.20	1.20
19		4.50	-
20		2.30	-
21		1.30	-
Mean Length		13.85	15.33
Standard Deviation		2.34	3.57
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)		12.50-15.20	12.78-17.88

Table 55. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ANTON DOHRN cruise 77-03, 01-13 November 1977.

Larval length class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
6	0.44		
7	7.52		
8	8.00		
9	0.44		
10	0.79		
11	3.91		
12	11.84		
13	31.52		
14	63.64		
15	80.57		
16	71.24		
17	35.11		
18	22.61		
19	6.00		
20	1.87		
21	-		
22	0.20		
23	0.15		
24	0.20		
Mean Length	14.83		
Standard Deviation	2.34		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	13.70-15.96		

Table 56. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by DELAWARE II cruise 77-13, 08-20 December 1977.

Larval Length Class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
13	7.96		
14	-		
15	-		
16	-		
17	-		
18	0.29		
19	0.61		
20	0.67		
21	0.65		
22	1.55		
23	1.10		
24	2.00		
25	0.39		
26	0.57		
27	1.01		
28	0.24		
Mean Length	23.11		
Standard Deviation	2.68		
95% C.L. ($\bar{x} \pm t\sqrt{\frac{s^2}{n}}$)	21.30-24.91		

Table 57. Larval herring (*Clupea harengus*) length-frequency summary for three subareas in the Gulf of Maine collected by ALBATROSS IV cruise 78-02, 14 February-08 March 1978.

Larval Length Class (mm)	Larval Abundance per Cruise Area ($x10^{-9}$)		
	Georges Bank-Nantucket Shoals	Western Gulf of Maine	Eastern Gulf of Maine
22	0.15		
23	-		
24	0.15		
25	0.19		
26	0.14		
27	0.34		
28	0.28		
29	0.30		
30	0.42		
31	0.35		
32	0.52		
33	0.49		
34	0.35		
35	0.63		
36	-		
37	1.10		
38	0.43		
39	-		
40	0.31		
41	0.12		
Mean Length	32.79		
Standard Deviation	5.02		
95% C.L. ($\bar{x} \pm \bar{t}\sqrt{\frac{s^2}{n}}$)	30.44-35.14		

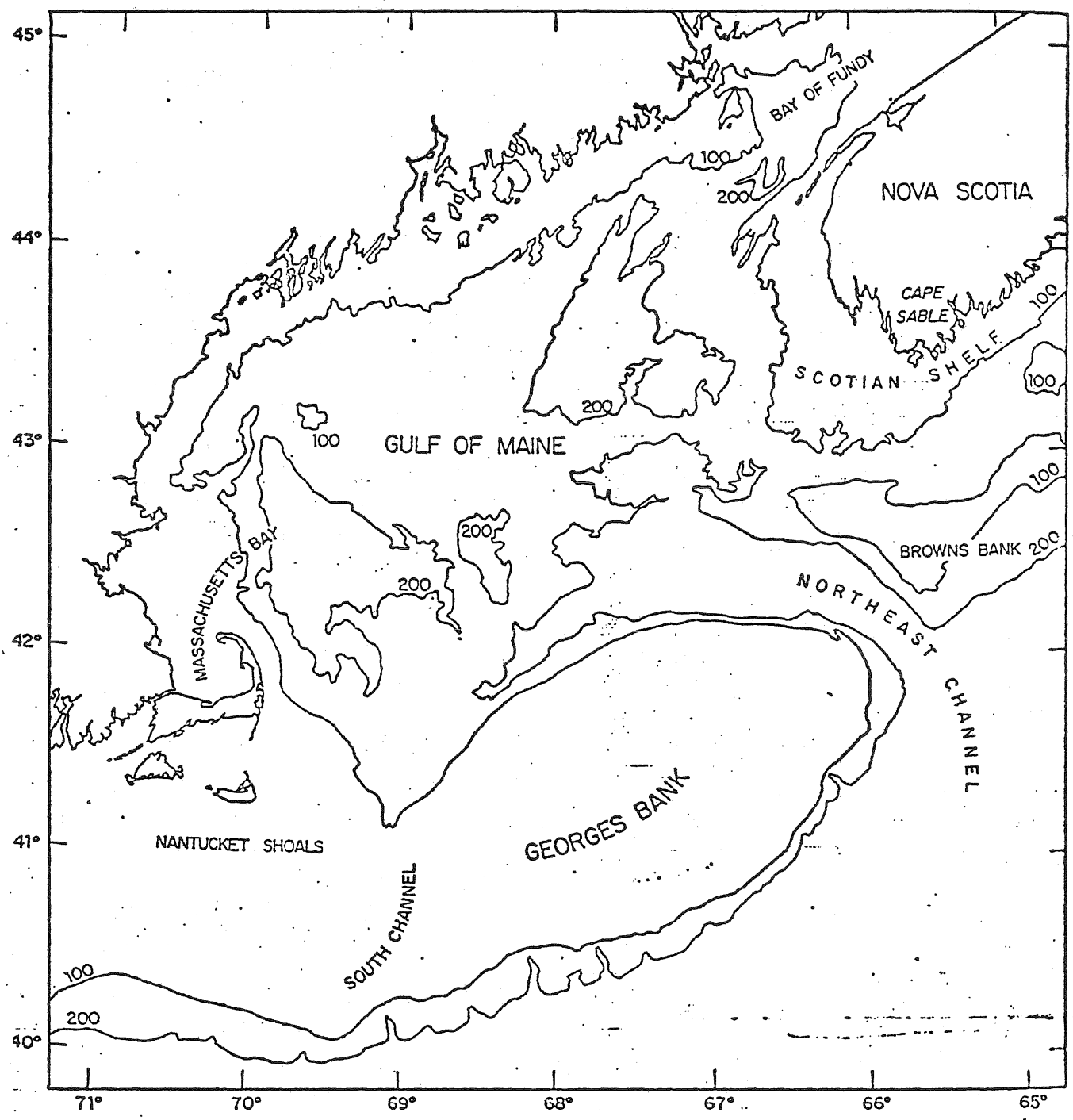


Fig. 1. The Gulf of Maine. (Depths are in meters).

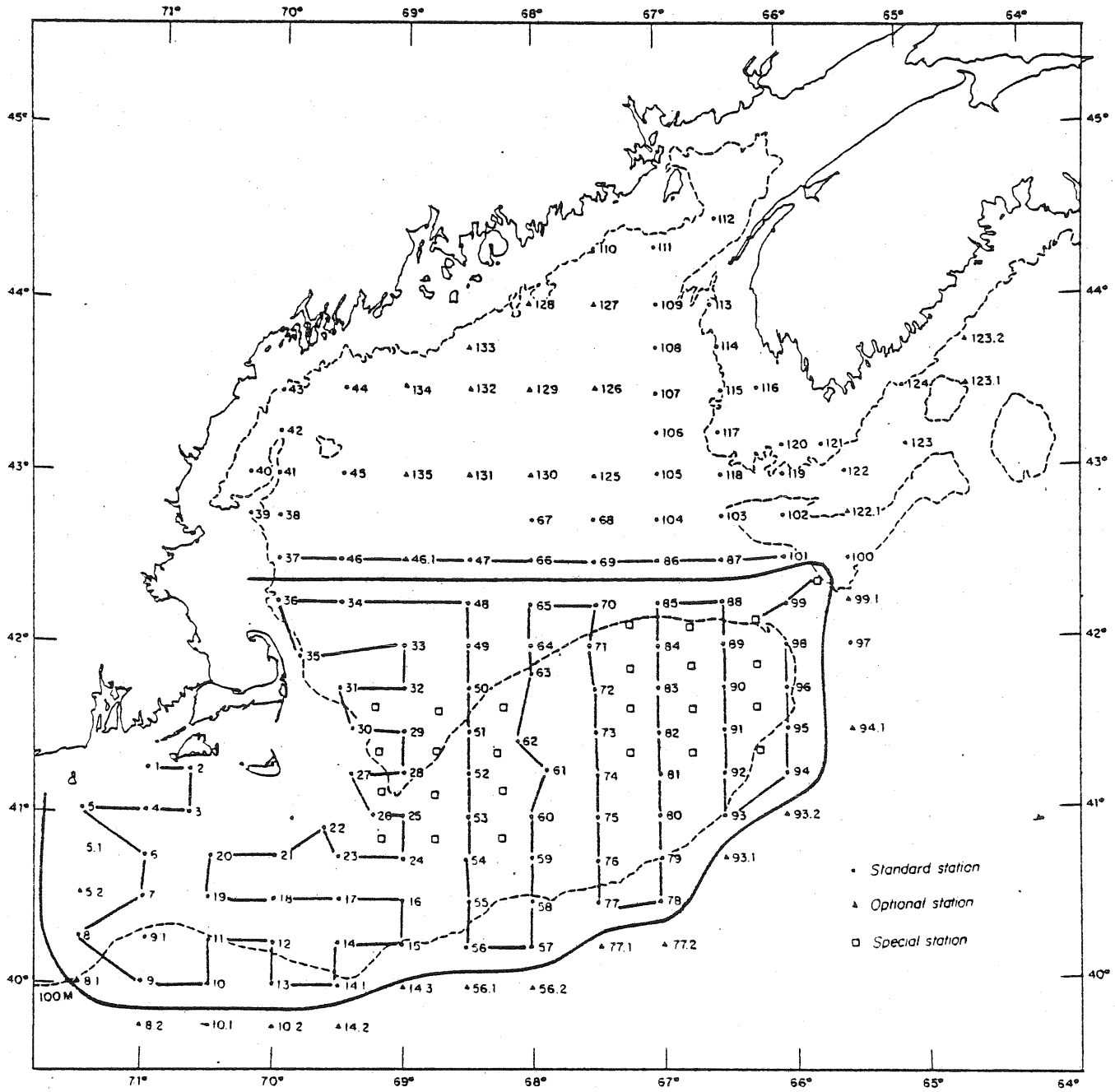


Figure 2. Station plot for ICNAF larval herring surveys with a standard cruise track drawn for the Georges Bank - Nantucket Shoals area. Station sampling within the encircled dark line has been emphasized since 1974, and this area represents our best coverage for the entire larval herring time series. Stations 1-36 represent the Nantucket Shoals area, and Stations 48-99 represent the Georges Bank area. Standard stations (closed circles) outside the encircled area are sampled as time permits. Open squares are examples of special stations where additional sampling may be made in areas of high larval densities. Triangles represent optional stations as time permits.

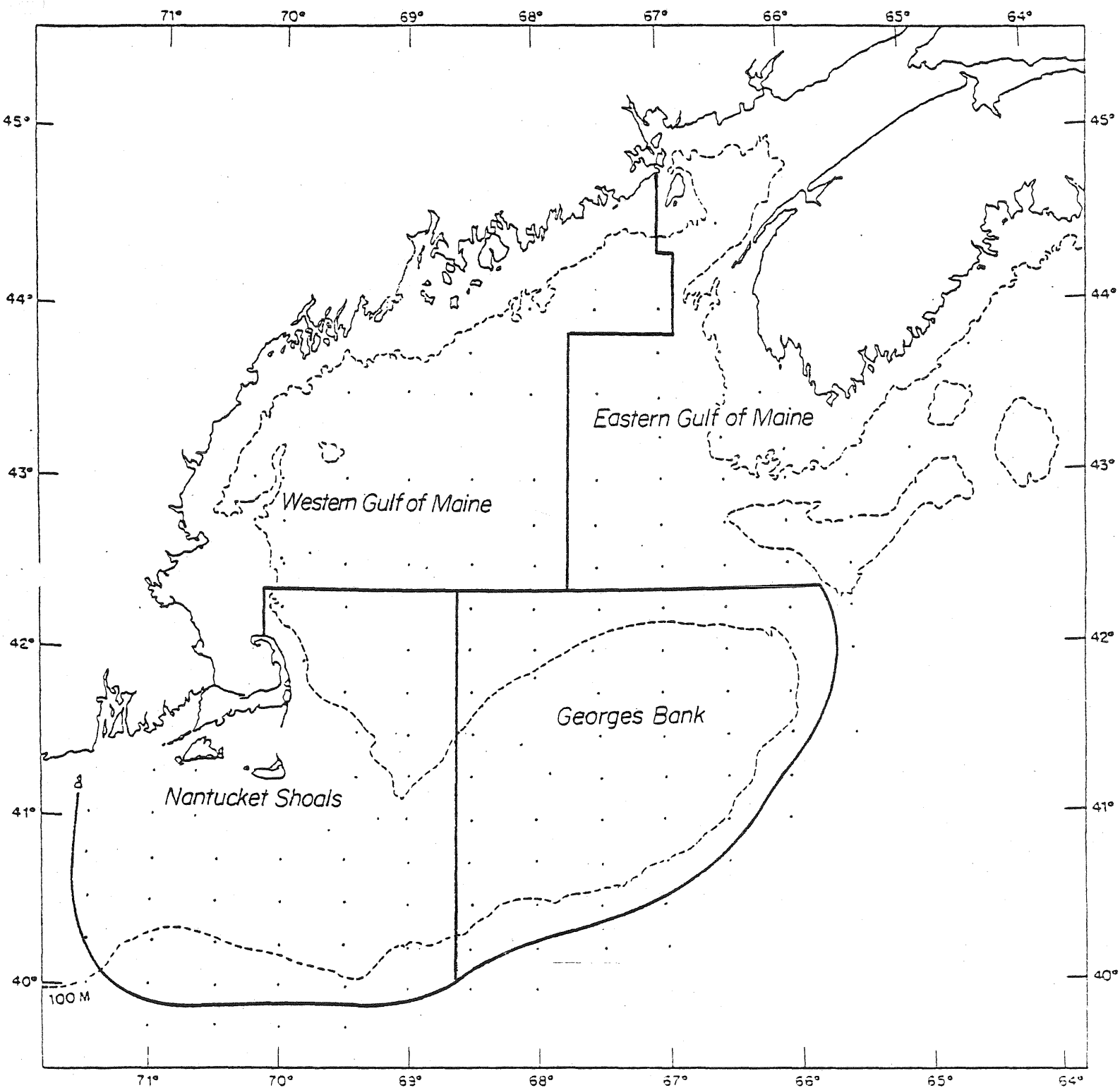


Figure 3. Geographical subdivisions of Georges Bank, Nantucket Shoals, Western Gulf of Maine, and Eastern Gulf of Maine used for abundance estimates of larval herring.

Figure 4.

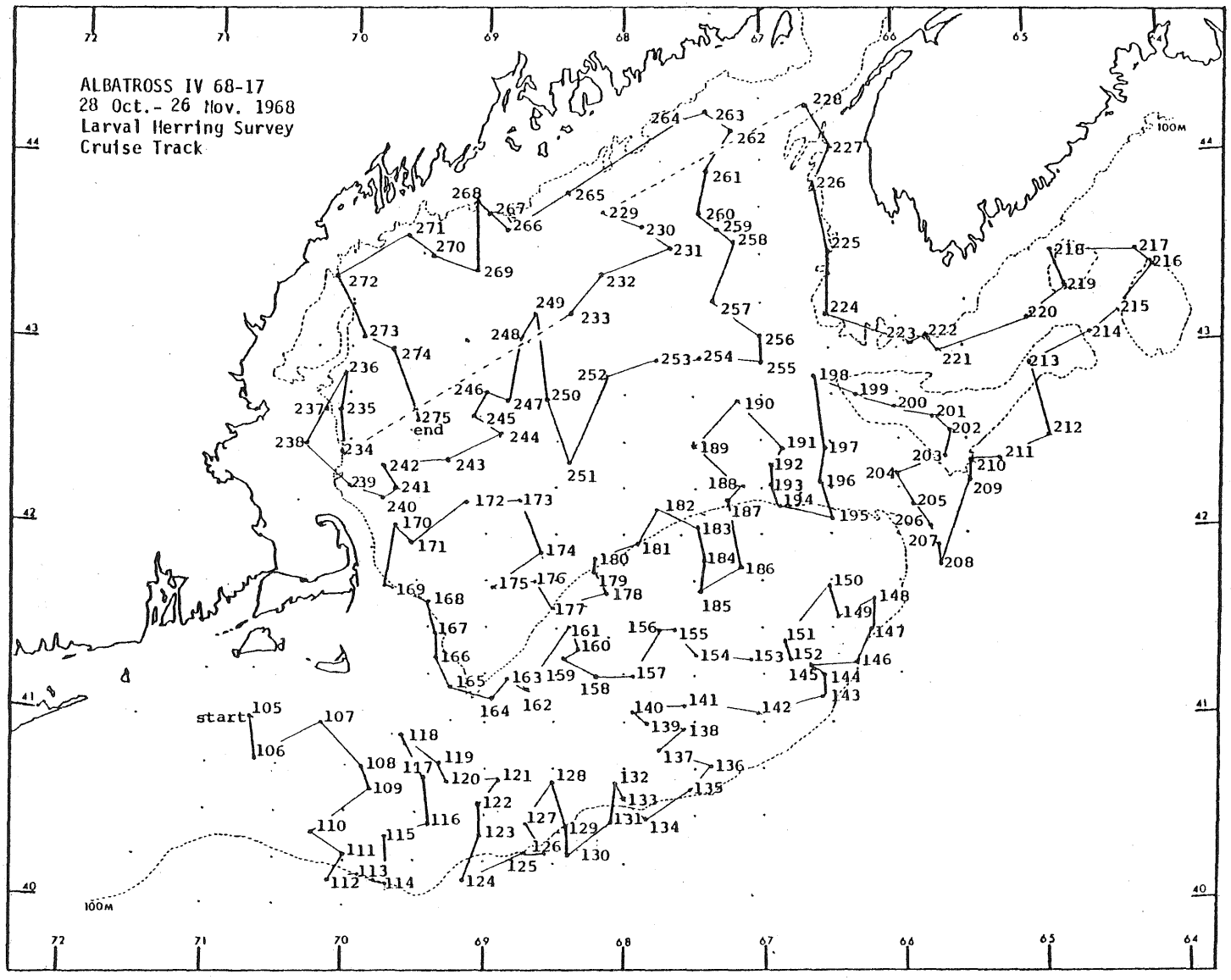

ALBATROSS IV 68-17
28 Oct.- 26 Nov. 1968
Larval Herring Survey
Cruise Track
start
end
100M

Figure 5.

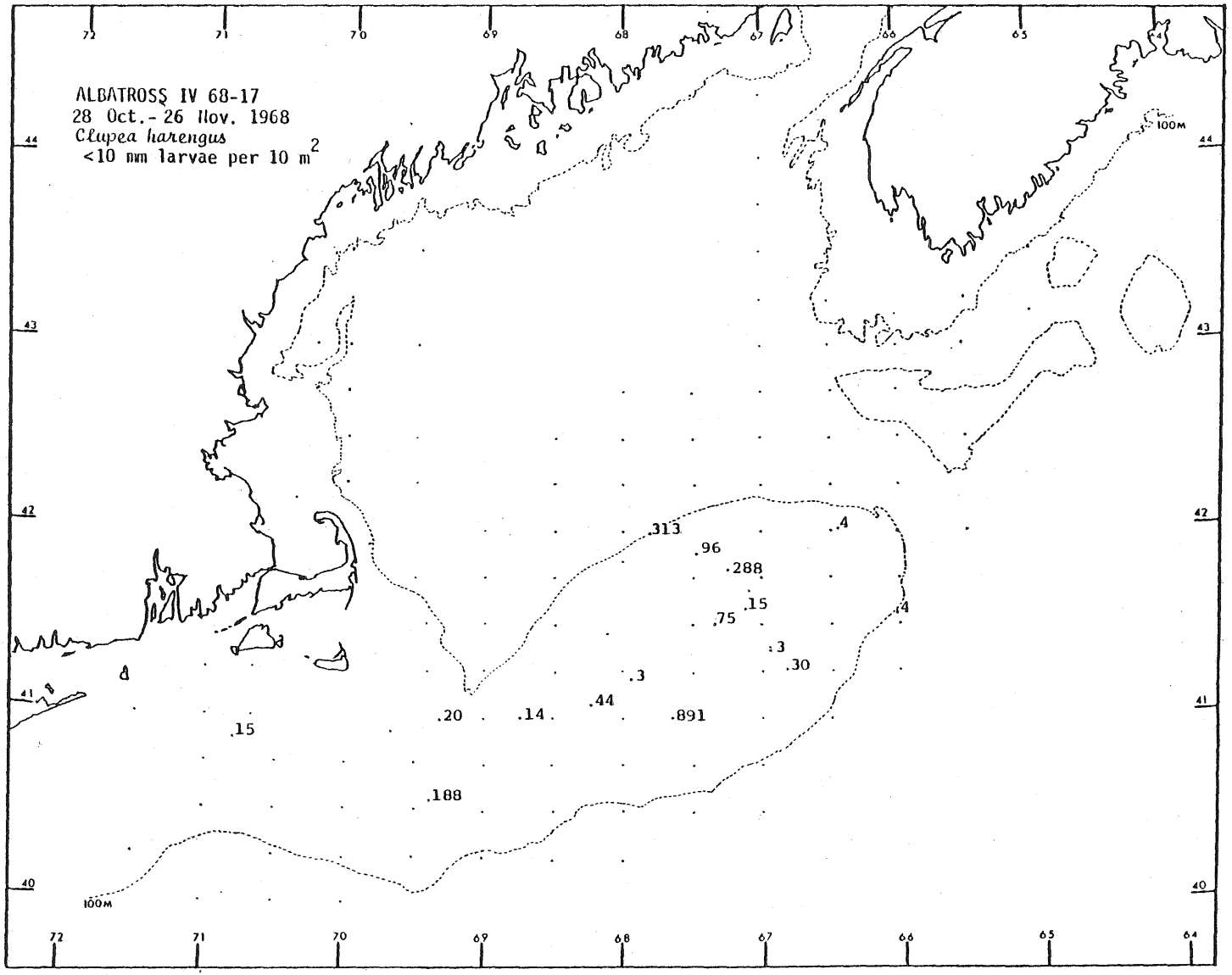

ALBATROSS IV 68-17
28 Oct.- 26 Nov. 1968
Clupea harengus
<10 mm larvae per 10 m2
72
71
70
69
68
67
66
65
64
44
43
42
41
40
100M
.313
.96
.288
.15
.75
.3
.30
.4
.4
.3
.44
.20
.14
.891
.15
.188

Figure 6.

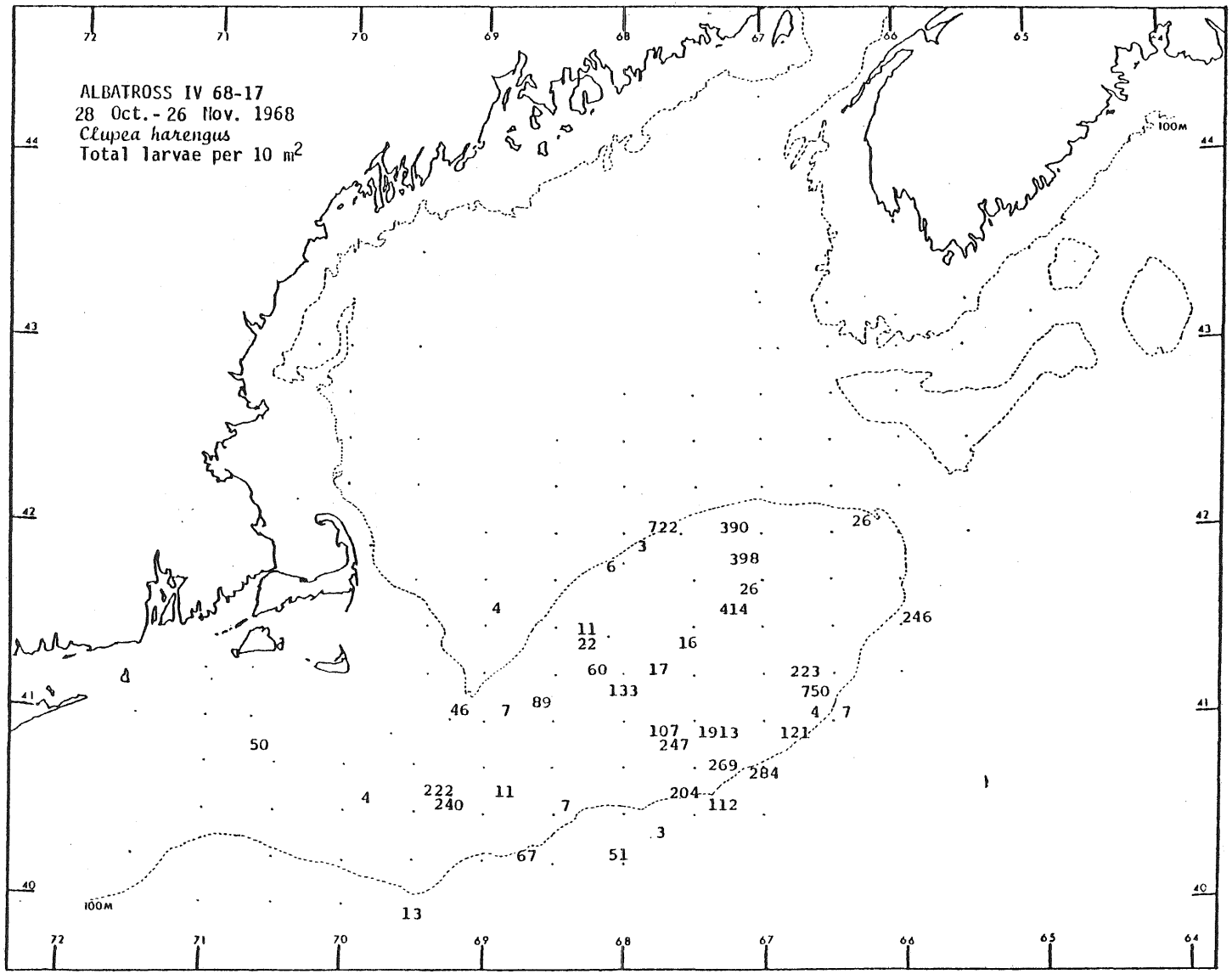

ALBATROSS IV 68-17
28 Oct.-26 Nov. 1968
Clupea harengus
Total larvae per 10 m2
100M
722
390
26
3
398
6
26
4
414
246
11
22
16
60
17
223
133
750
46
7
89
4
7
107
1913
121
247
50
269
284
222
240
11
204
112
4
7
3
67
51
13

Figure 7.

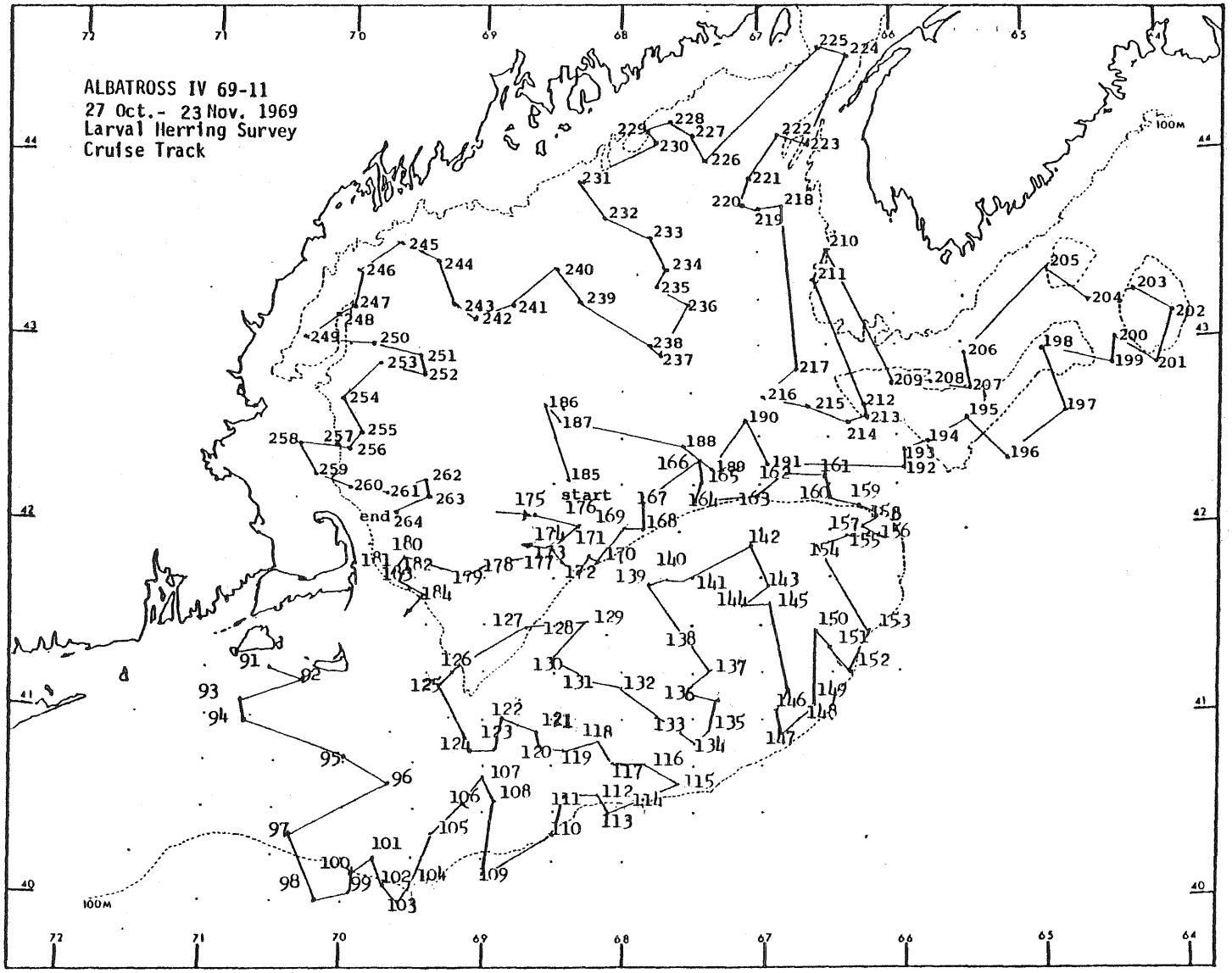

ALBATROSS IV 69-11
27 Oct.- 23 Nov. 1969
Larval Herring Survey
Cruise Track
start
end
100M

Figure 8.

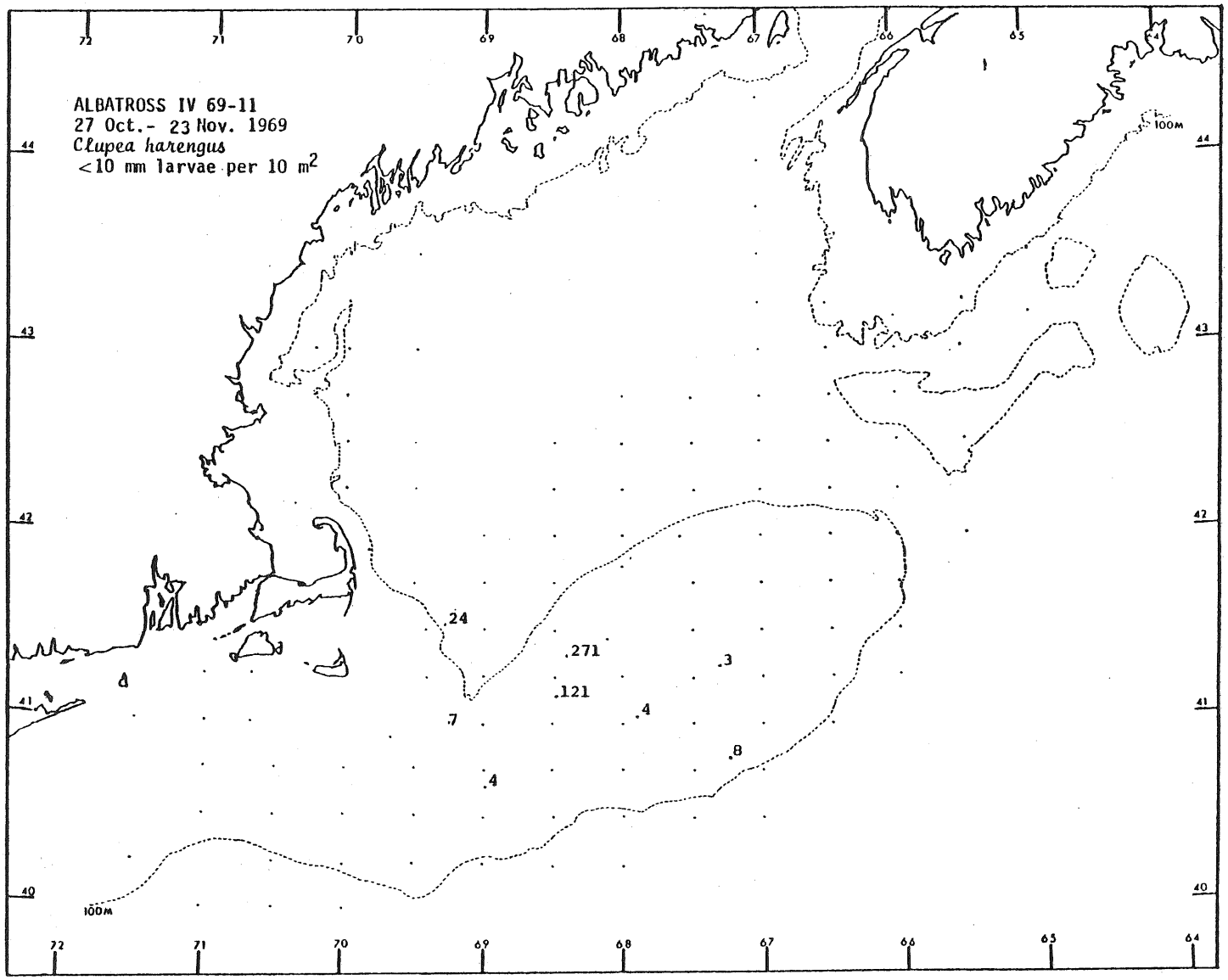

ALBATROSS IV 69-11
27 Oct.- 23 Nov. 1969
Clupea harengus
<10 mm larvae per 10 m2
100M
24
271
121
3
4
7
8
4
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 9.

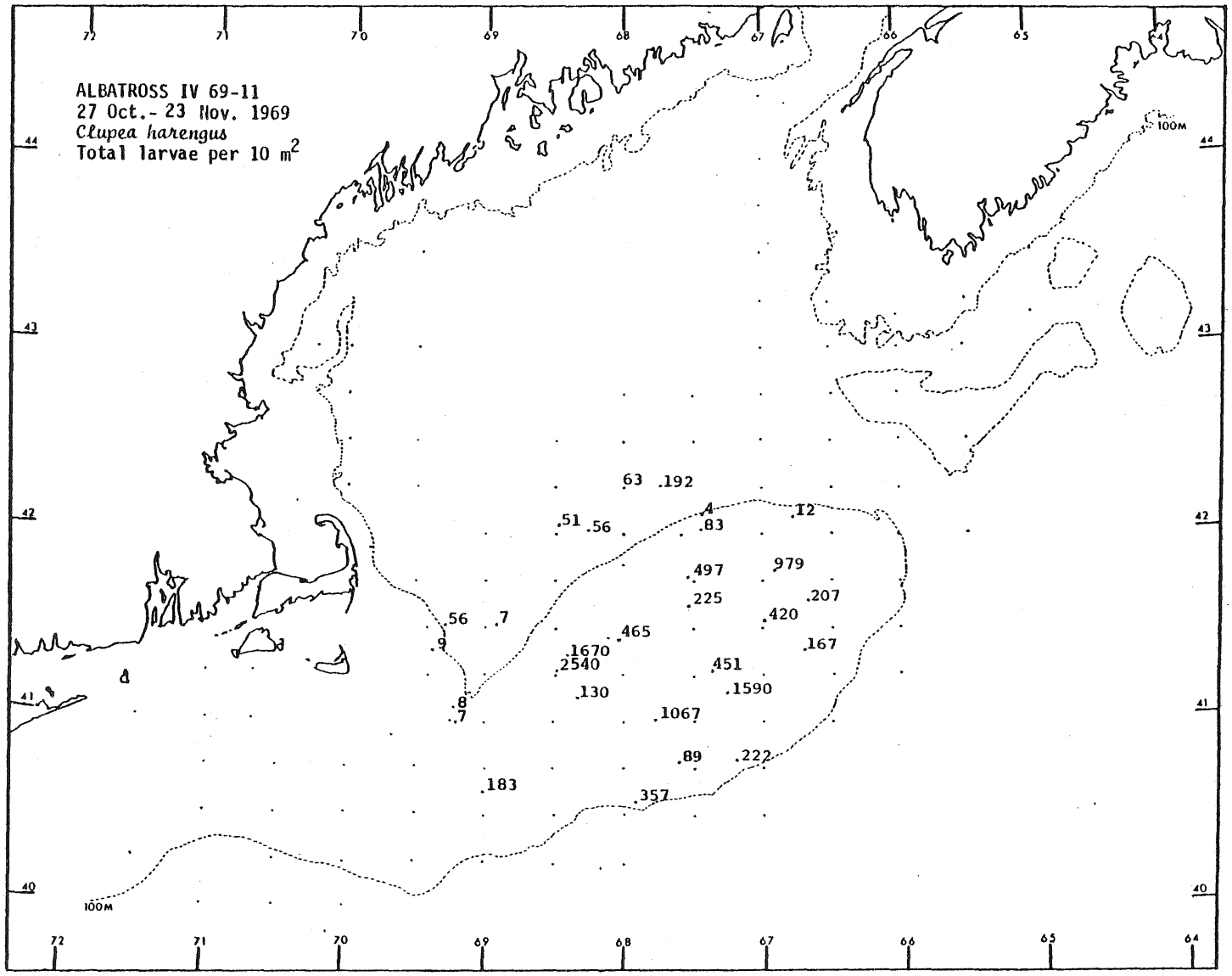

ALBATROSS IV 69-11
27 Oct.- 23 Nov. 1969
Clupea harengus
Total larvae per 10 m2
100M
63
192
4
12
51
56
83
497
979
225
207
420
56
7
465
167
9
1670
2540
451
130
1590
8
7
1067
89
222
183
357
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 10.

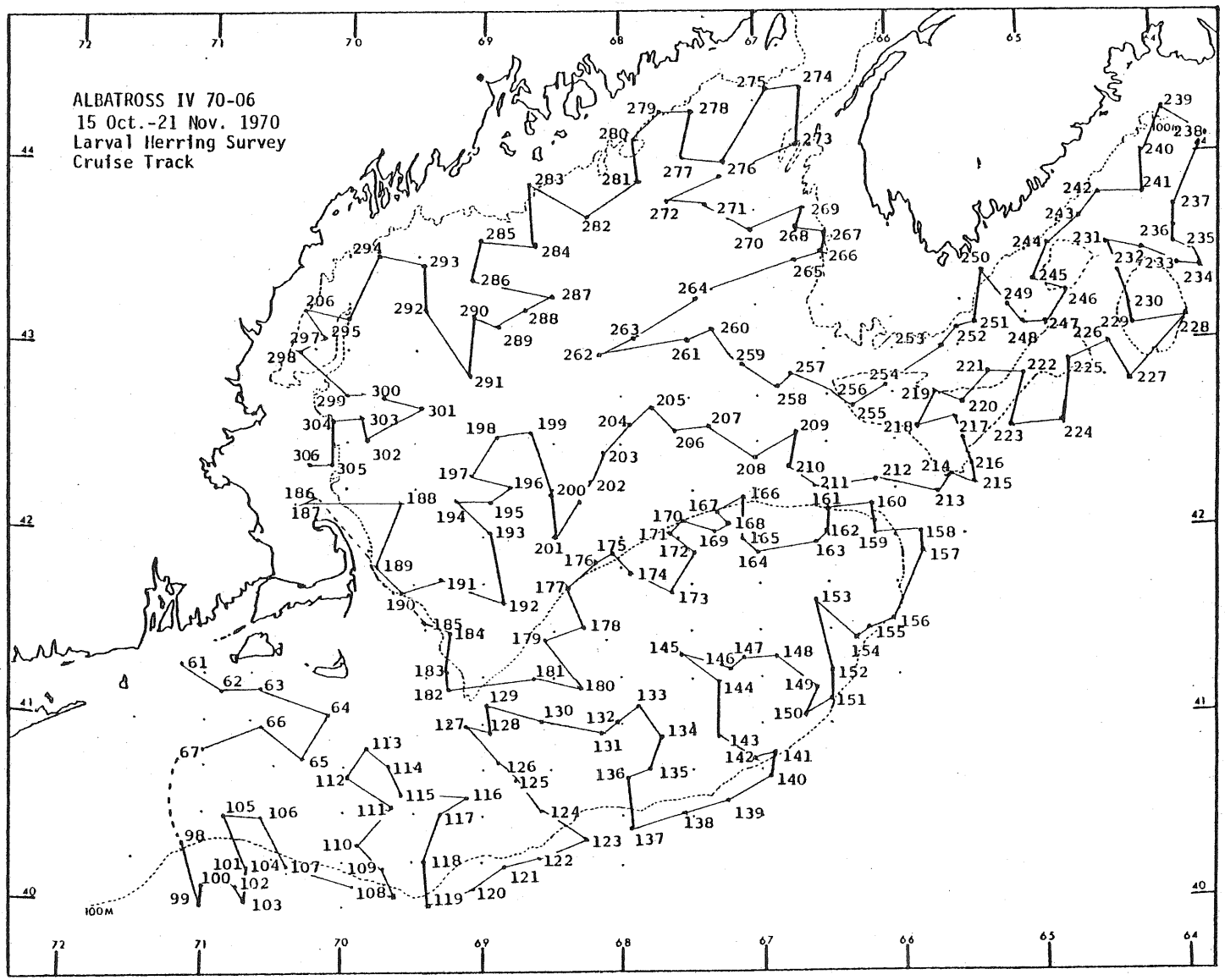

ALBATROSS IV 70-06
15 Oct.-21 Nov. 1970
Larval Herring Survey
Cruise Track
100M

Figure 11.

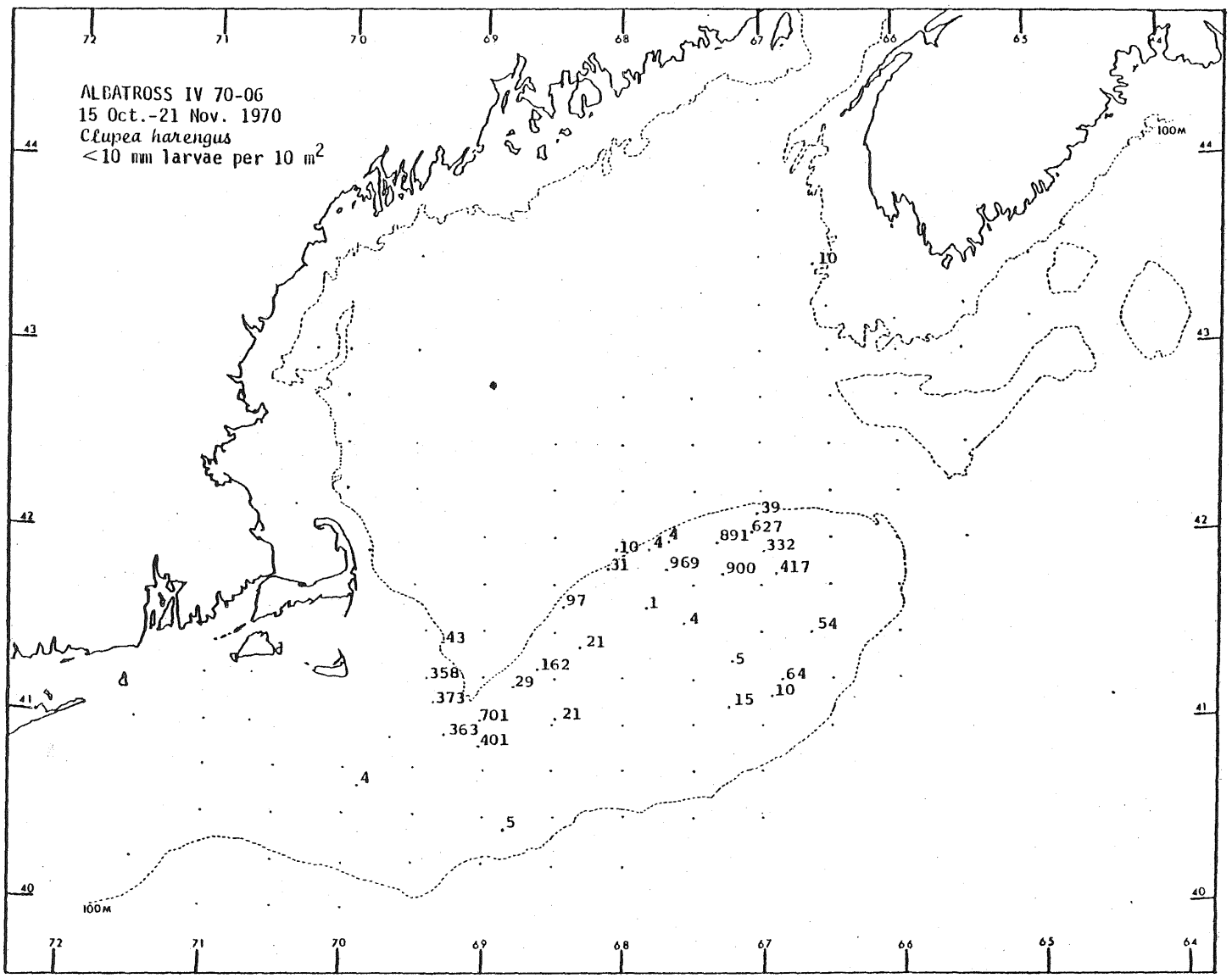

ALBATROSS IV 70-06
15 Oct.-21 Nov. 1970
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
.10
.39
.627
.4
.4
.891
.332
.10
.31
.969
.900
.417
.97
.1
.4
.54
.43
.21
.5
.358
.162
.64
.29
.10
.373
.15
.701
.21
.363
.401
.4
.5

Figure 12.

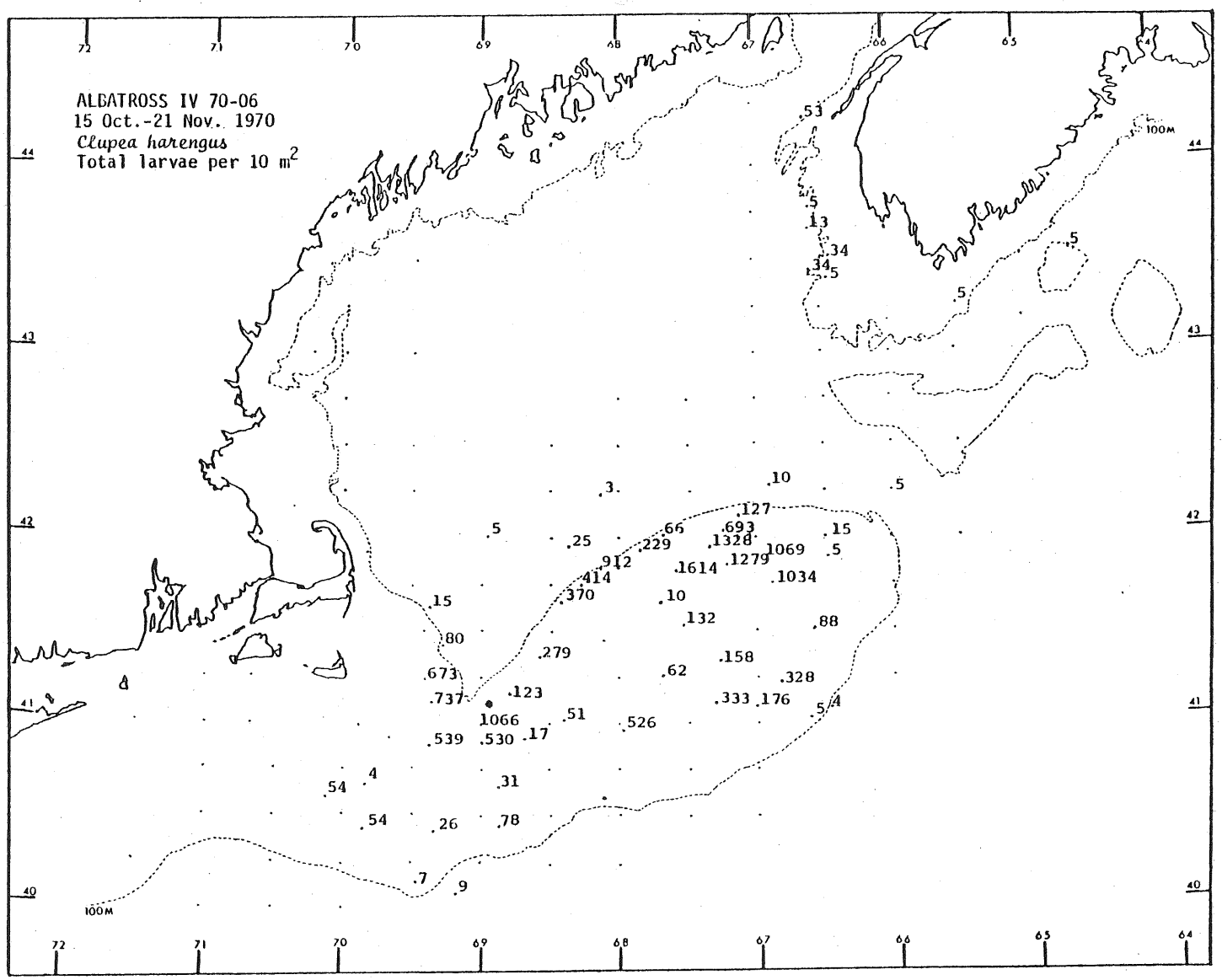

ALBATROSS IV 70-06
15 Oct.-21 Nov. 1970
Clupea harengus
Total larvae per 10 m2
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
.53
.5
.13
.34
.34
.5
.5
.5
.3
.10
.5
.127
.66
.693
.15
.5
.25
.229
.1328
.1069
.912
.1279
.1614
.414
.1034
.370
.10
.15
.132
.88
.80
.279
.158
.673
.62
.328
.737
.123
.333
.176
.5
.4
.1066
.51
.526
.539
.530
.17
.4
.31
.54
.54
.26
.78
.7
.9

Figure 13.

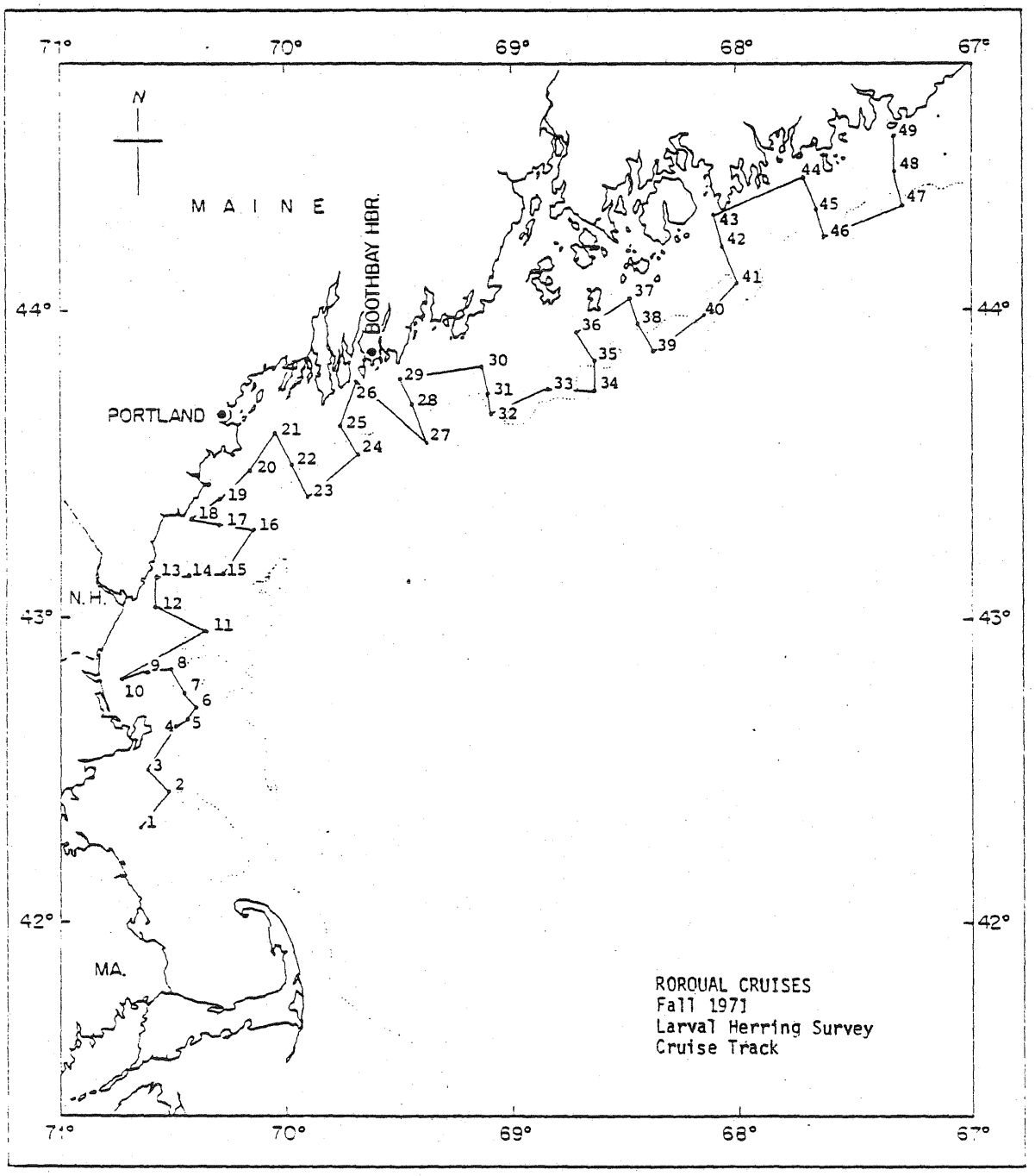

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
ROROUAL CRUISES
Fall 1971
Larval Herring Survey
Cruise Track

Figure 14.

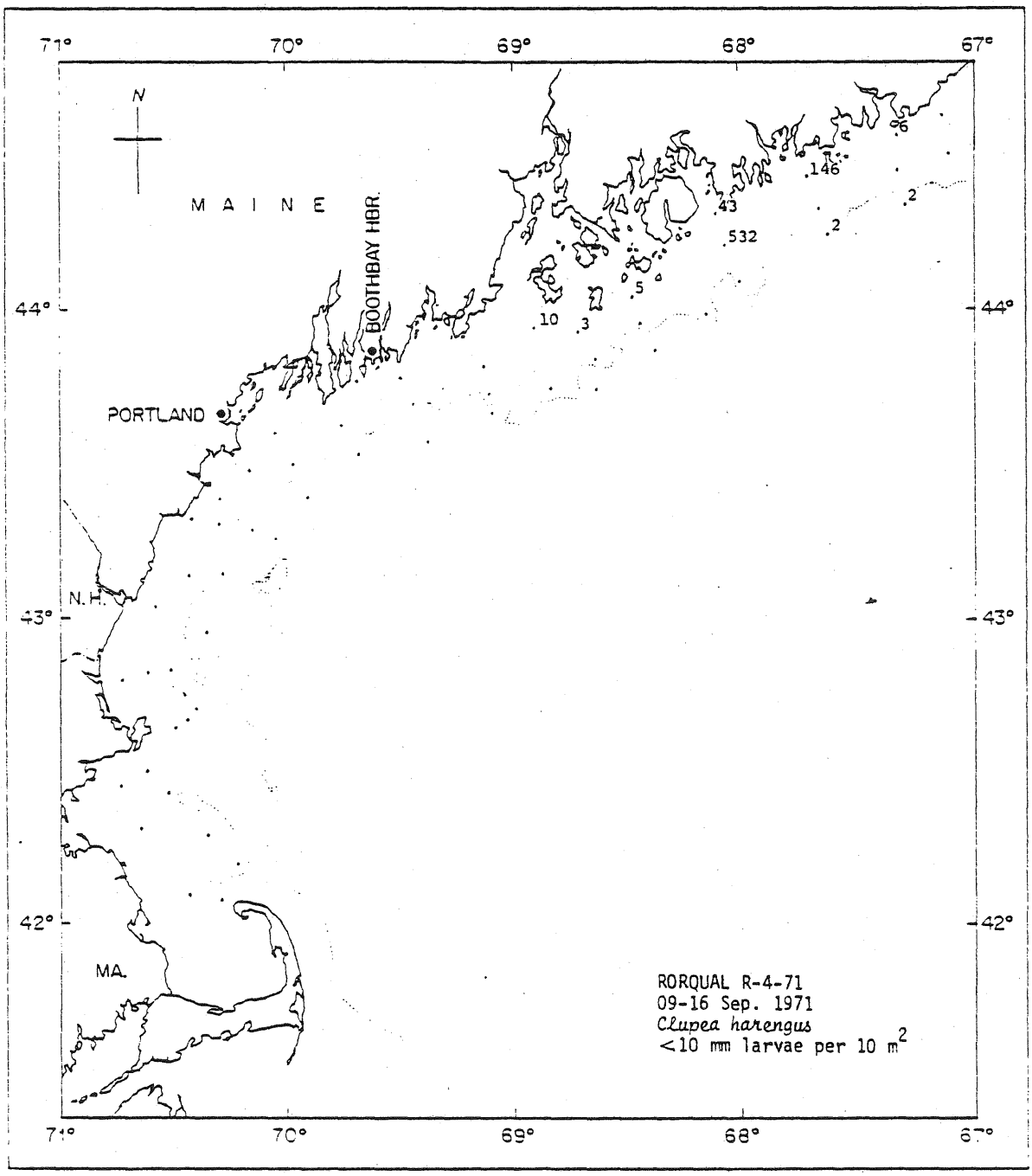

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
6
146
43
532
2
2
5
10
3
RORQUAL R-4-71
09-16 Sep. 1971
Clupea harengus
<10 mm larvae per 10 m2

Figure 15.

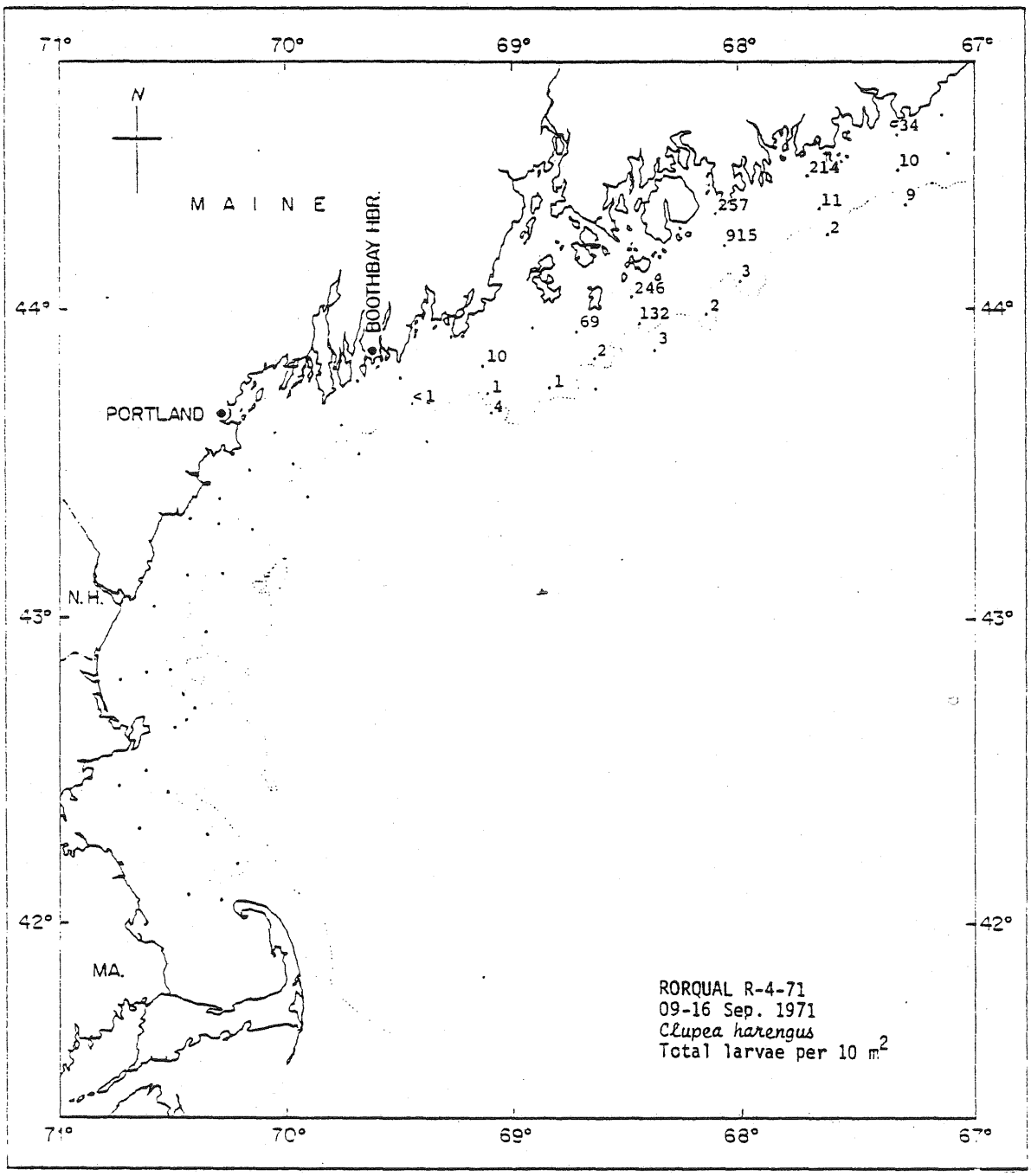

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
34
10
214
9
11
257
2
915
3
246
2
132
69
3
2
10
1
1
<1
4
RORQUAL R-4-71
09-16 Sep. 1971
Clupea harengus
Total larvae per 10 m2

Figure 16.

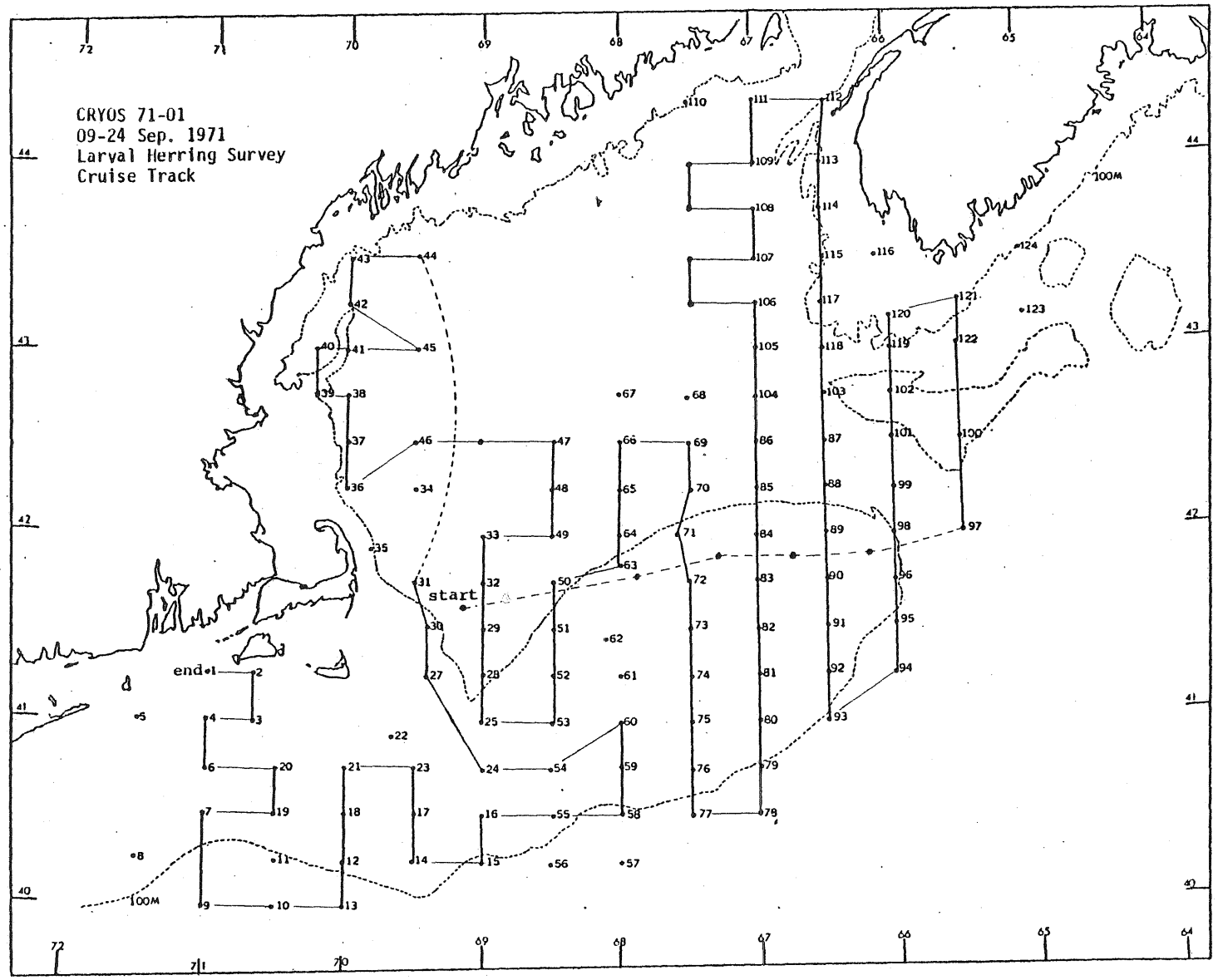

CRYOS 71-01
09-24 Sep. 1971
Larval Herring Survey
Cruise Track
start
end
100M

Figure 17.

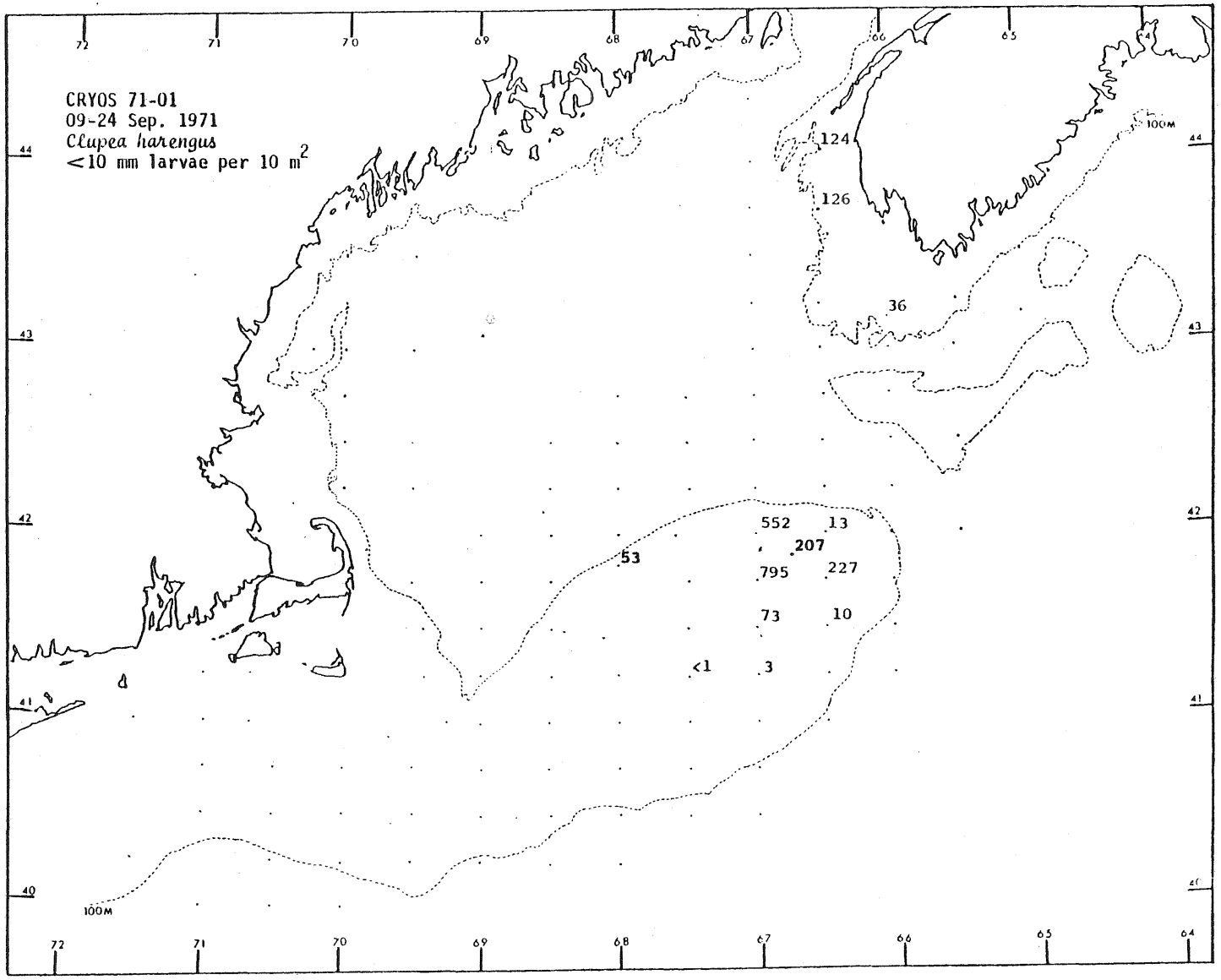

CRYOS 71-01
09-24 Sep. 1971
Clupea harengus
<10 mm larvae per 10 m2
124
126
36
552
13
207
53
795
227
73
10
<1
3
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 18.

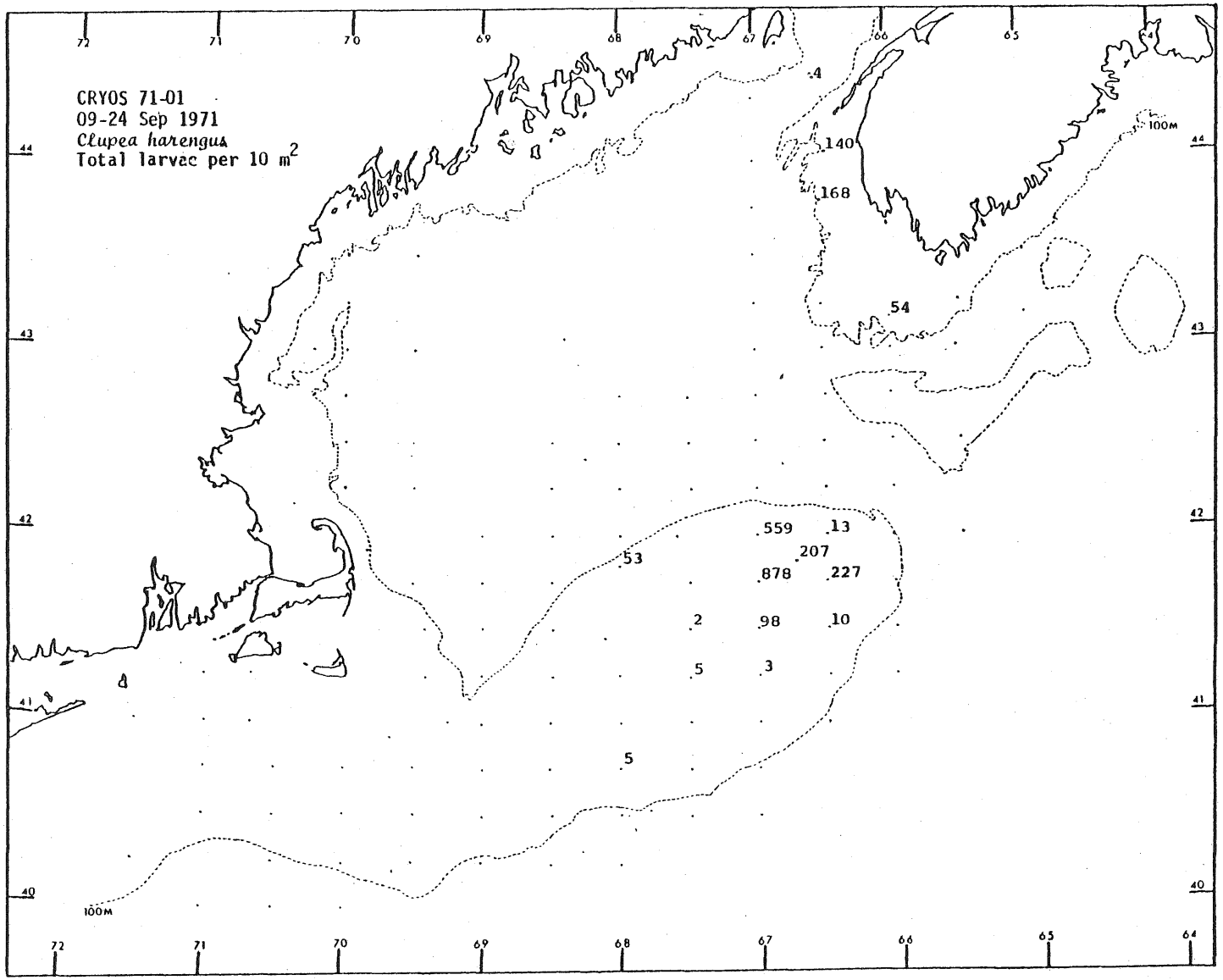

CRYOS 71-01
09-24 Sep 1971
Clupea harengus
Total larvae per 10 m2
4
140
168
54
559
13
207
53
878
227
2
98
10
5
3
5
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 19.

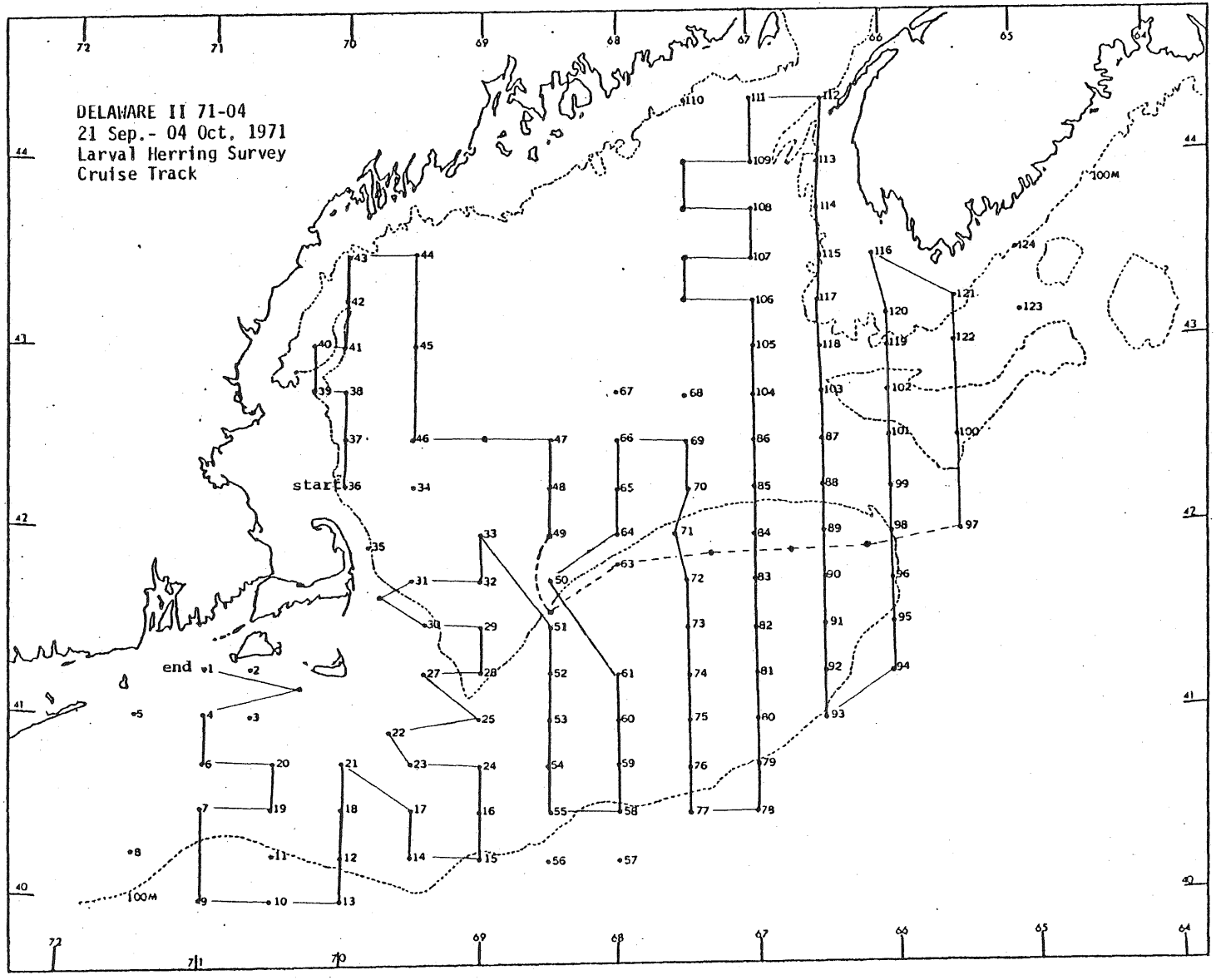

DELAWARE II 71-04
21 Sep.- 04 Oct, 1971
Larval Herring Survey
Cruise Track
start
end
100M

Figure 20.

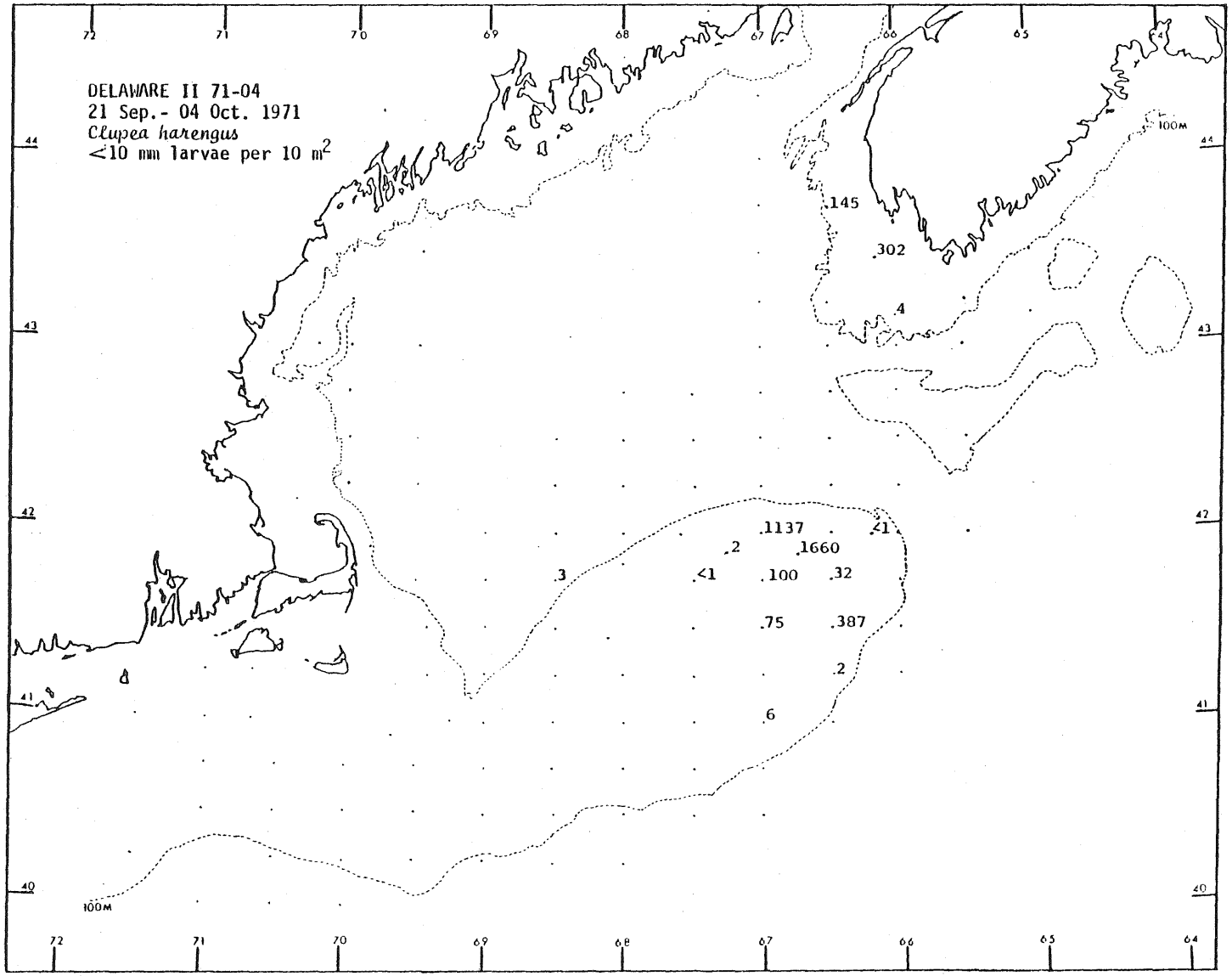

DELAWARE II 71-04
21 Sep.- 04 Oct. 1971
Clupea harengus
<10 mm larvae per 10 m2
72
71
70
69
68
67
66
65
64
44
43
42
41
40
100M
145
302
4
1137
<1
2
1660
3
<1
100
32
75
387
2
6

Figure 21.

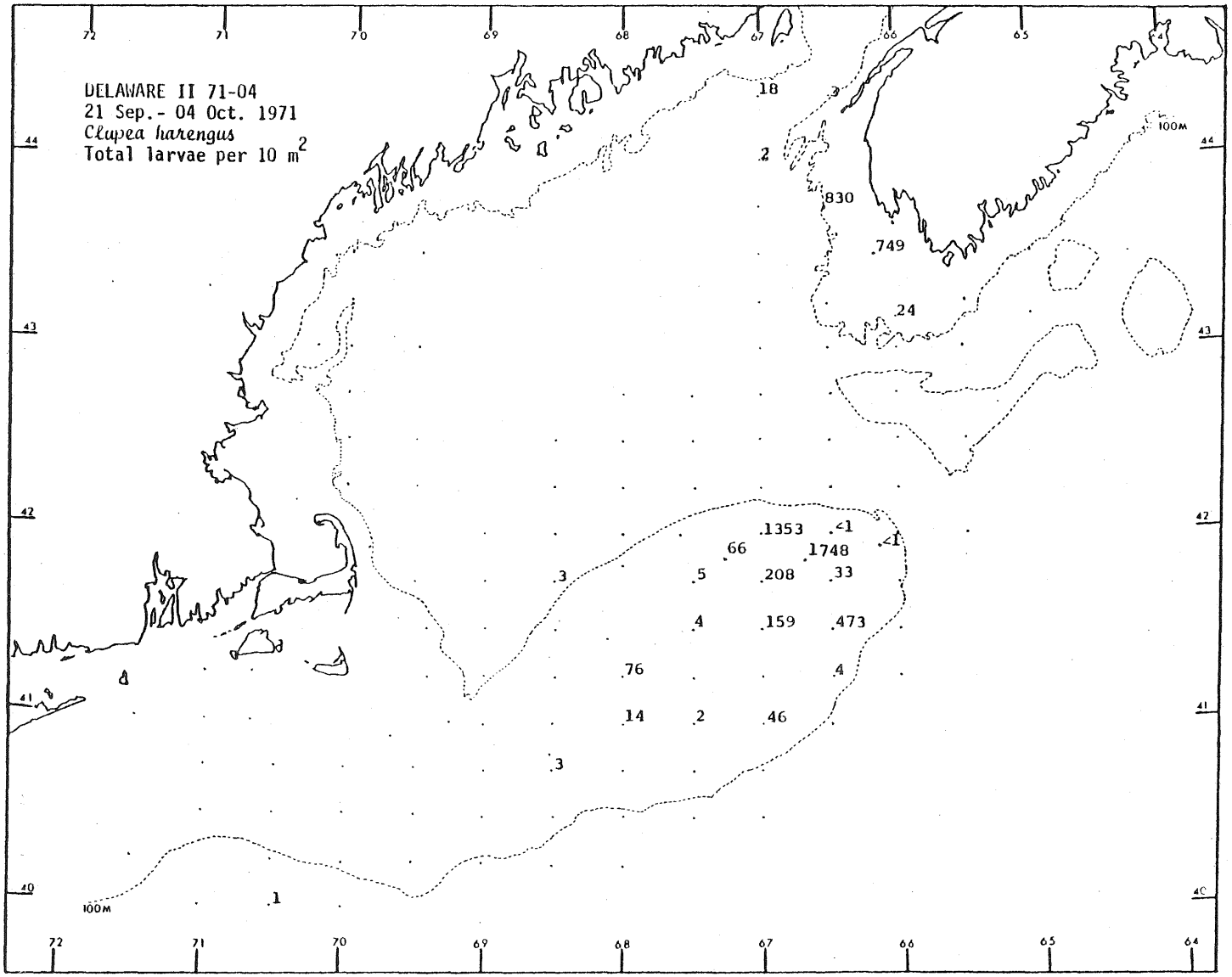

DELAWARE II 71-04
21 Sep.- 04 Oct. 1971
Clupea harengus
Total larvae per 10 m2
100M
18
2
830
749
24
1353
<1
66
1748
<1
3
5
208
33
4
159
473
76
4
14
2
46
3
1
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 22.

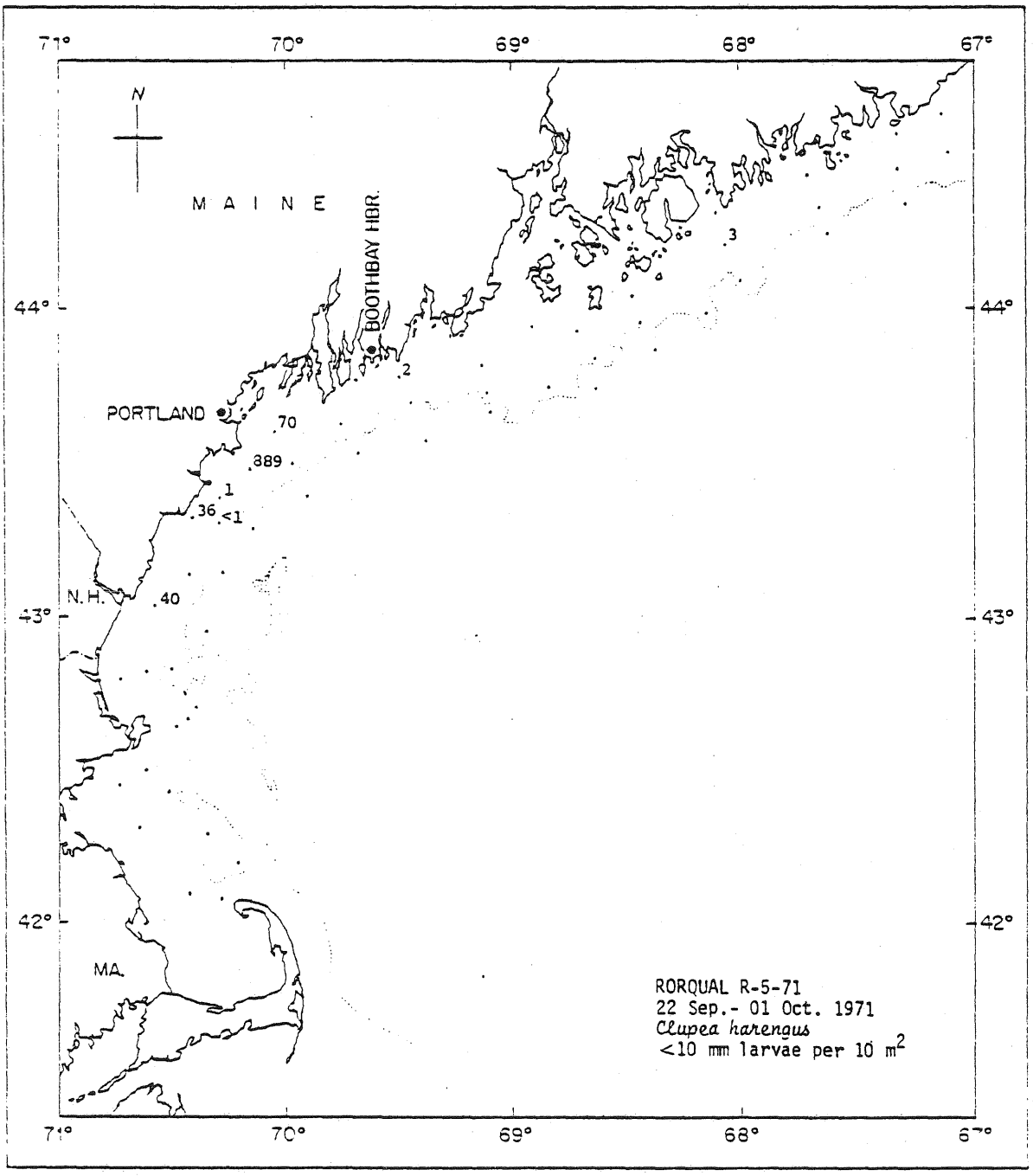

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
44°
PORTLAND
.70
.389
.1
.36
<1
.2
.3
N.H.
.40
43°
42°
MA.
RORQUAL R-5-71
22 Sep.- 01 Oct. 1971
Clupea harengus
<10 mm larvae per 10 m2

Figure 23.

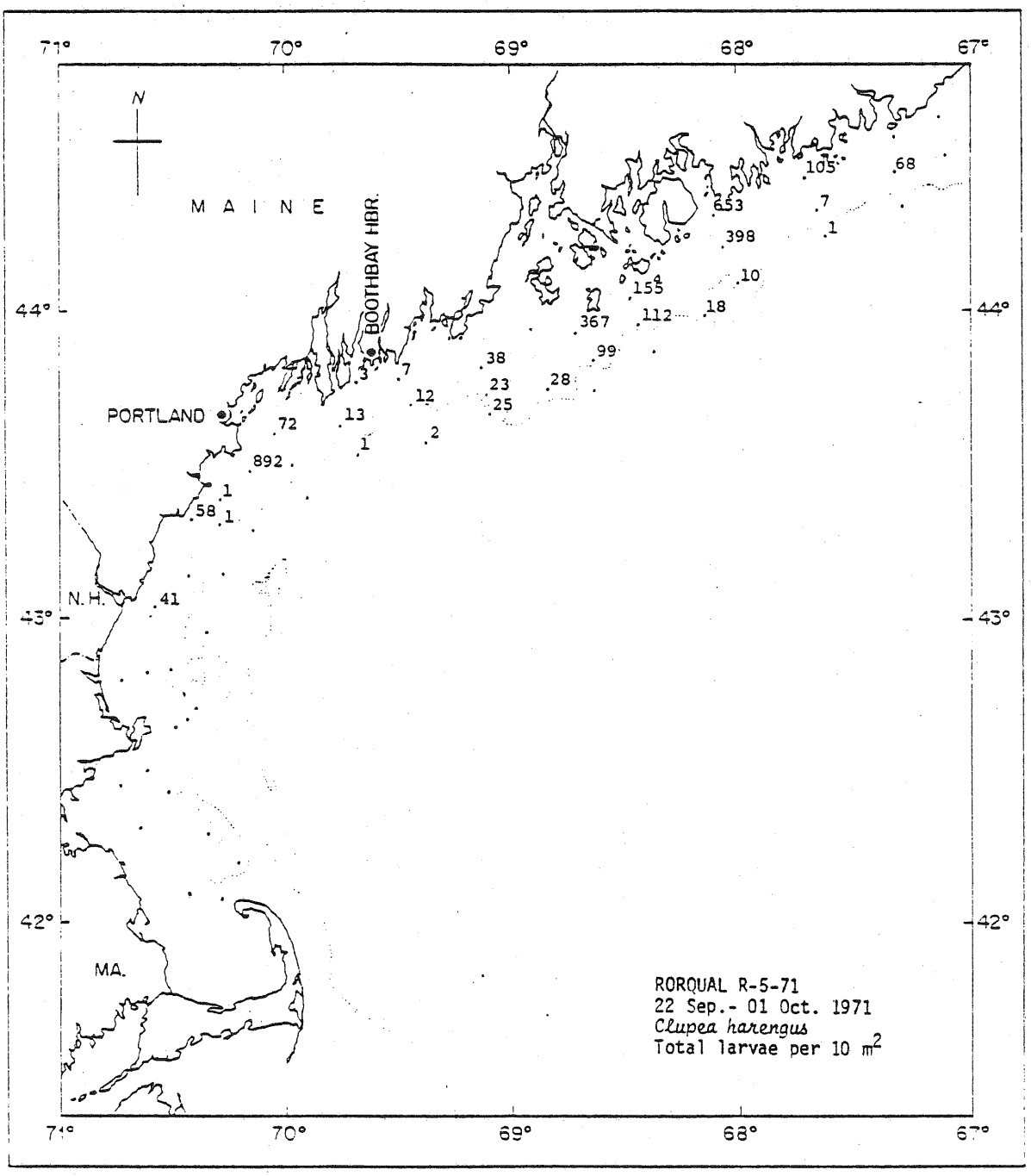

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
653
398
105
68
7
1
10
155
18
112
367
99
38
23
25
28
3
7
12
2
13
1
72
892
1
58
1
41
RORQUAL R-5-71
22 Sep.- 01 Oct. 1971
Clupea harengus
Total larvae per 10 m2

Figure 24.

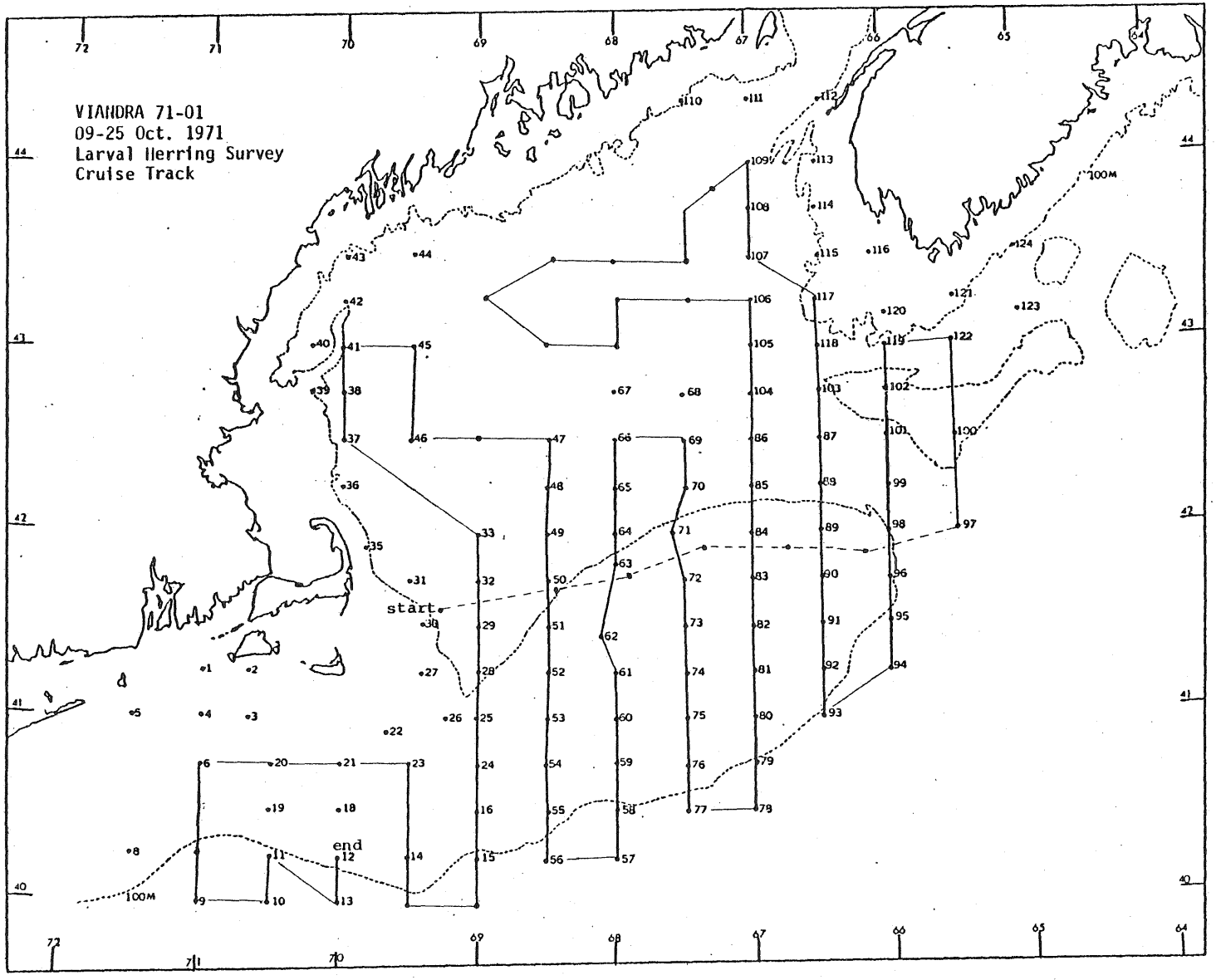

VIANDRA 71-01
09-25 Oct. 1971
Larval Herring Survey
Cruise Track
start
end
100M

Figure 25.

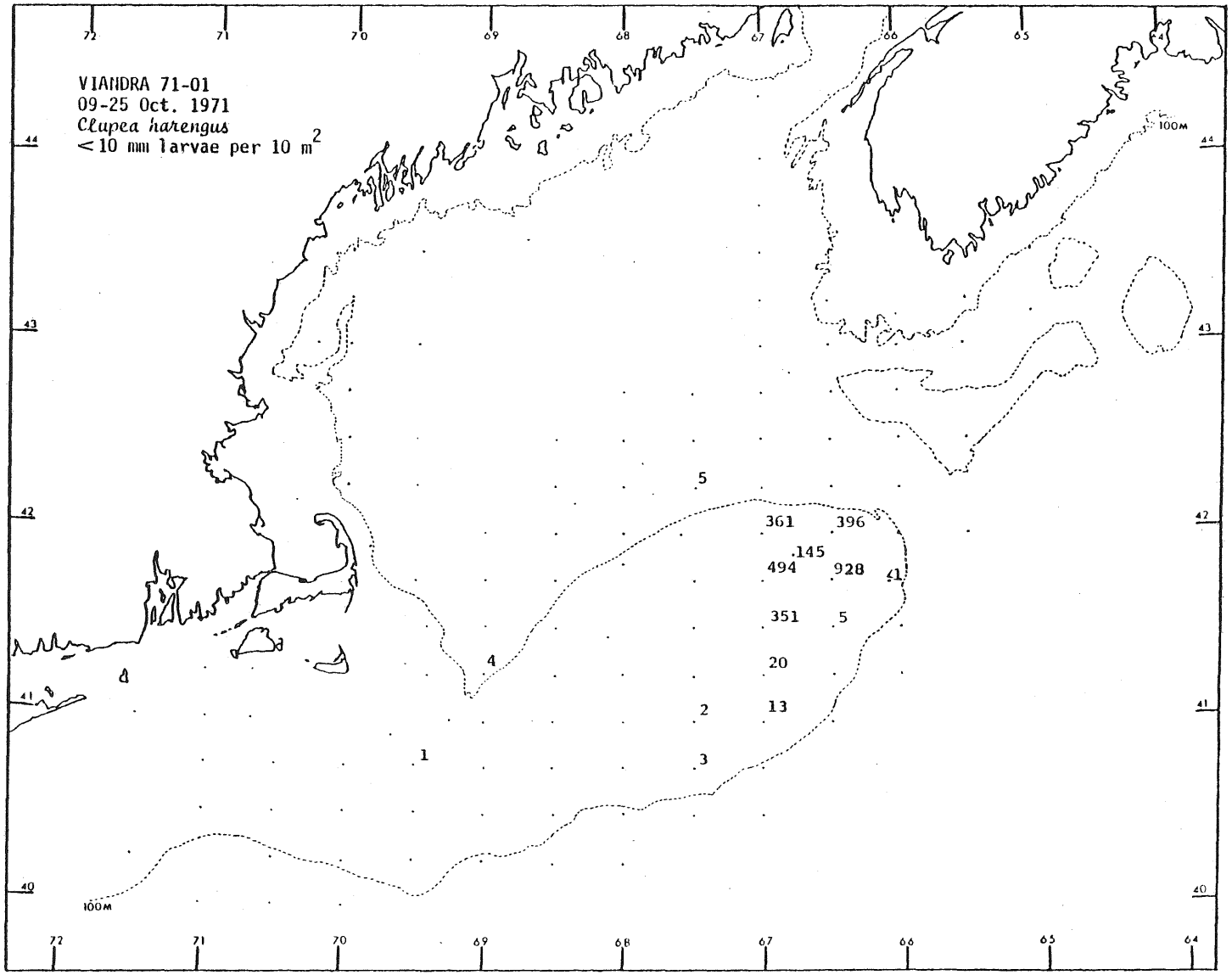

VIANDRA 71-01
09-25 Oct. 1971
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
5
361
396
145
494
928
41
351
5
4
20
2
13
1
3

Figure 26.

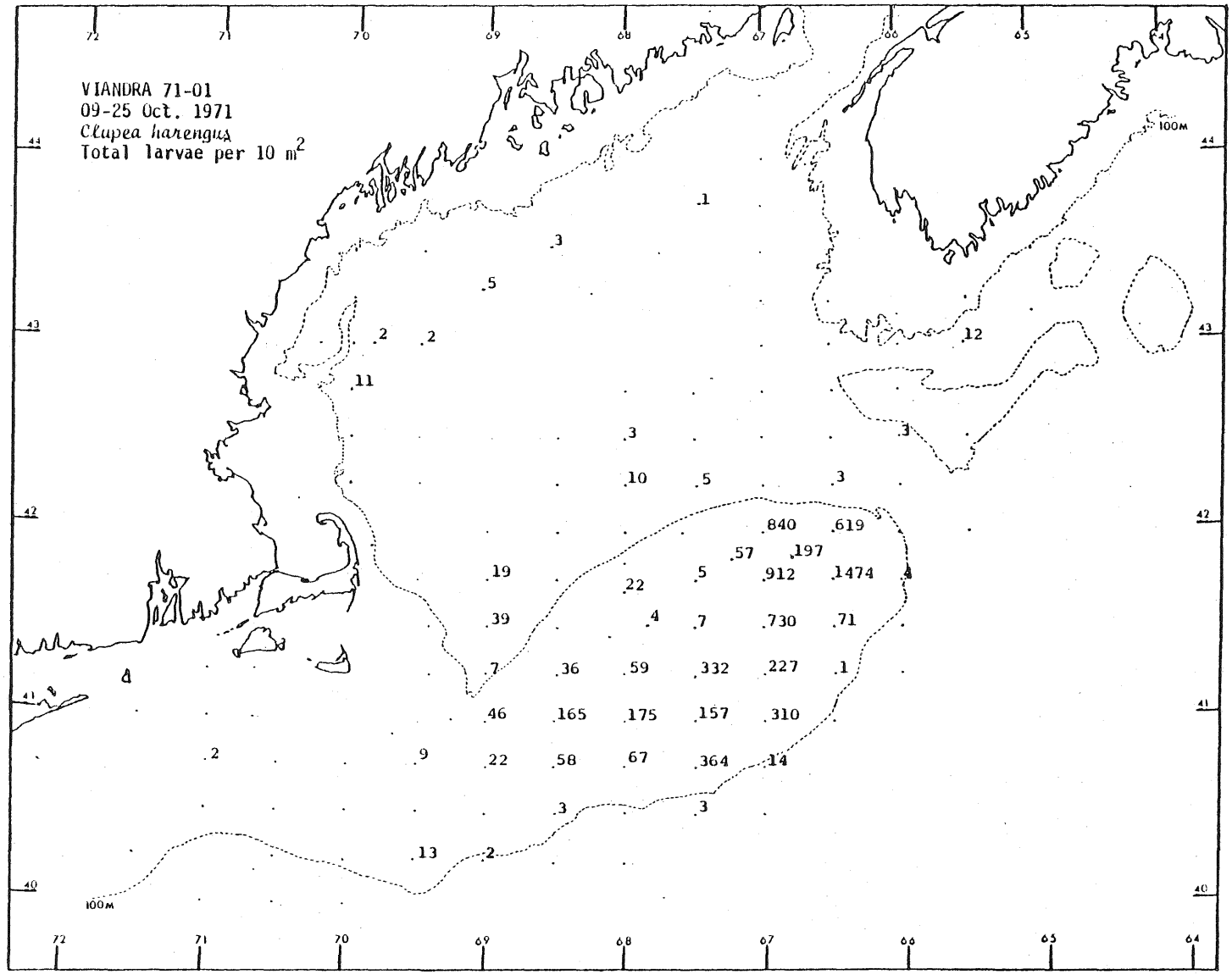

VIANDRA 71-01
09-25 Oct. 1971
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
1
3
5
2
2
11
12
3
3
10
5
3
840
619
57
197
19
22
5
912
1474
39
4
7
730
71
7
36
59
332
227
1
46
165
175
157
310
2
9
22
58
67
364
14
3
3
13
2

Figure 27.

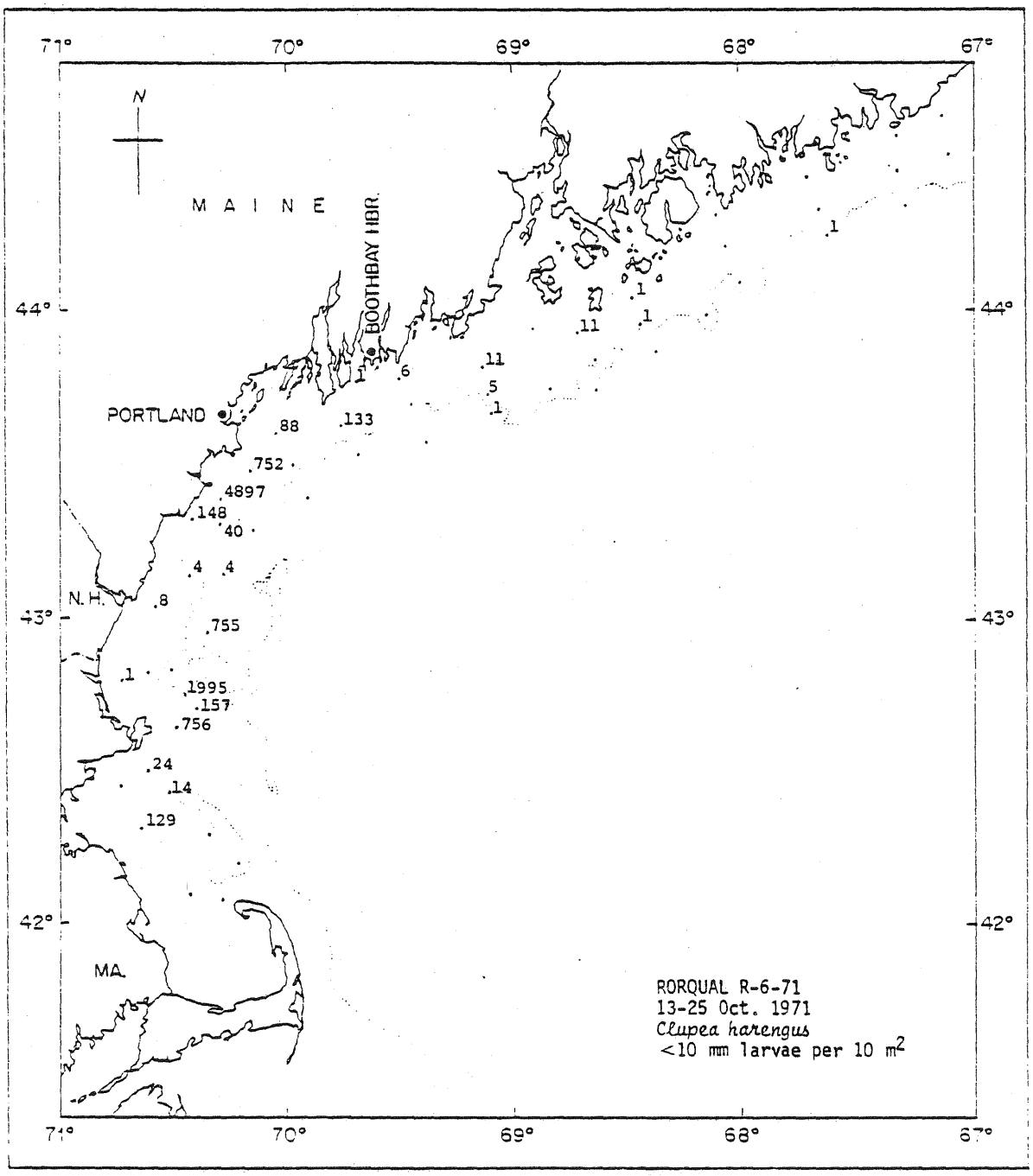

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
1
6
11
5
1
11
1
1
1
88
133
752
4897
148
40
4
4
8
755
1
1995
157
756
24
14
129
RORQUAL R-6-71
13-25 Oct. 1971
Clupea harengus
<10 mm larvae per 10 m2

Figure 28.

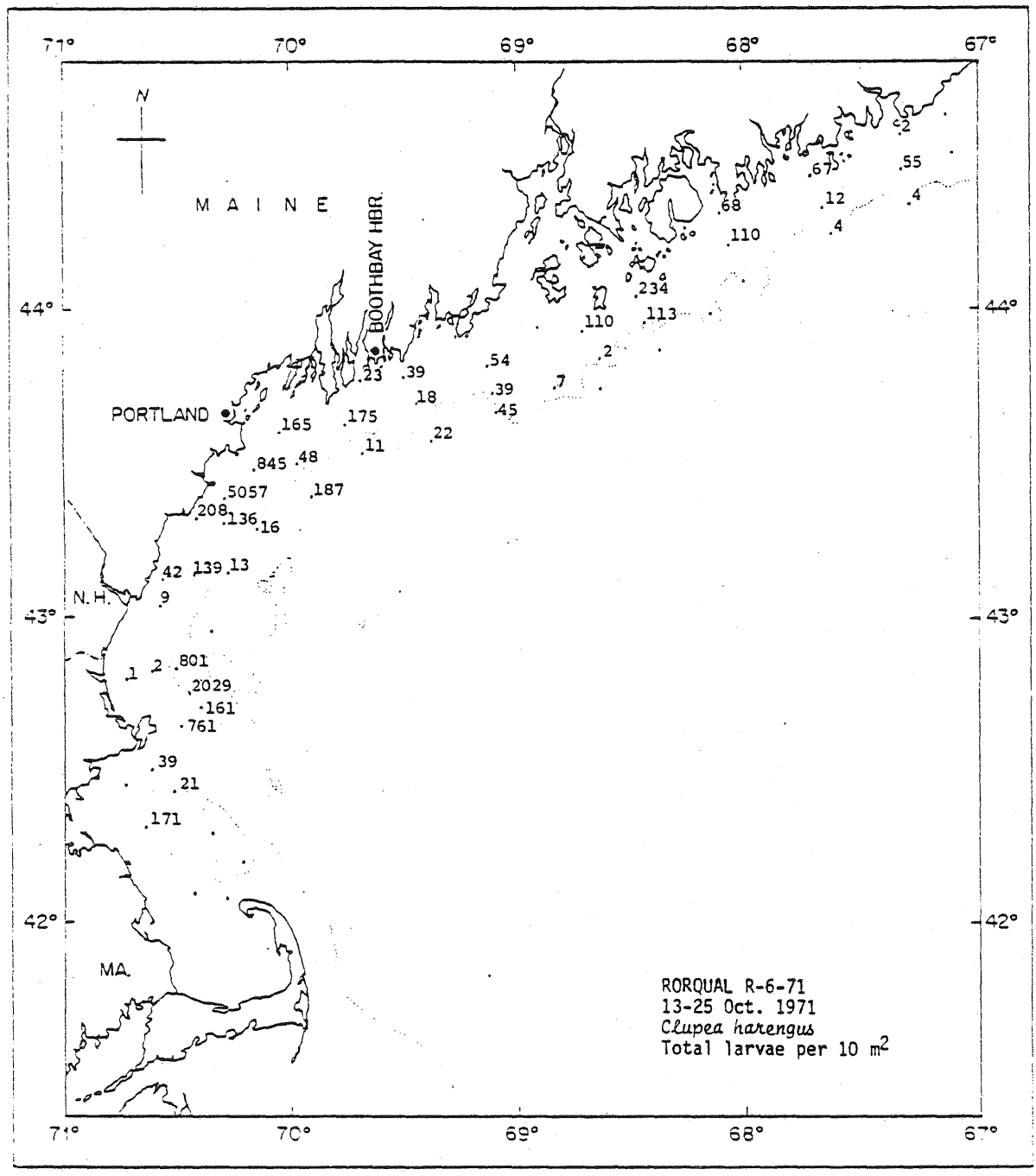

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
.2
.55
.67
.12
.4
.4
.68
.110
.234
.110
.113
.2
.54
.39
.7
.39
.45
.23
.39
.18
.22
.165
.175
.11
.845
.48
.5057
.187
.208
.136
.16
.42
.139
.13
.9
.1
.2
.801
.2029
.161
.761
.39
.21
.171
RORQUAL R-6-71
13-25 Oct. 1971
Clupea harengus
Total larvae per 10 m2

Figure 29.

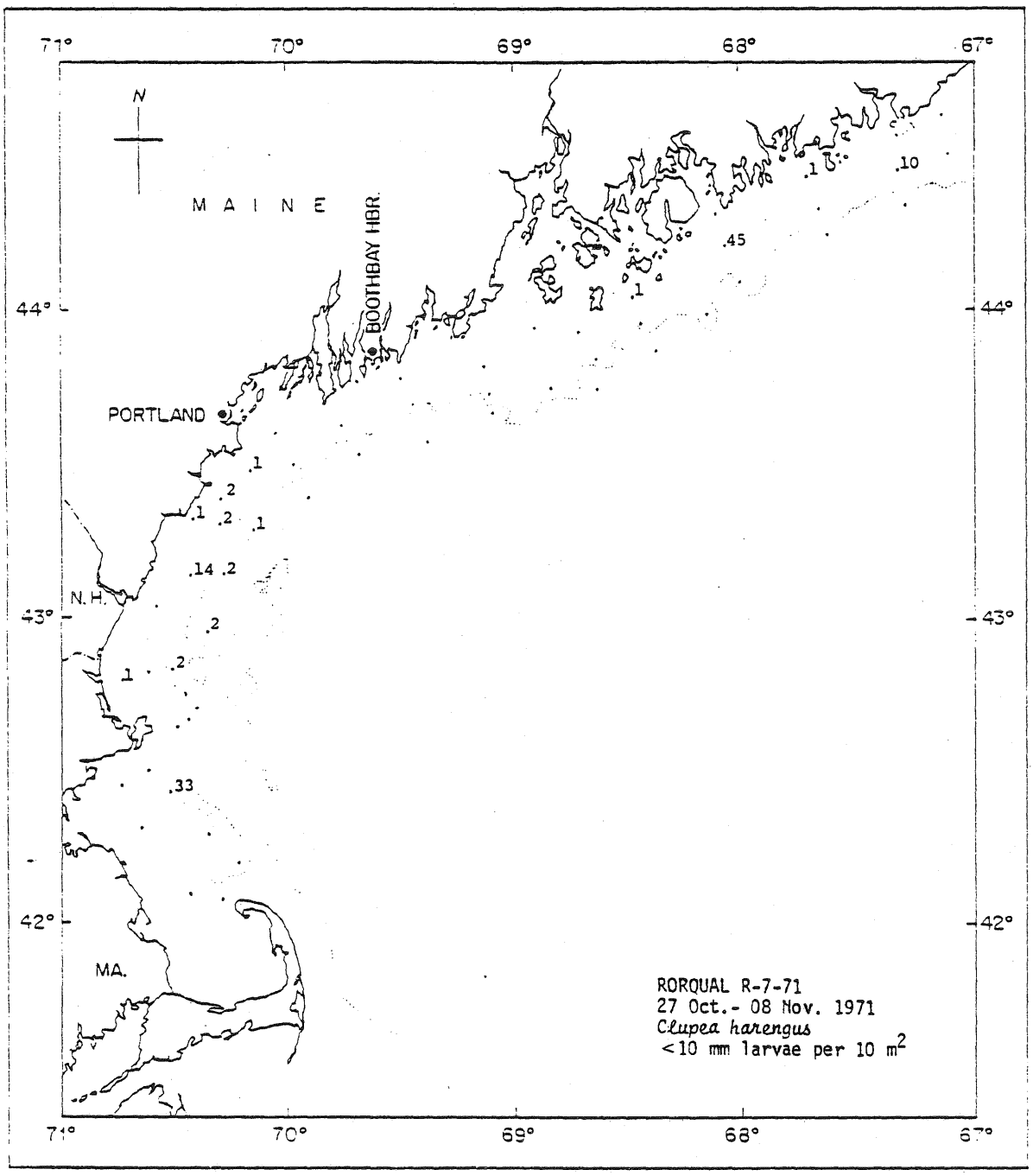

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
.1
.2
.1
.2
.1
.14
.2
.2
.1
.2
.33
.45
.1
.1
.10
RORQUAL R-7-71
27 Oct.- 08 Nov. 1971
Clupea harengus
<10 mm larvae per 10 m2

Figure 30.

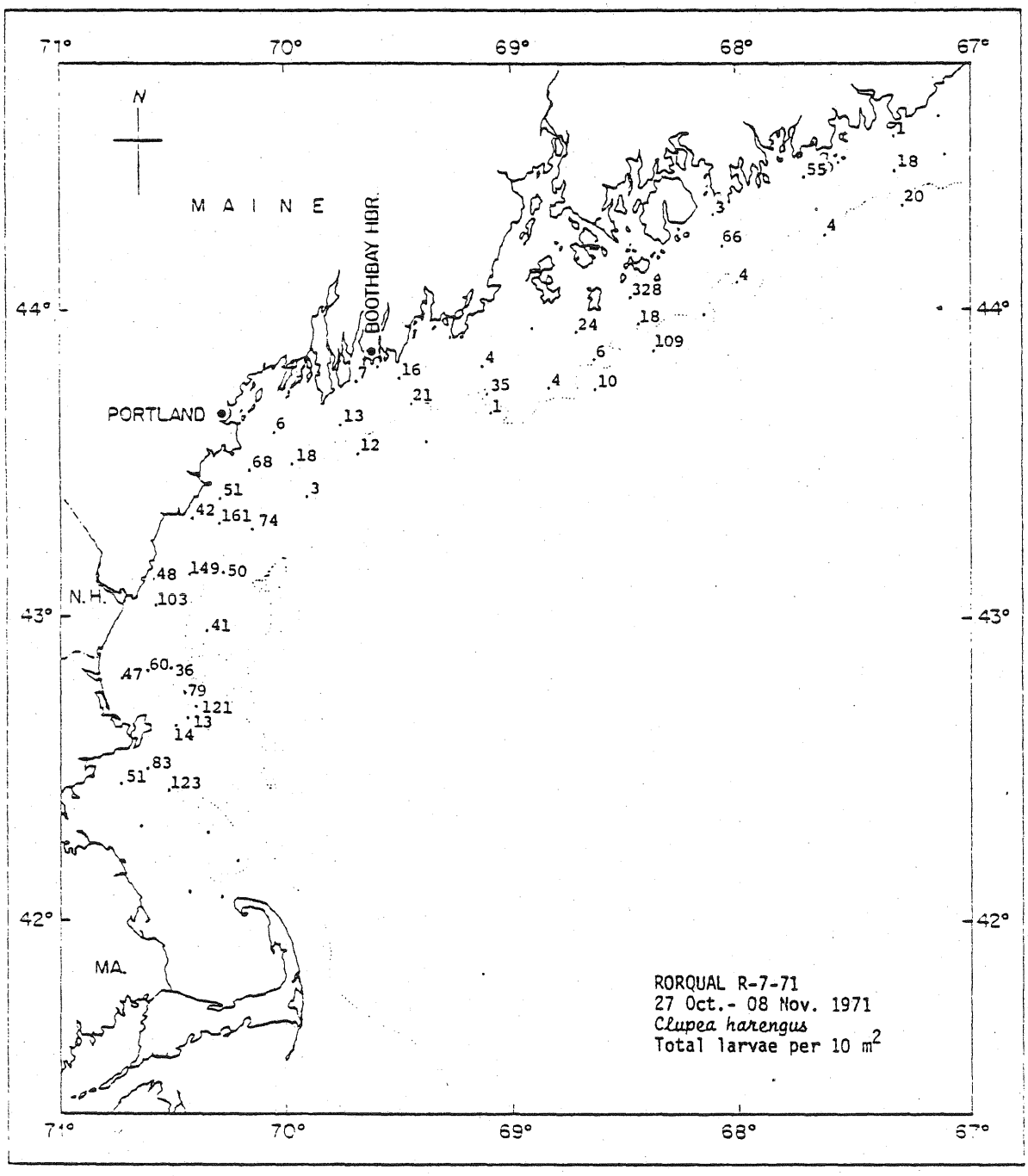

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
RORQUAL R-7-71
27 Oct.- 08 Nov. 1971
Clupea harengus
Total larvae per 10 m2

Figure 31.

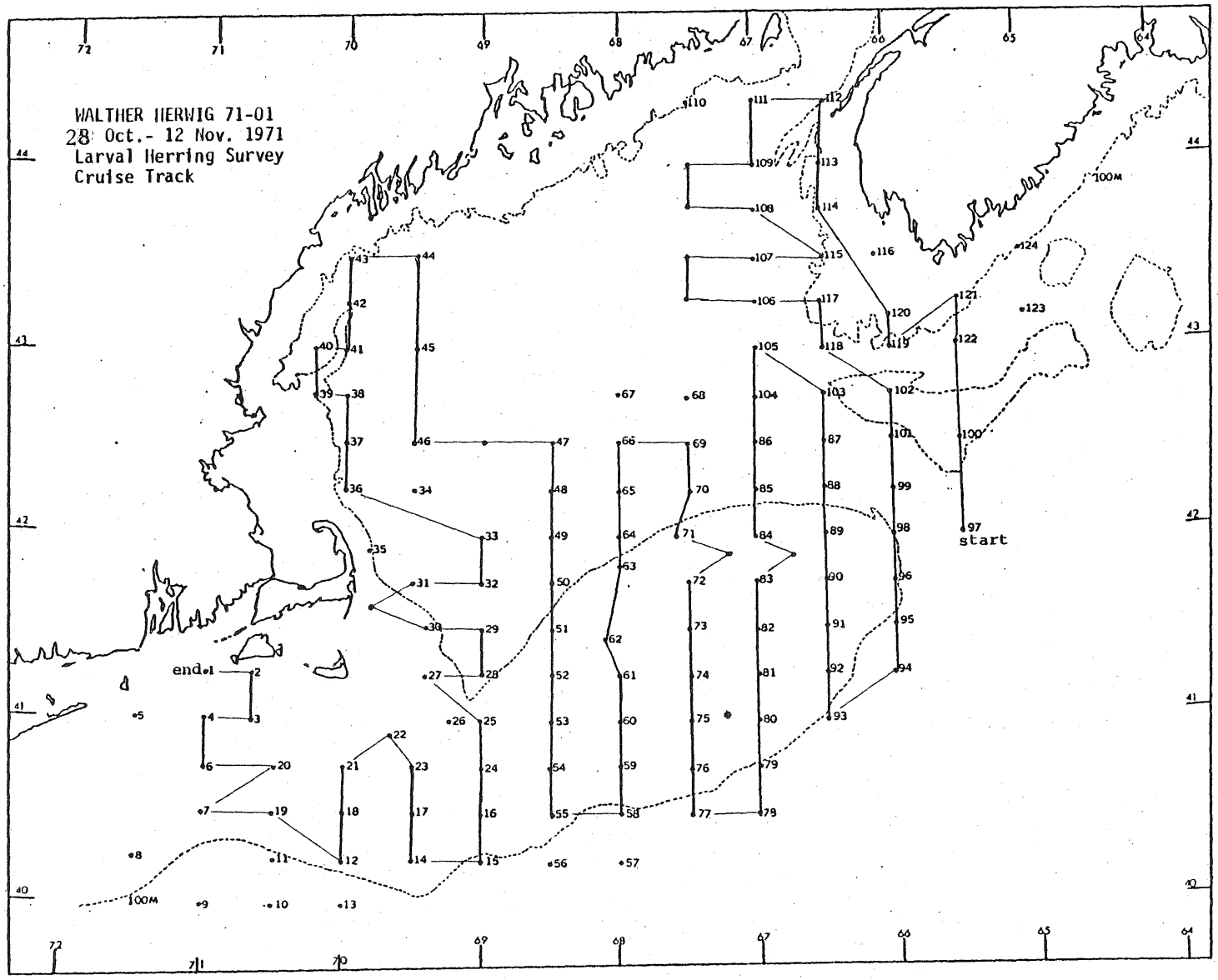

WALTHER HERWIG 71-01
28 Oct.- 12 Nov. 1971
Larval Herring Survey
Cruise Track
start
end
100M

Figure 32.

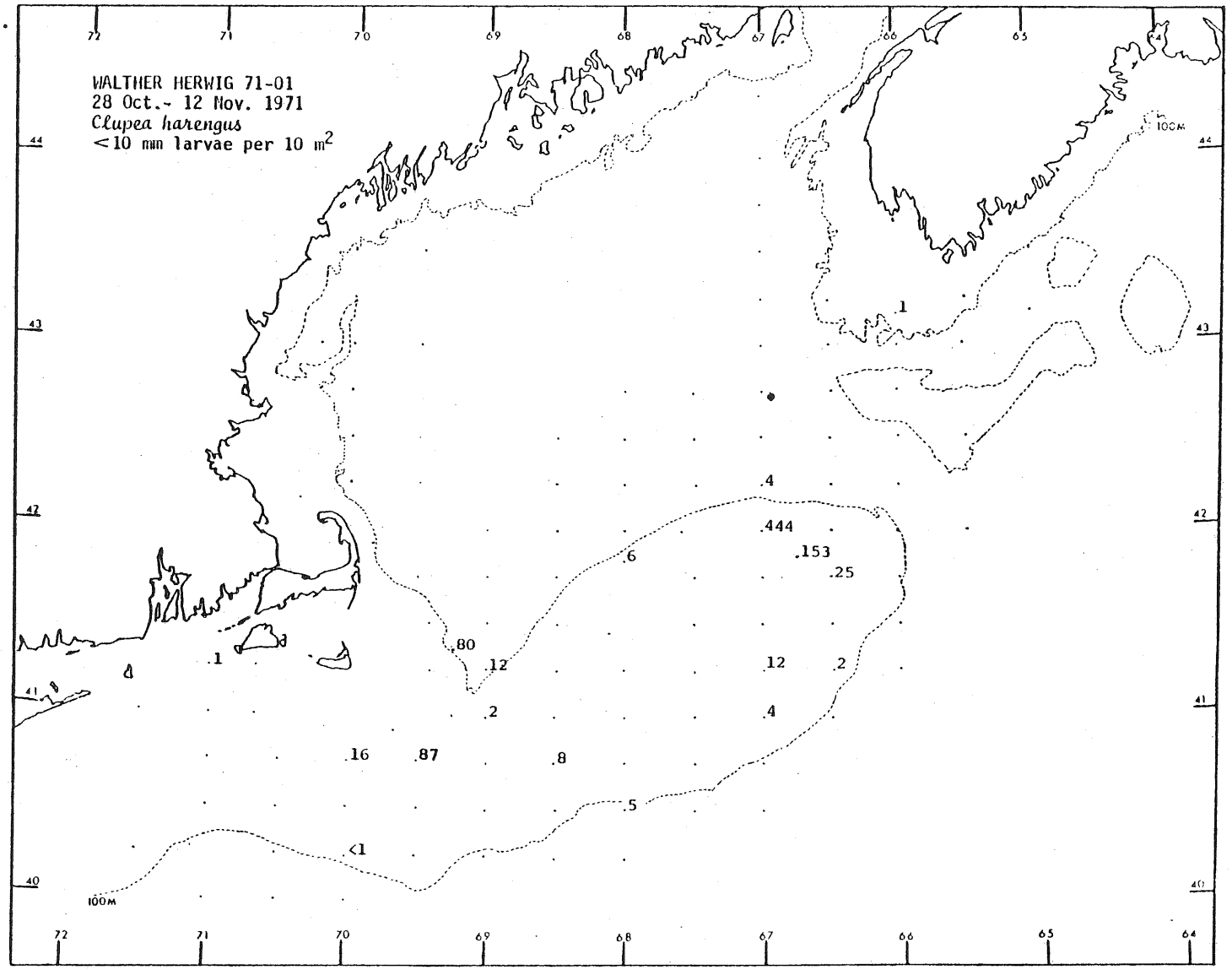

WALTHER HERWIG 71-01
28 Oct.- 12 Nov. 1971
Clupea harengus
<10 mm larvae per 10 m²
100M
1
4
444
153
25
6
80
12
12
2
1
2
4
16
87
8
5
<1
100M

Figure 33.

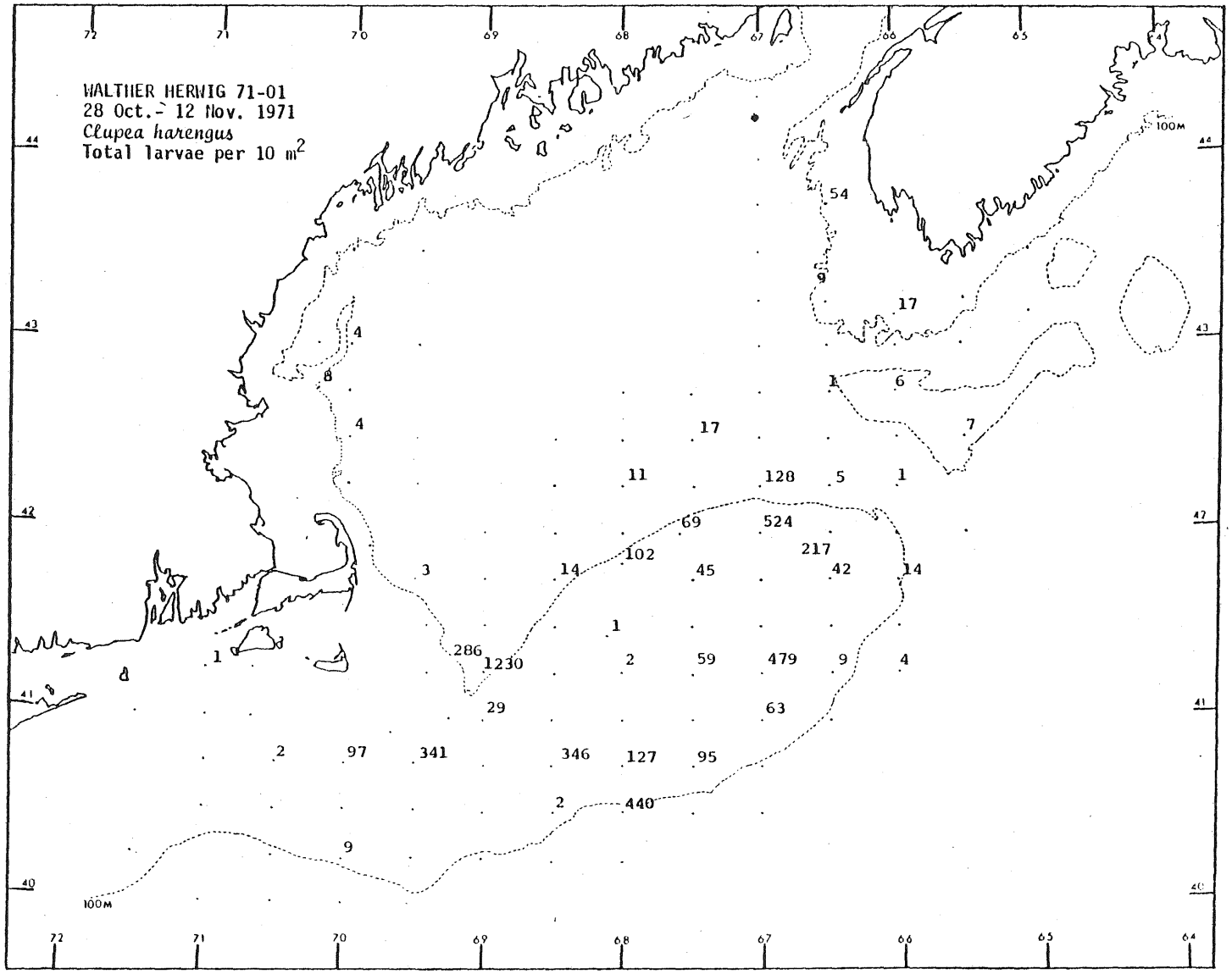

WALTHER HERWIG 71-01
28 Oct.- 12 Nov. 1971
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
54
9
17
4
8
1
6
4
17
7
11
128
5
1
69
524
217
102
3
14
45
42
14
1
1
286
1230
2
59
479
9
4
29
63
2
97
341
346
127
95
2
440
9

Figure 34.

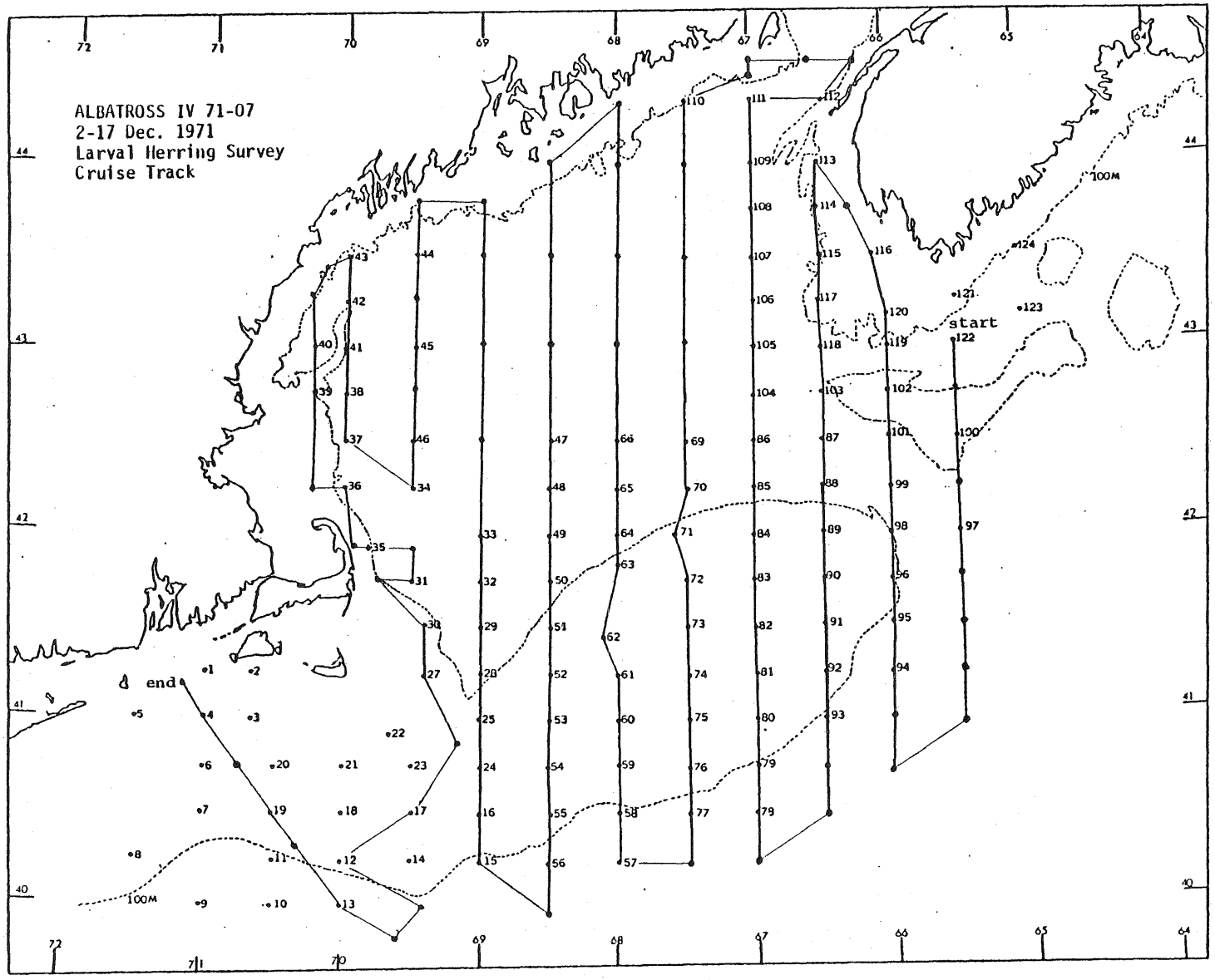

ALBATROSS IV 71-07
2-17 Dec. 1971
Larval Herring Survey
Cruise Track
start
end
100M

Figure 35.

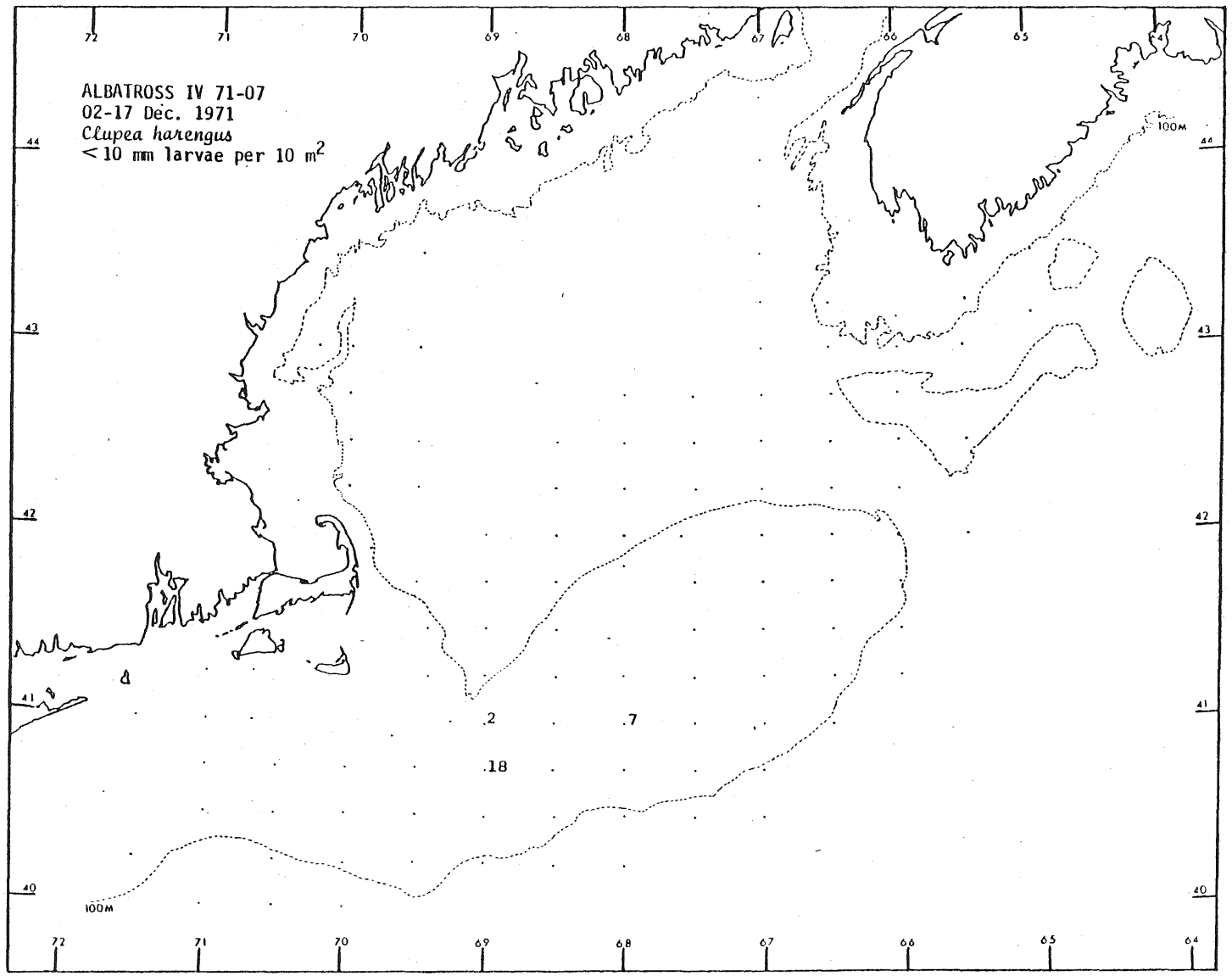

ALBATROSS IV 71-07
02-17 Dec. 1971
Clupea harengus
< 10 mm larvae per 10 m2
72
71
70
69
68
67
66
65
64
44
43
42
41
40
100M
.2
.7
.18

Figure 36.

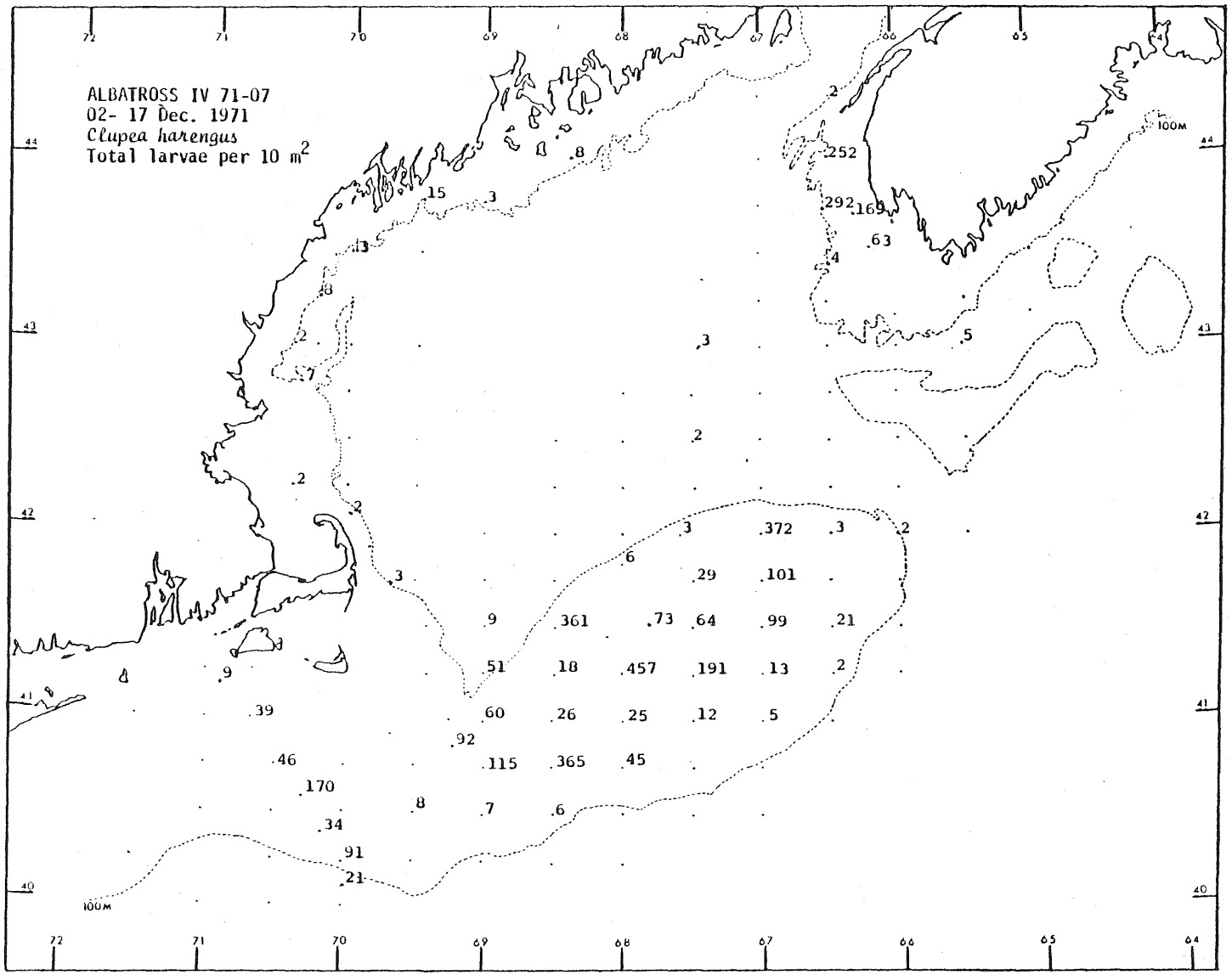

ALBATROSS IV 71-07
02- 17 Dec. 1971
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 37.

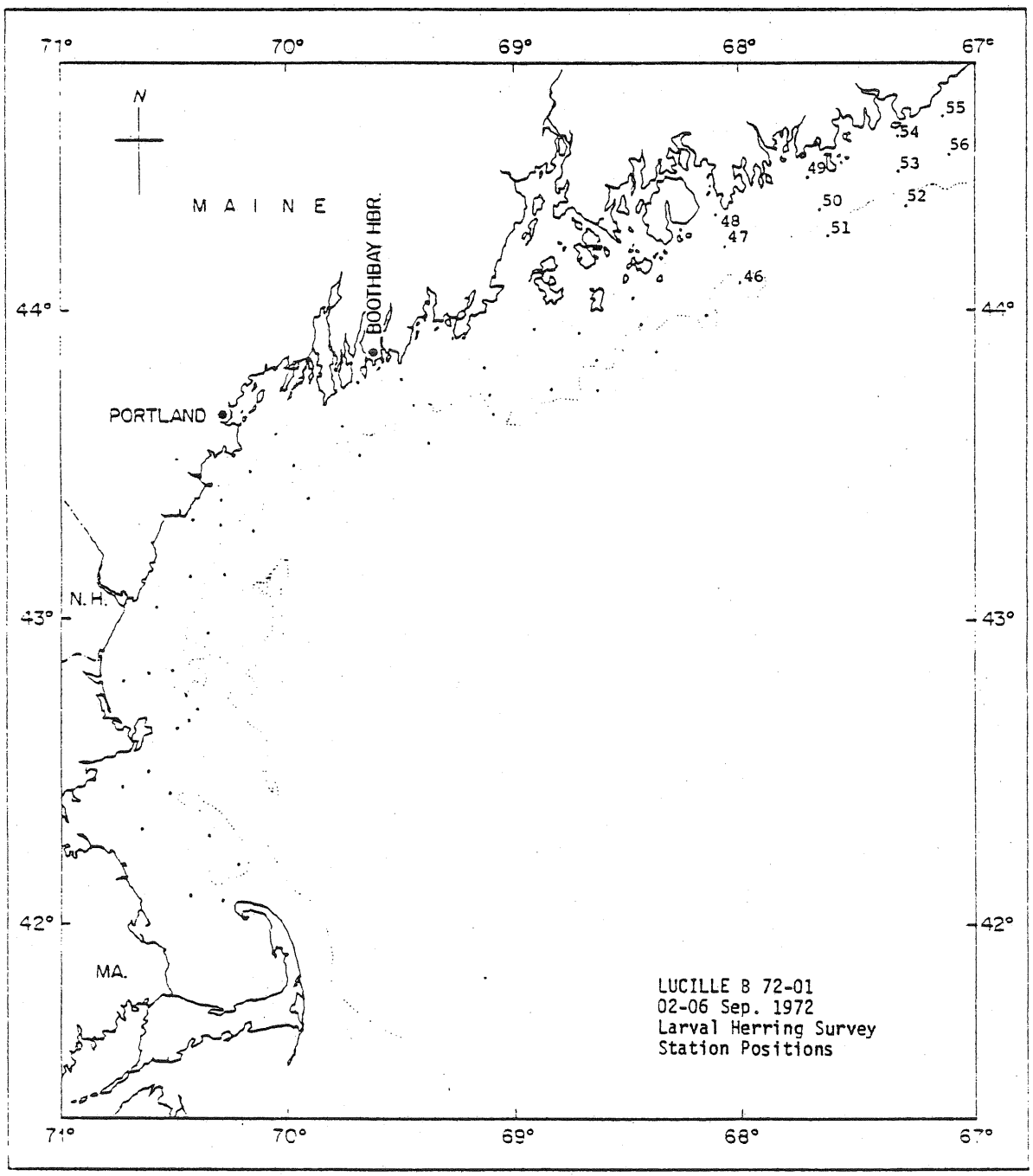

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
.55
.54
.56
.49
.53
.50
.52
.48
.47
.51
.46
LUCILLE B 72-01
02-06 Sep. 1972
Larval Herring Survey
Station Positions

Figure 38.

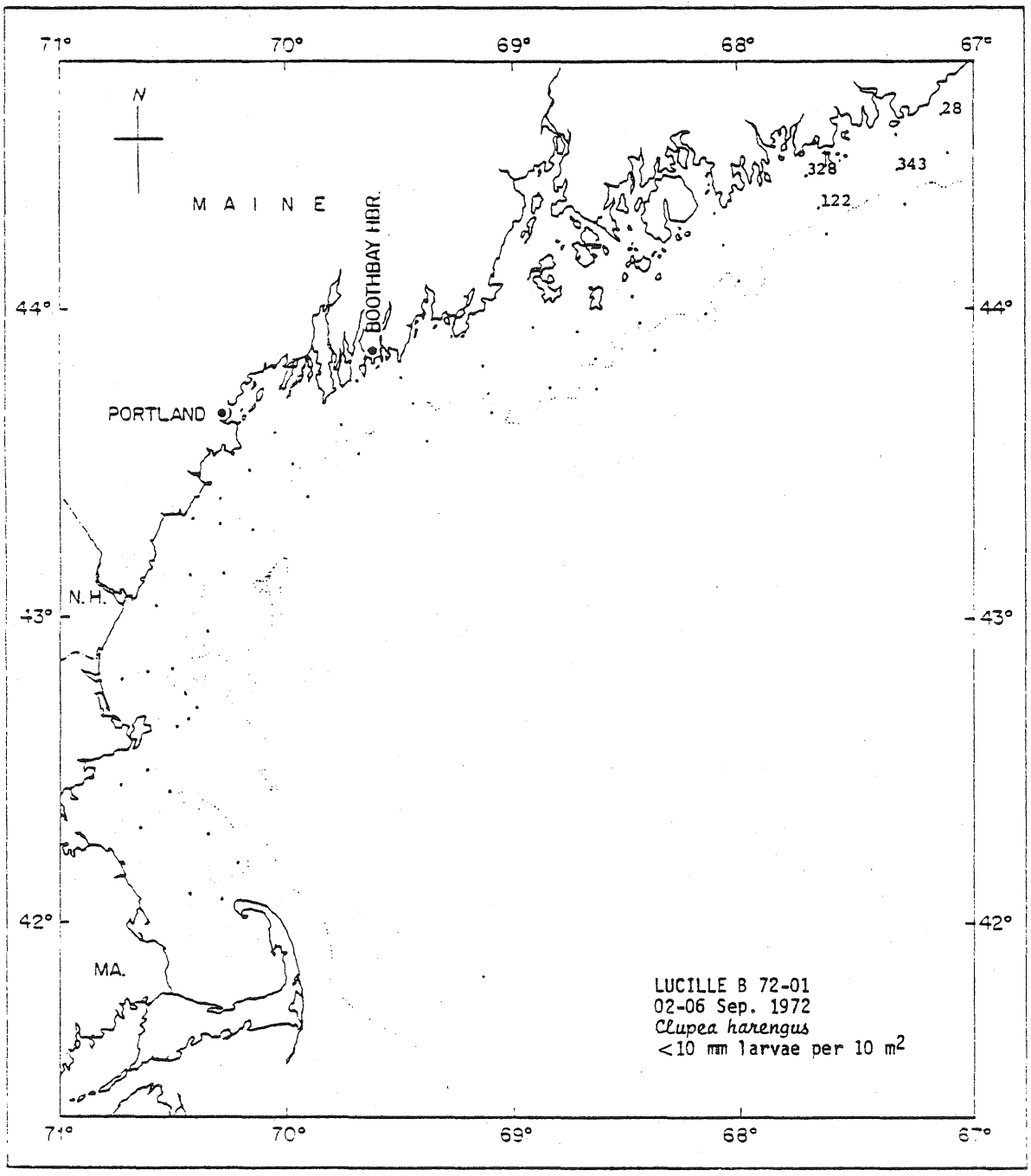

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
28
343
328
122
LUCILLE B 72-01
02-06 Sep. 1972
Clupea harengus
<10 mm larvae per 10 m2

Figure 39.

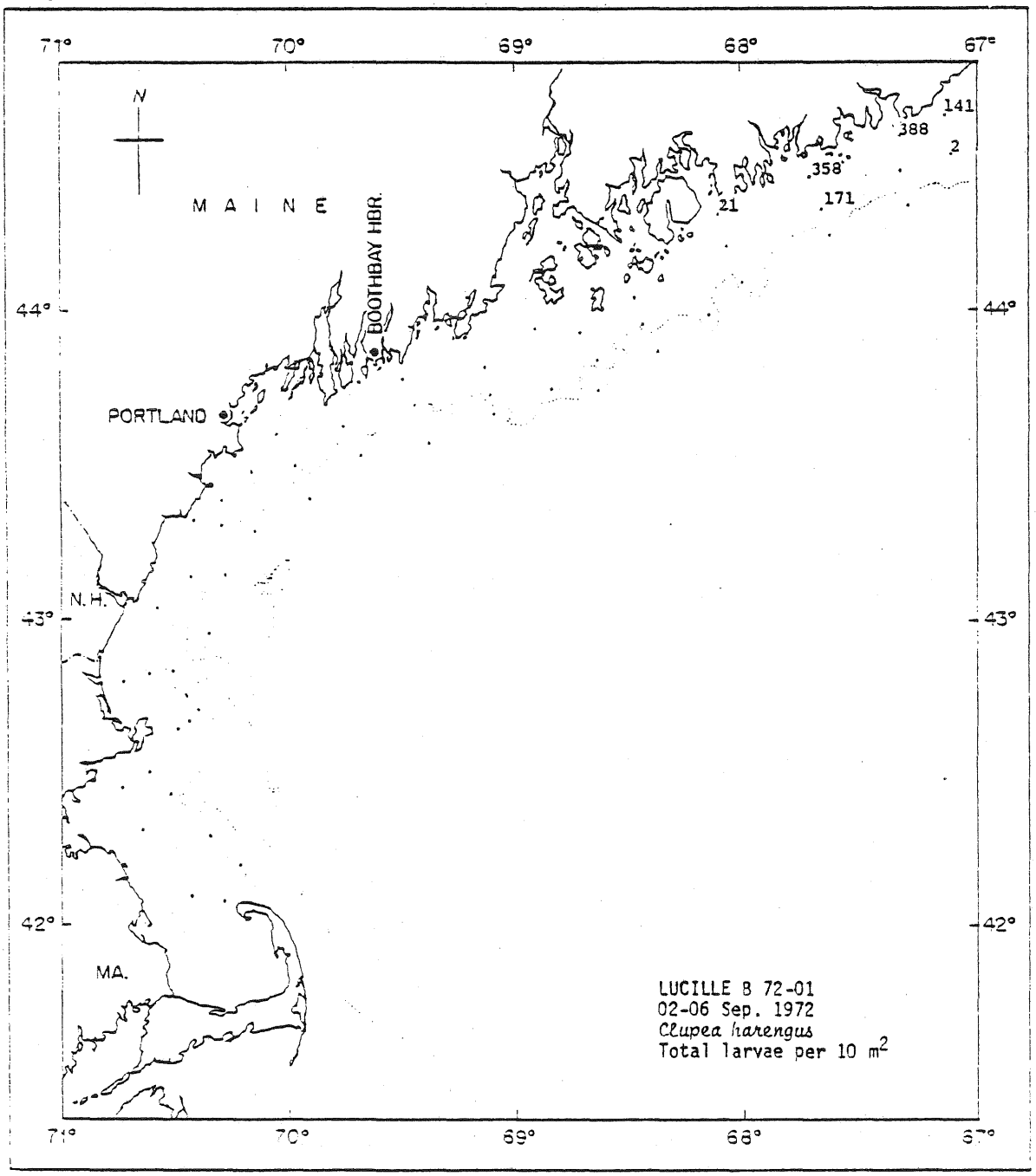

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
141
388
2
358
171
21
LUCILLE B 72-01
02-06 Sep. 1972
Clupea harengus
Total larvae per 10 m2

Figure 40.

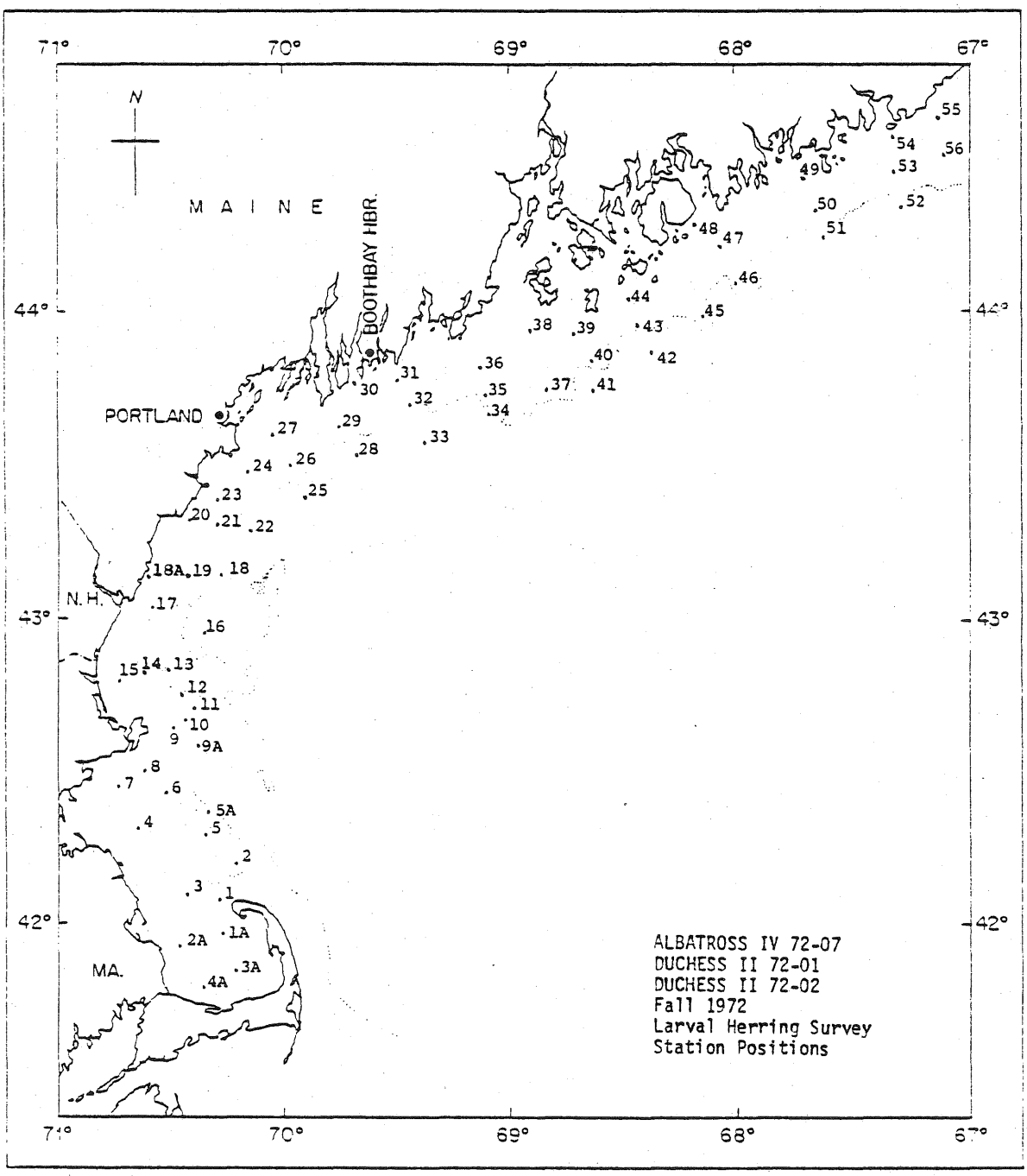

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
ALBATROSS IV 72-07
DUCHESS II 72-01
DUCHESS II 72-02
Fall 1972
Larval Herring Survey
Station Positions

Figure 41.

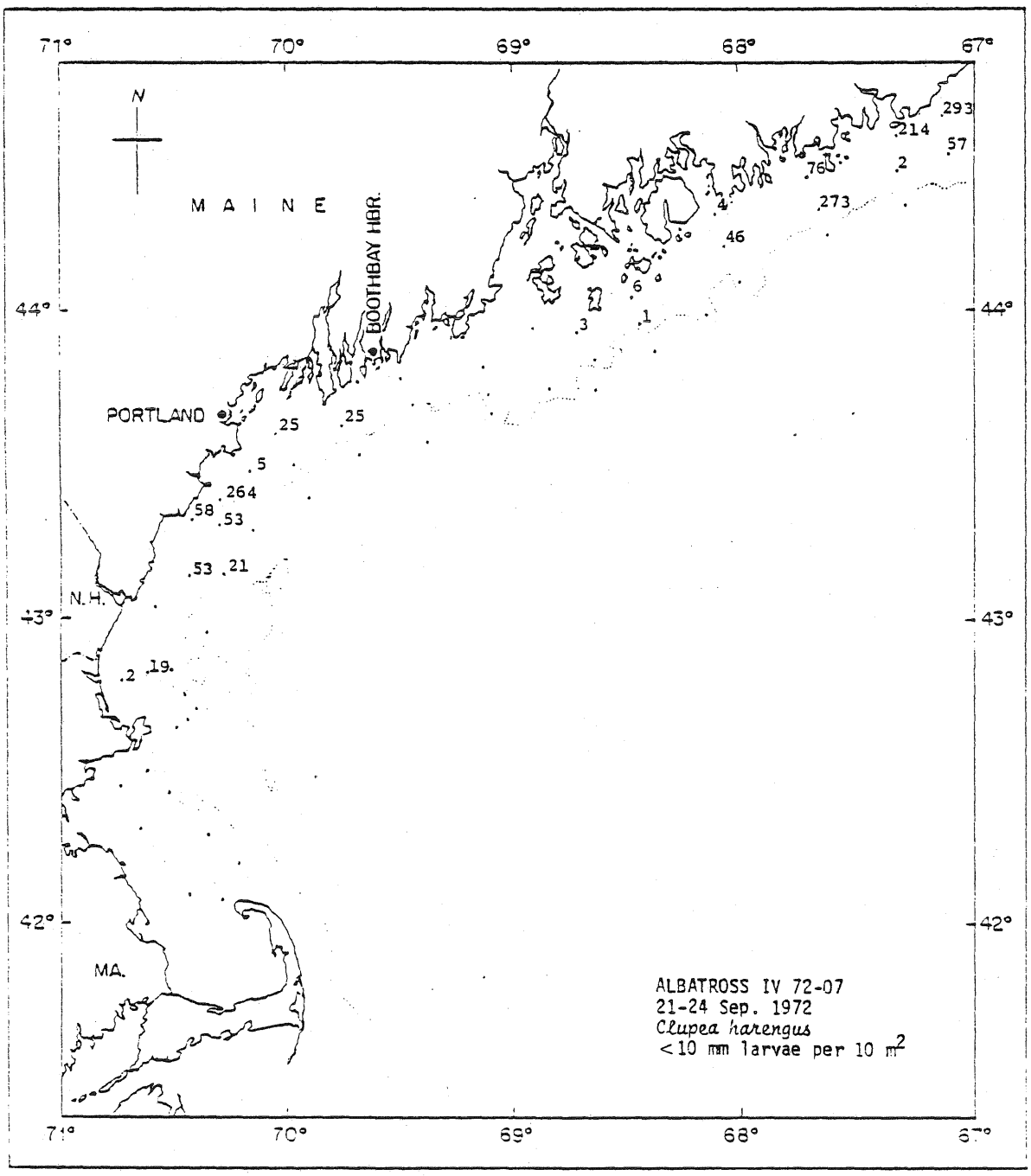

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
293
214
57
76
2
273
4
46
6
3
1
25
25
5
264
58
53
53
21
2
19
ALBATROSS IV 72-07
21-24 Sep. 1972
Clupea harengus
<10 mm larvae per 10 m2

Figure 42.

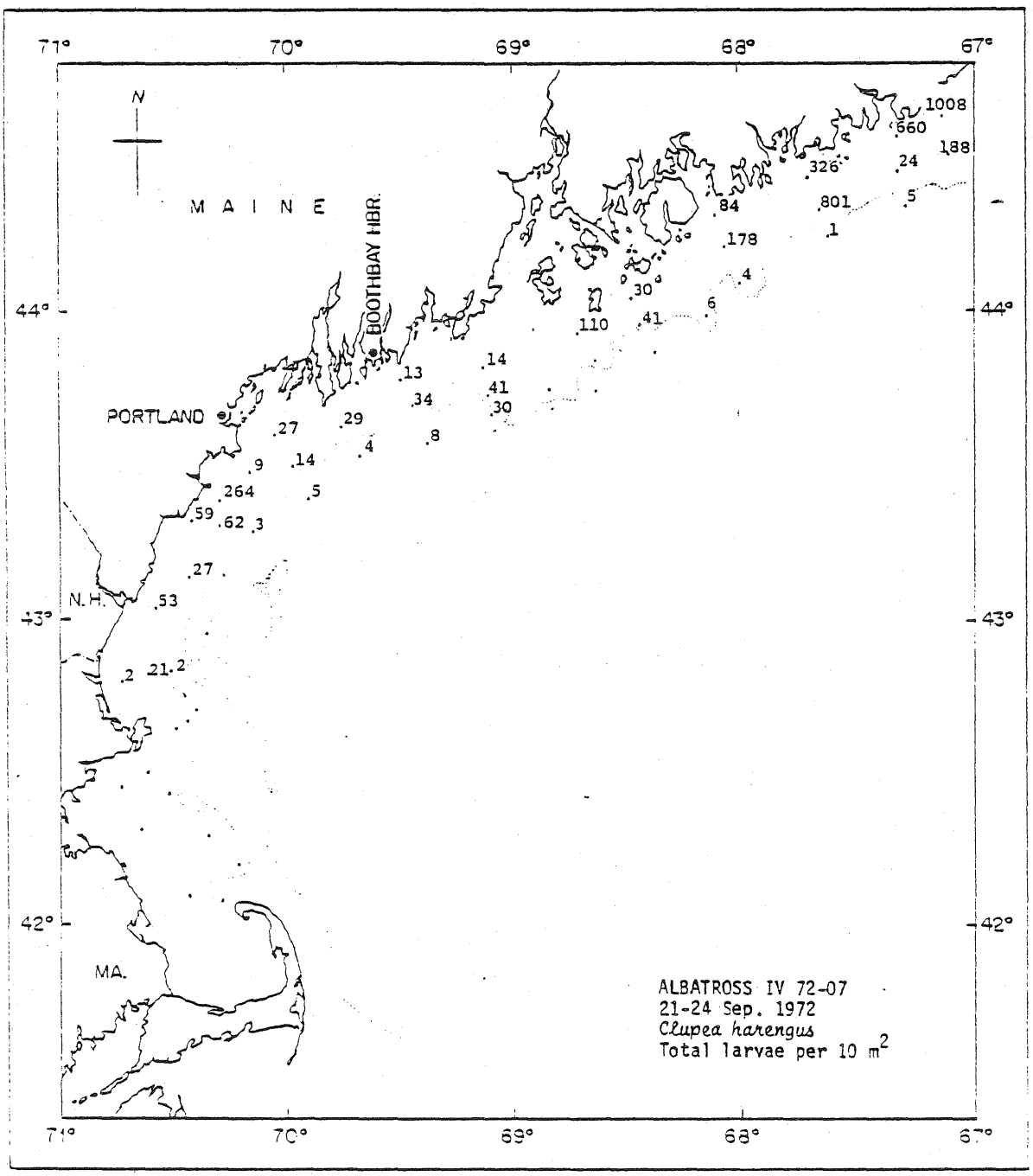

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
1008
660
188
326
24
84
801
5
178
1
4
30
6
110
41
14
13
41
34
30
29
27
8
4
14
9
264
5
59
62
3
27
53
2
21
2
ALBATROSS IV 72-07
21-24 Sep. 1972
Clupea harengus
Total larvae per 10 m2

Figure 43.

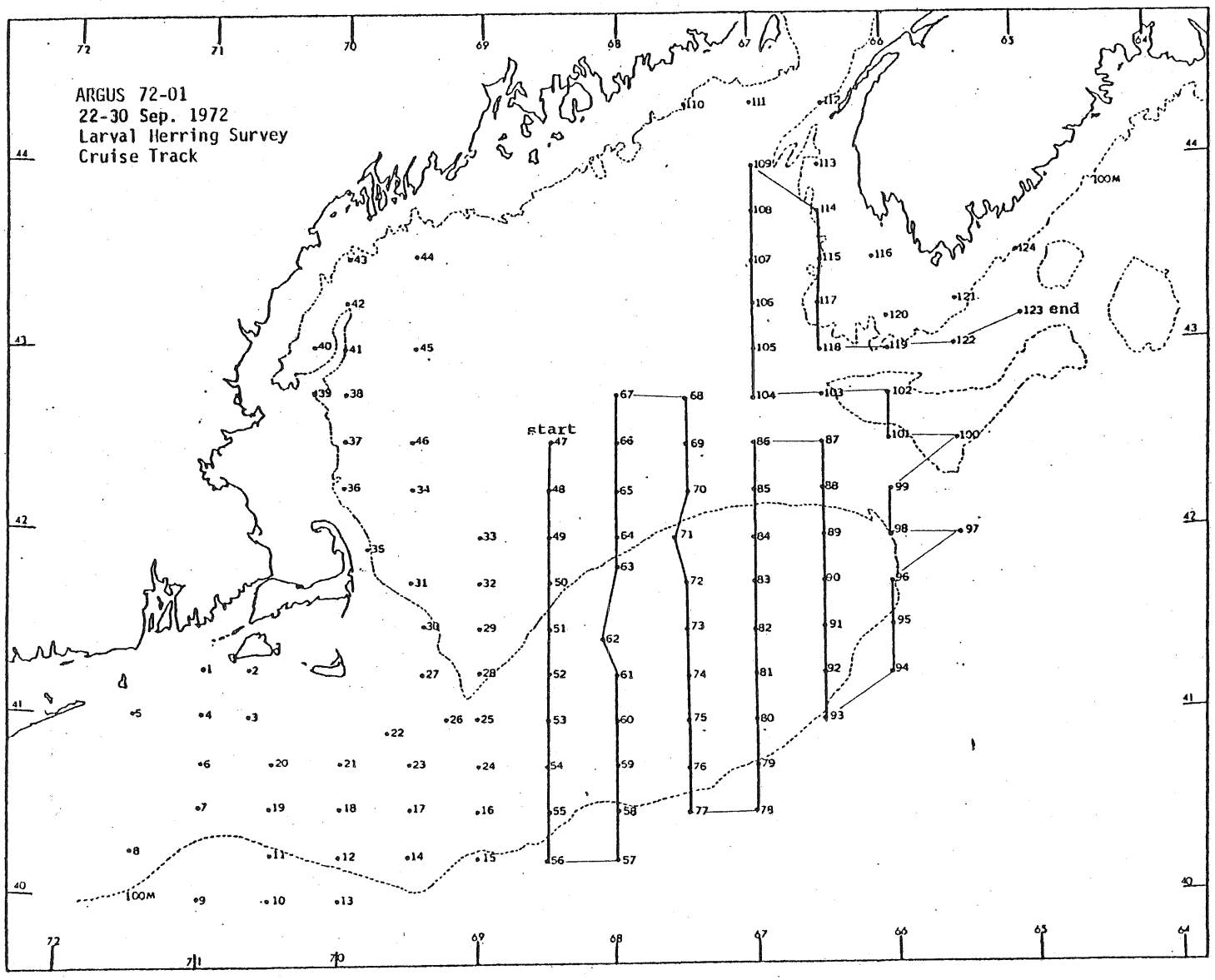

ARGUS 72-01
22-30 Sep. 1972
Larval Herring Survey
Cruise Track
start
123 end
100M

Figure 44.

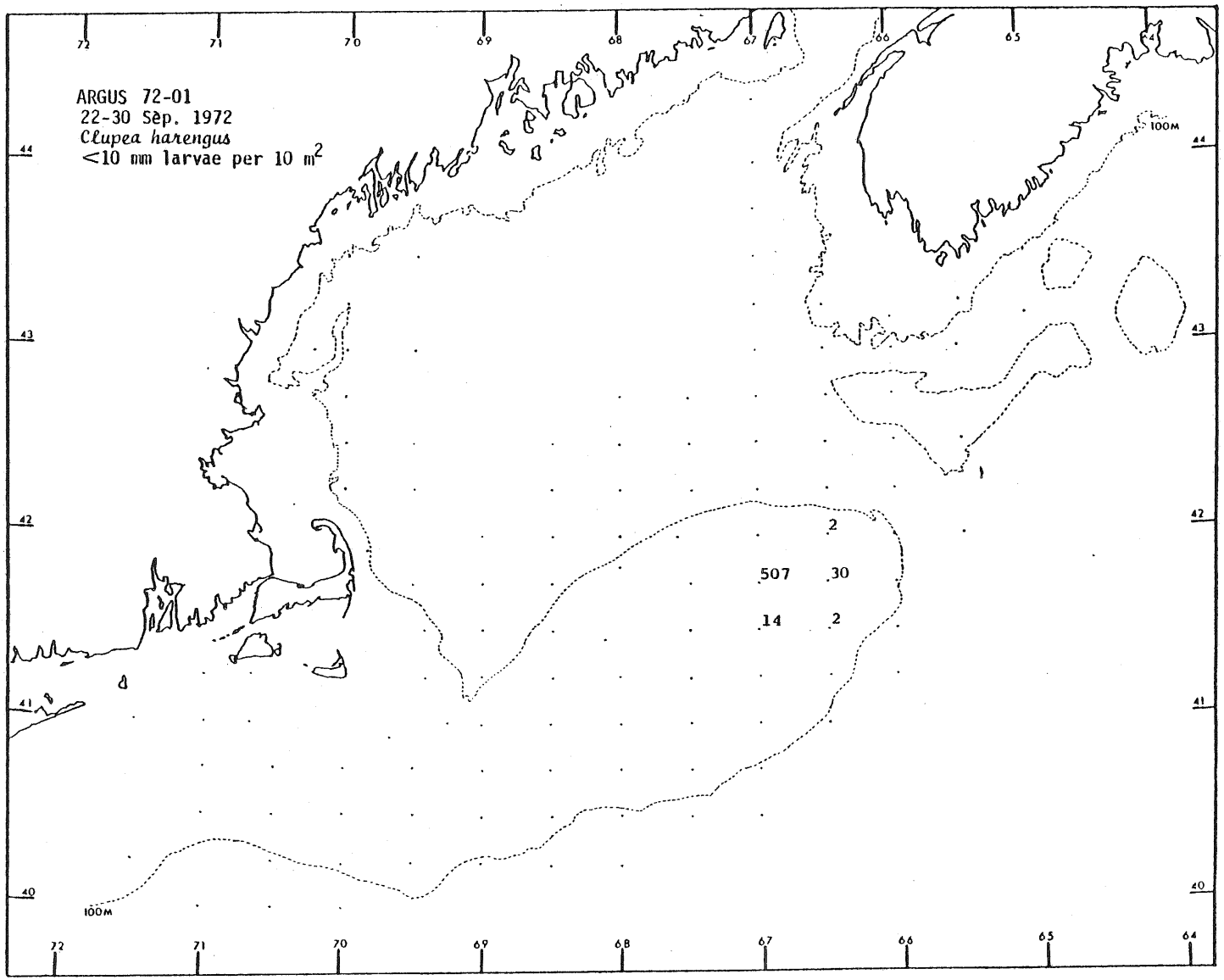

ARGUS 72-01
22-30 Sep. 1972
Clupea harengus
<10 mm larvae per 10 m2
72
71
70
69
68
67
66
65
64
44
43
42
41
40
100M
2
507
30
14
2

Figure 45.

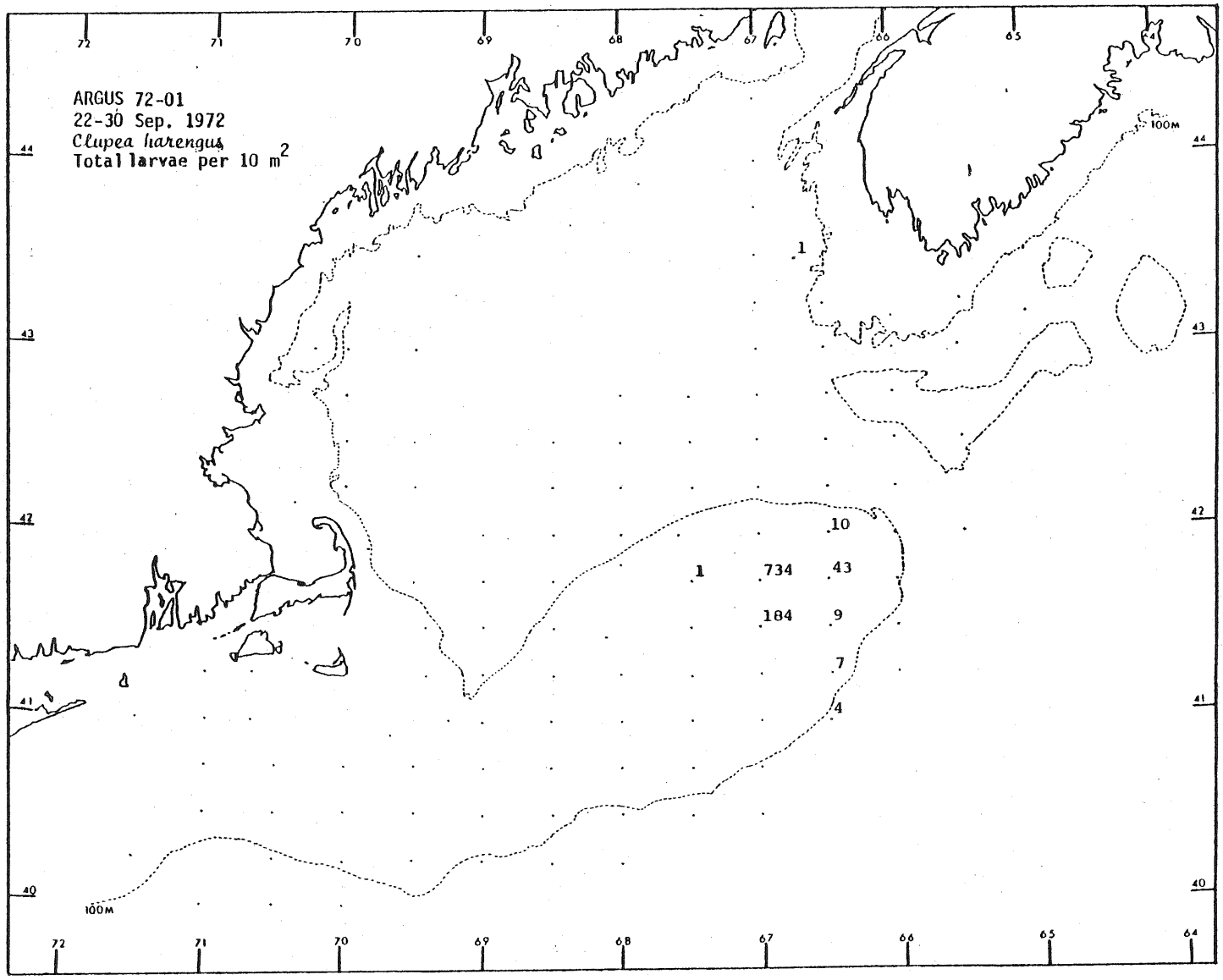

ARGUS 72-01
22-30 Sep. 1972
Clupea harengus
Total larvae per 10 m2
72
71
70
69
68
67
66
65
64
44
43
42
41
40
100M
1
1
734
184
10
43
9
7
4

Figure 46.

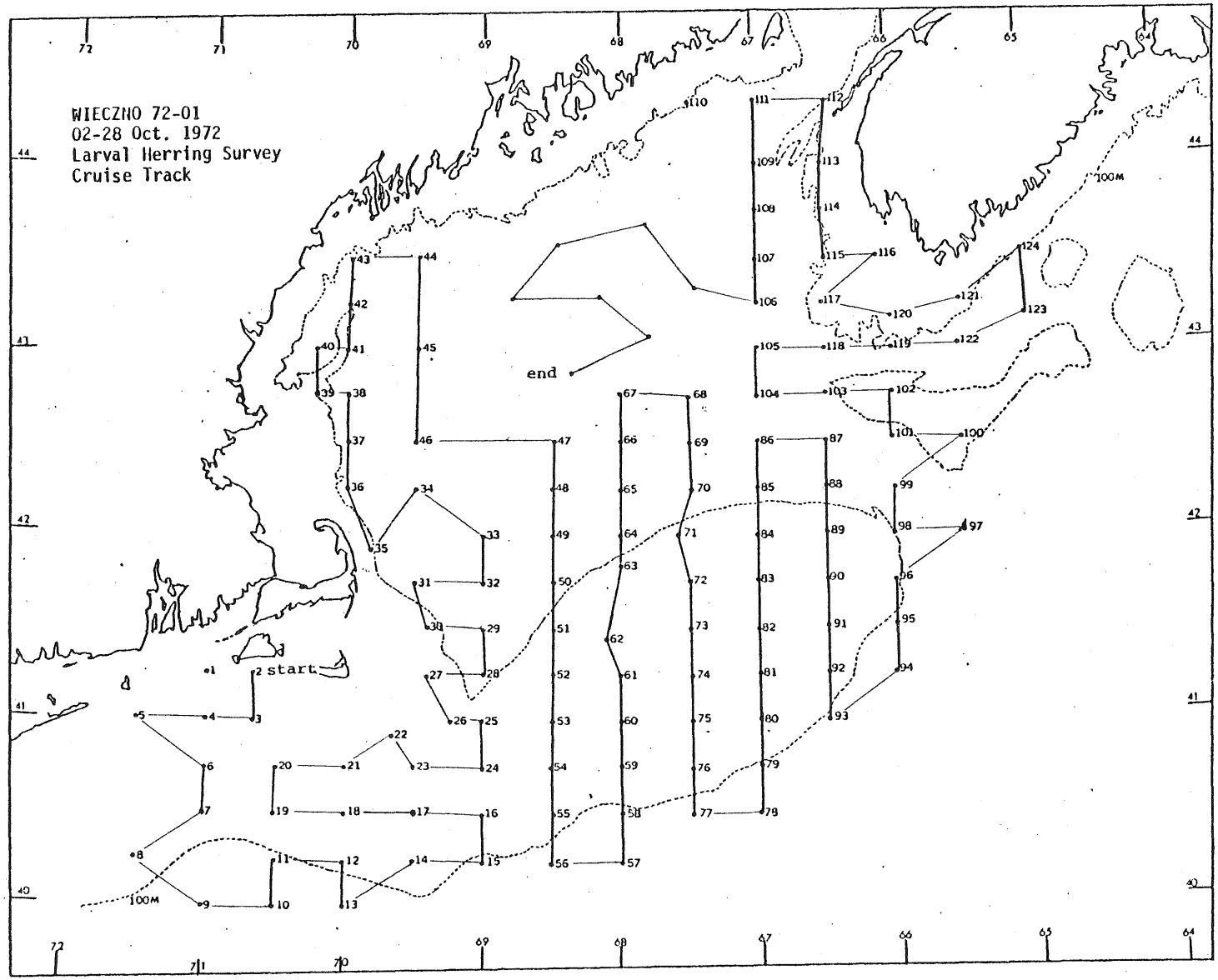

WIECZNO 72-01
02-28 Oct. 1972
Larval Herring Survey
Cruise Track
start
end
100M

Figure 47.

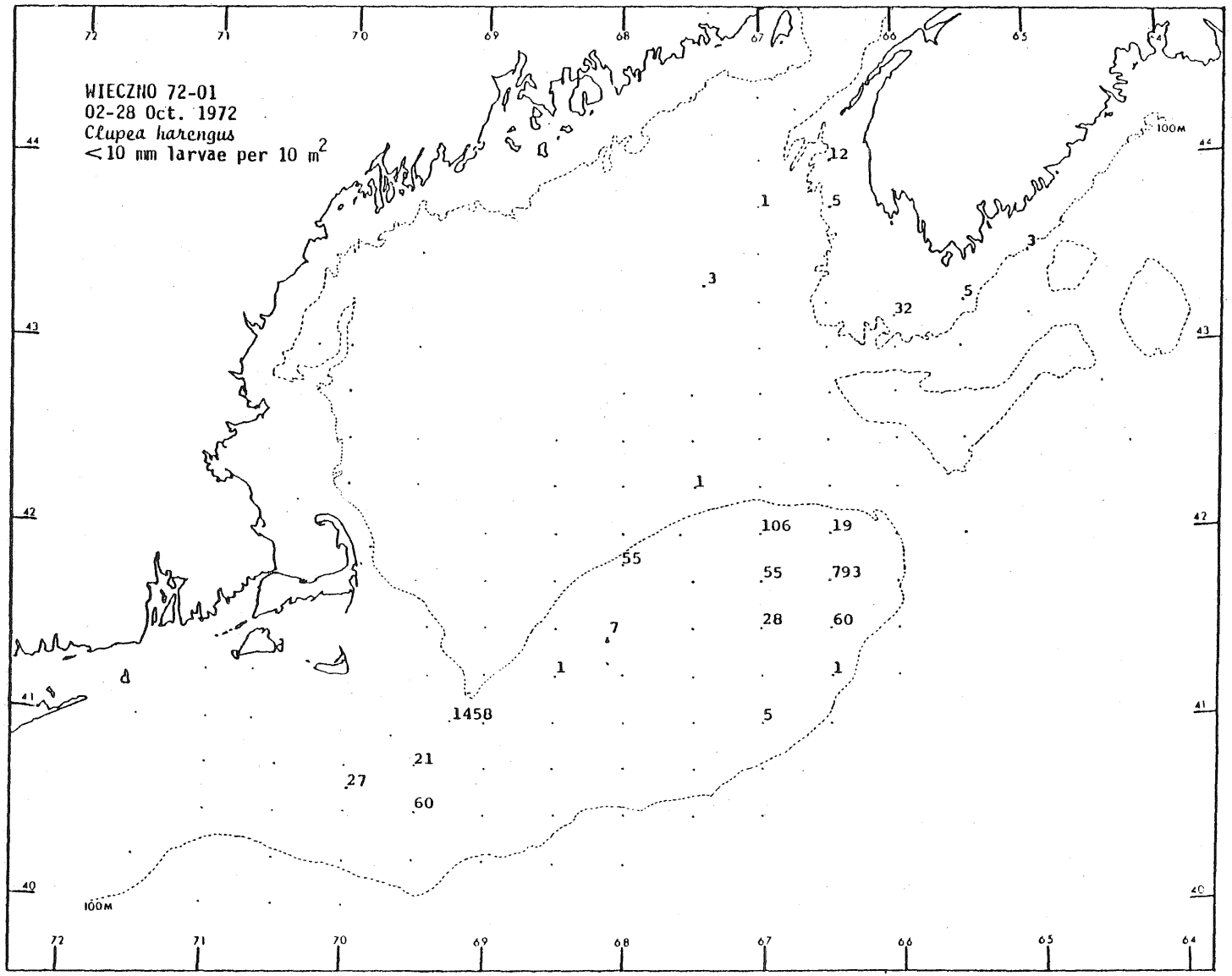

WIECZNO 72-01
02-28 Oct. 1972
Clupea harengus
<10 mm larvae per 10 m2
100M
12
1
5
3
3
5
32
1
106
19
55
55
793
28
60
7
1
1
1458
5
21
27
60
100M

Figure 48.

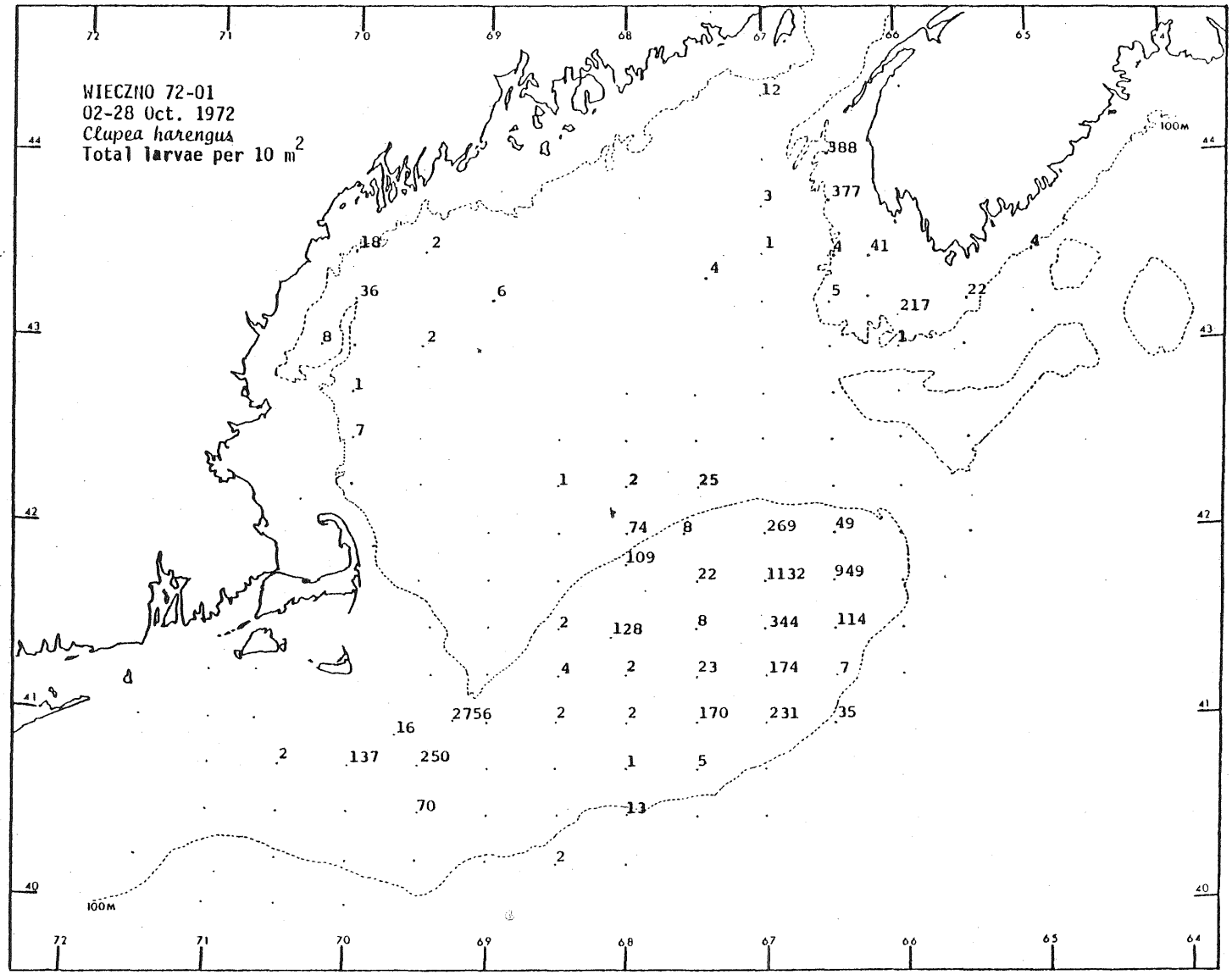

WIECZNO 72-01
02-28 Oct. 1972
Clupea harengus
Total larvae per 10 m2
100M
12
388
377
3
1
4
41
4
5
22
217
1
18
2
36
6
8
2
1
7
1
2
25
74
8
269
49
109
22
1132
949
2
128
8
344
114
4
2
23
174
7
2756
2
2
170
231
35
16
2
137
250
1
5
70
13
2
100M

Figure 49.

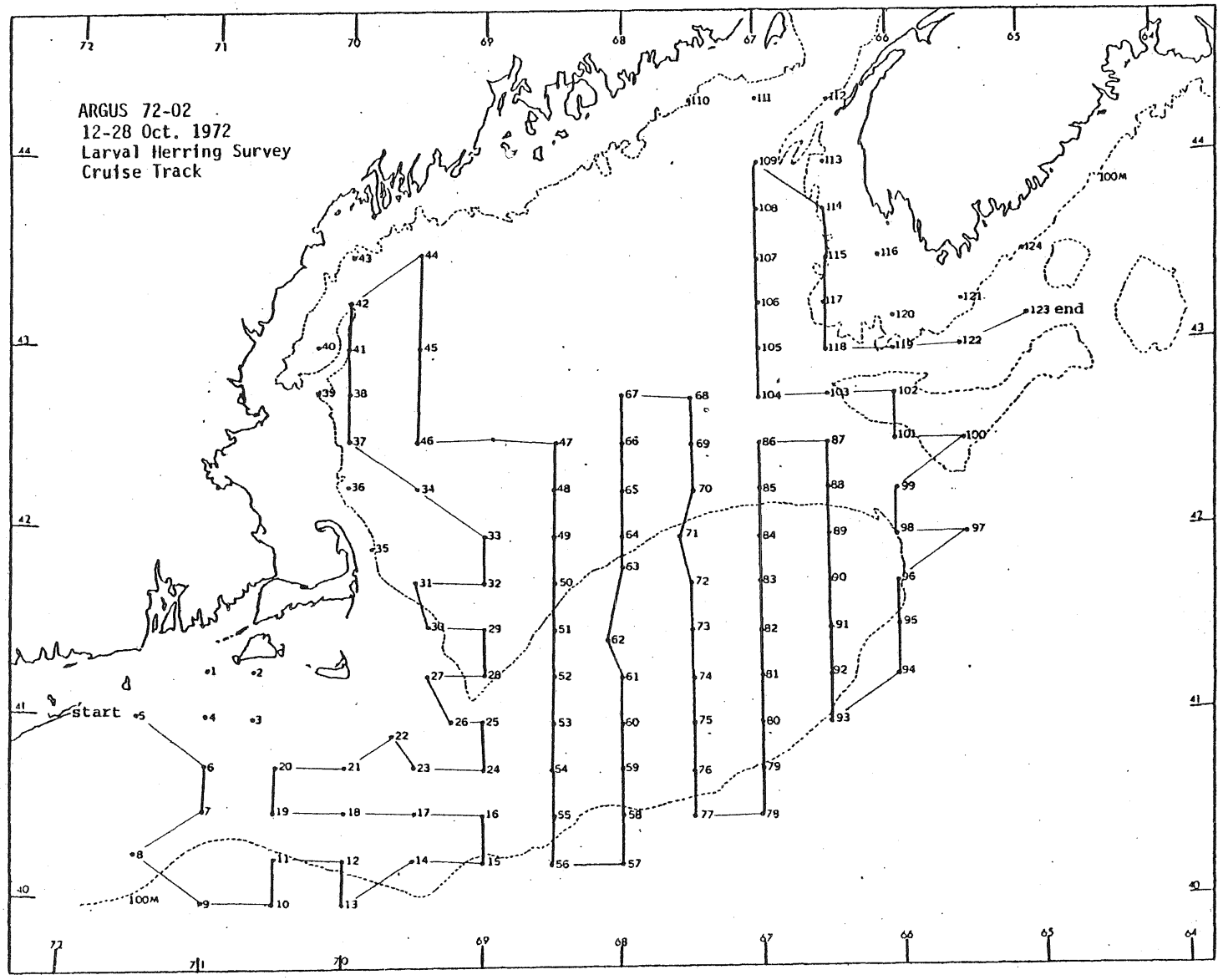

ARGUS 72-02
12-28 Oct. 1972
Larval Herring Survey
Cruise Track
start
123 end
100M

Figure 50.

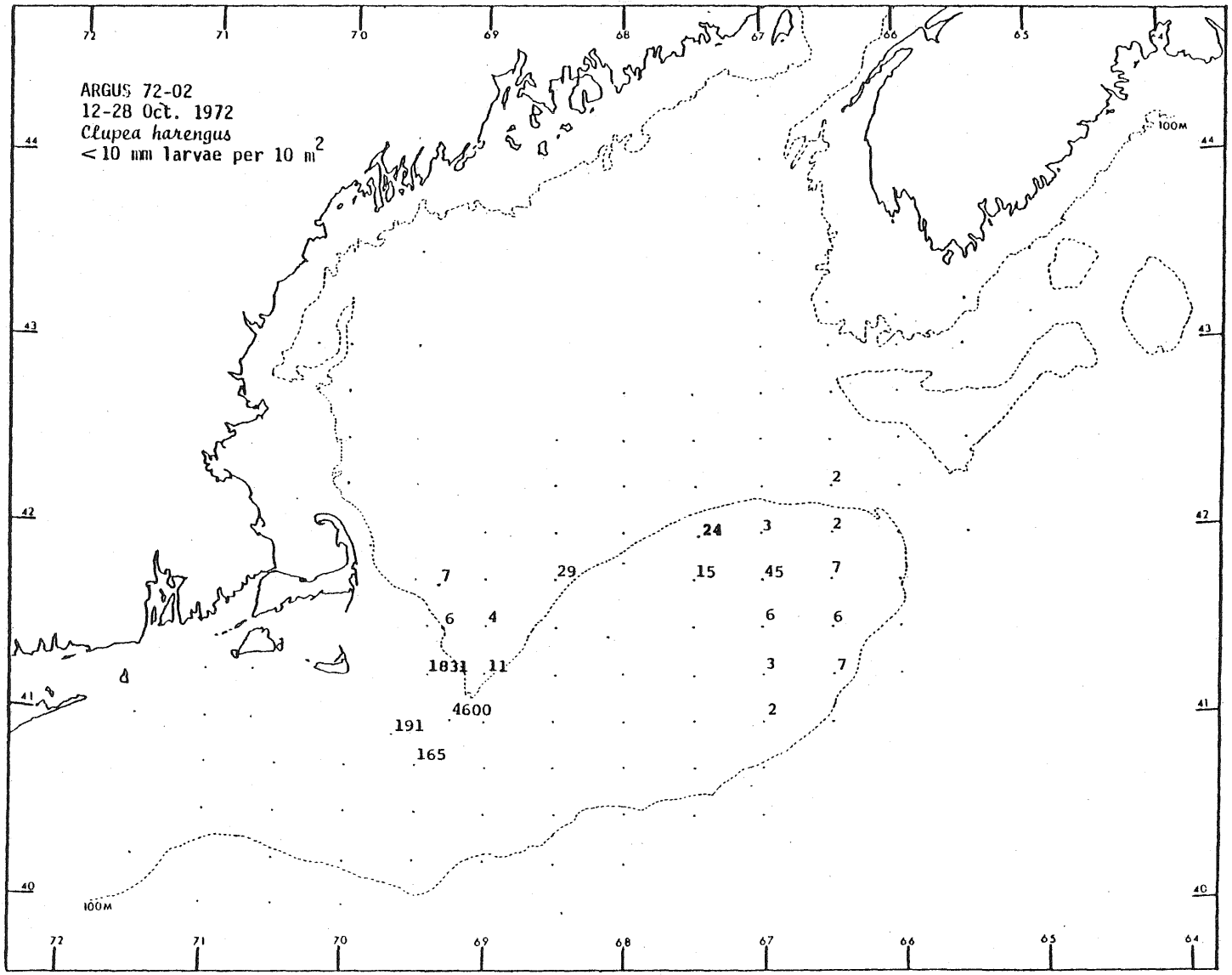

ARGUS 72-02
12-28 Oct. 1972
Clupea harengus
< 10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
2
24
3
2
7
29
15
45
7
6
4
6
6
1831
11
3
7
4600
2
191
165

Figure 51.

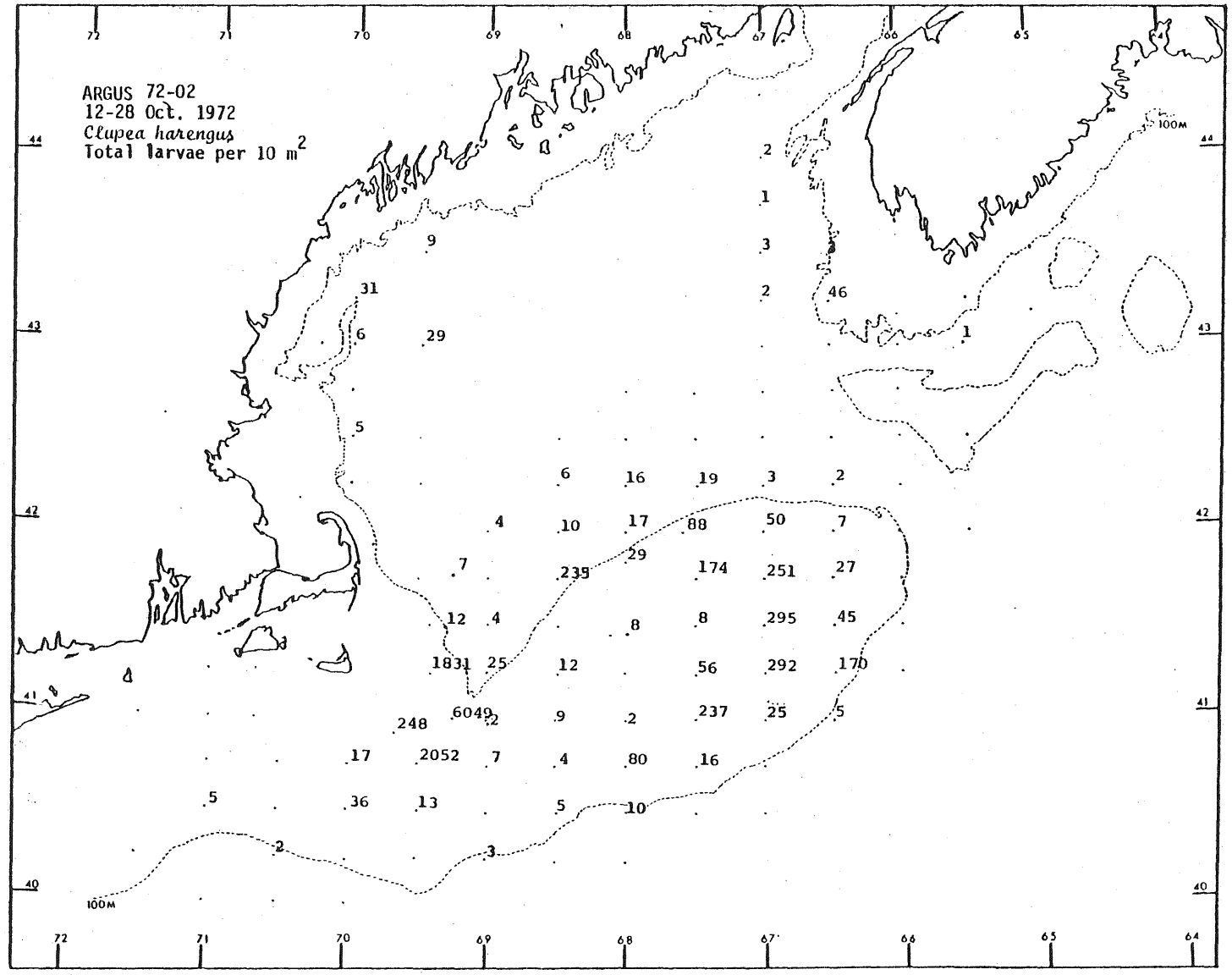

ARGUS 72-02
12-28 Oct. 1972
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 52.

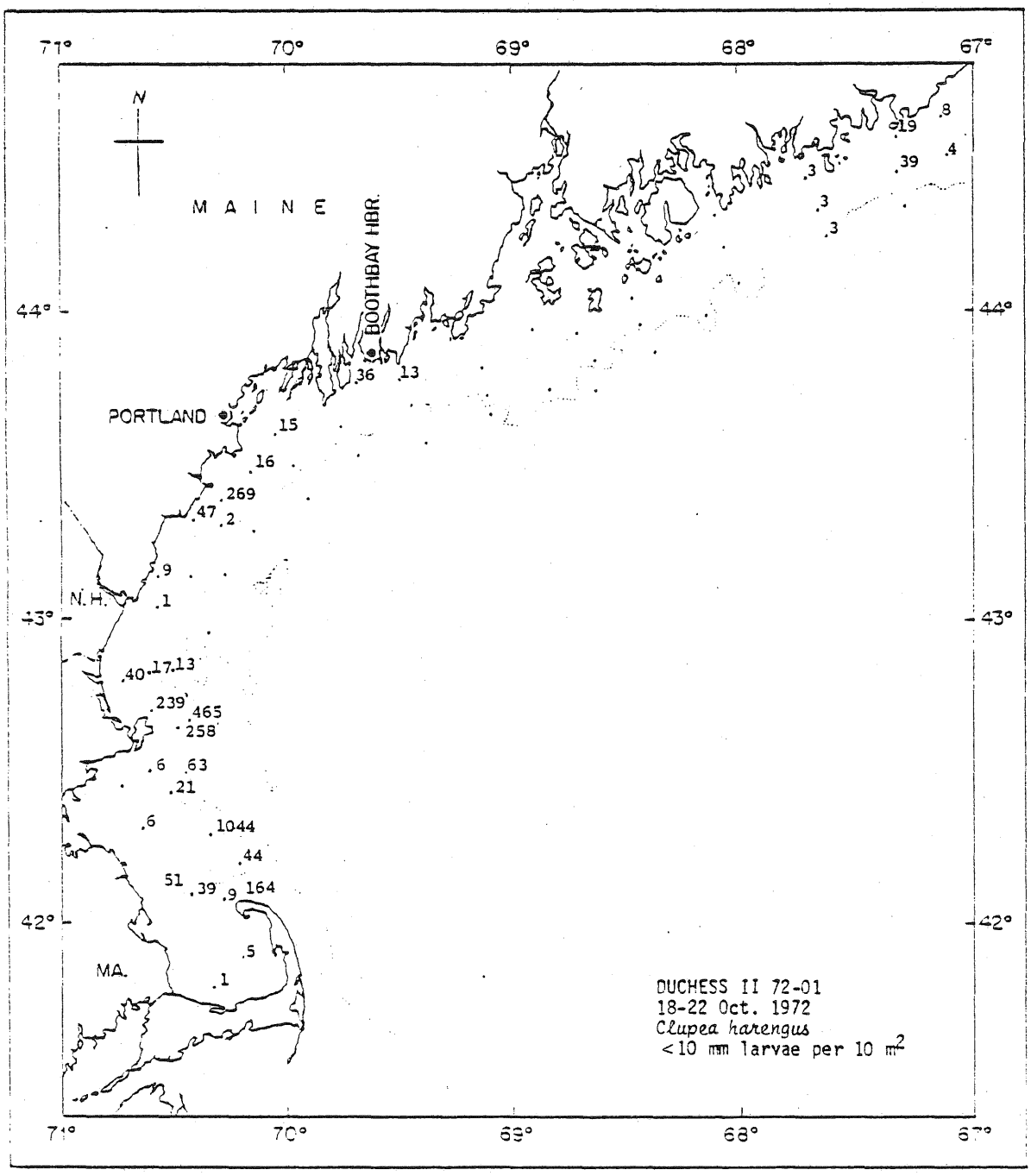

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
.36
.13
.15
.16
.269
.47
.2
.9
.1
.40
.17
.13
.239
.465
.258
.6
.63
.21
.6
.1044
.44
.51
.39
.9
.164
.5
.1
.8
.19
.4
.39
.3
.3
.3
DUCHESS II 72-01
18-22 Oct. 1972
Clupea harengus
<10 mm larvae per 10 m2

Figure 53.

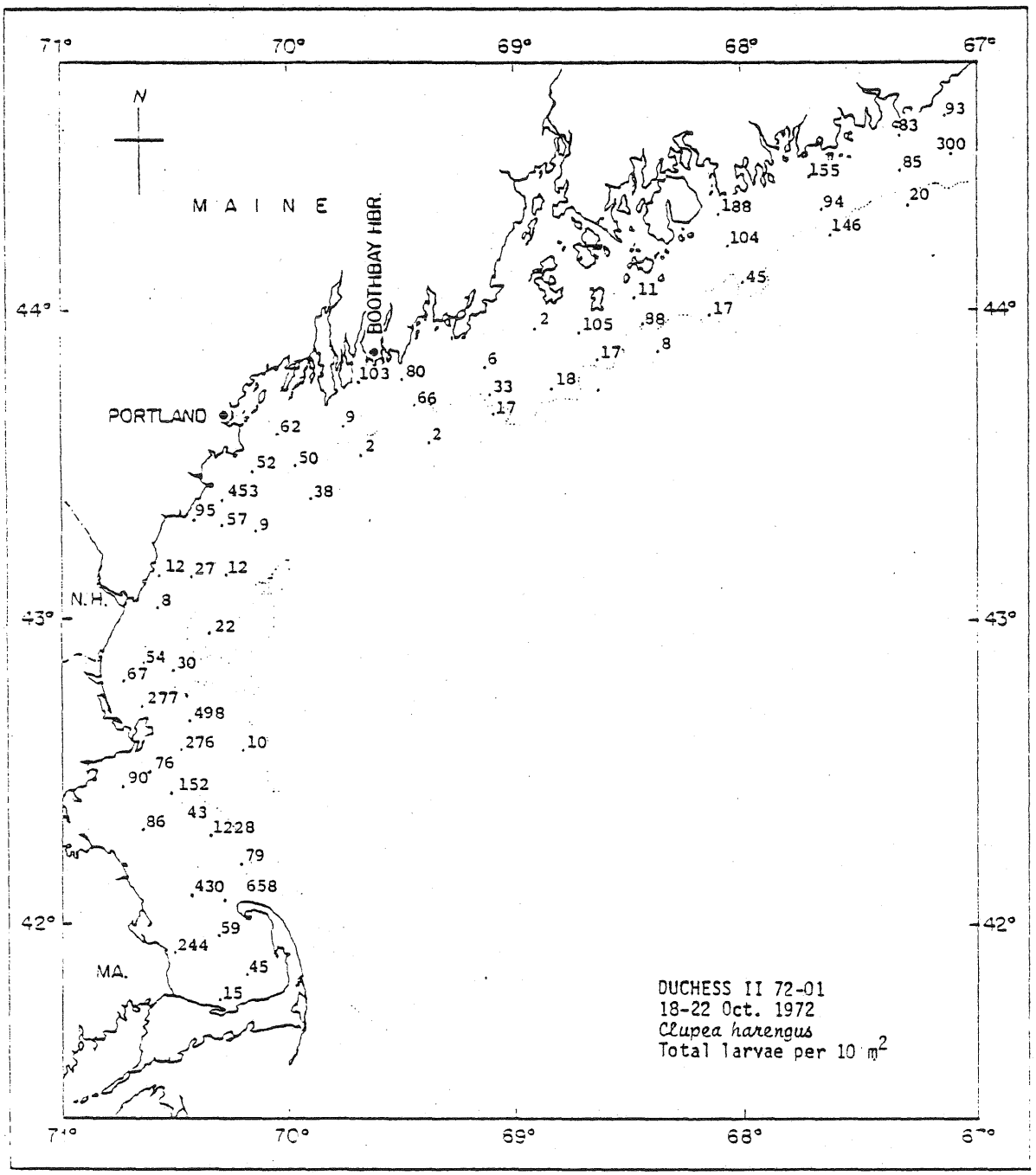

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
DUCHESS II 72-01
18-22 Oct. 1972
Clupea harengus
Total larvae per 10 m²

Figure 54.

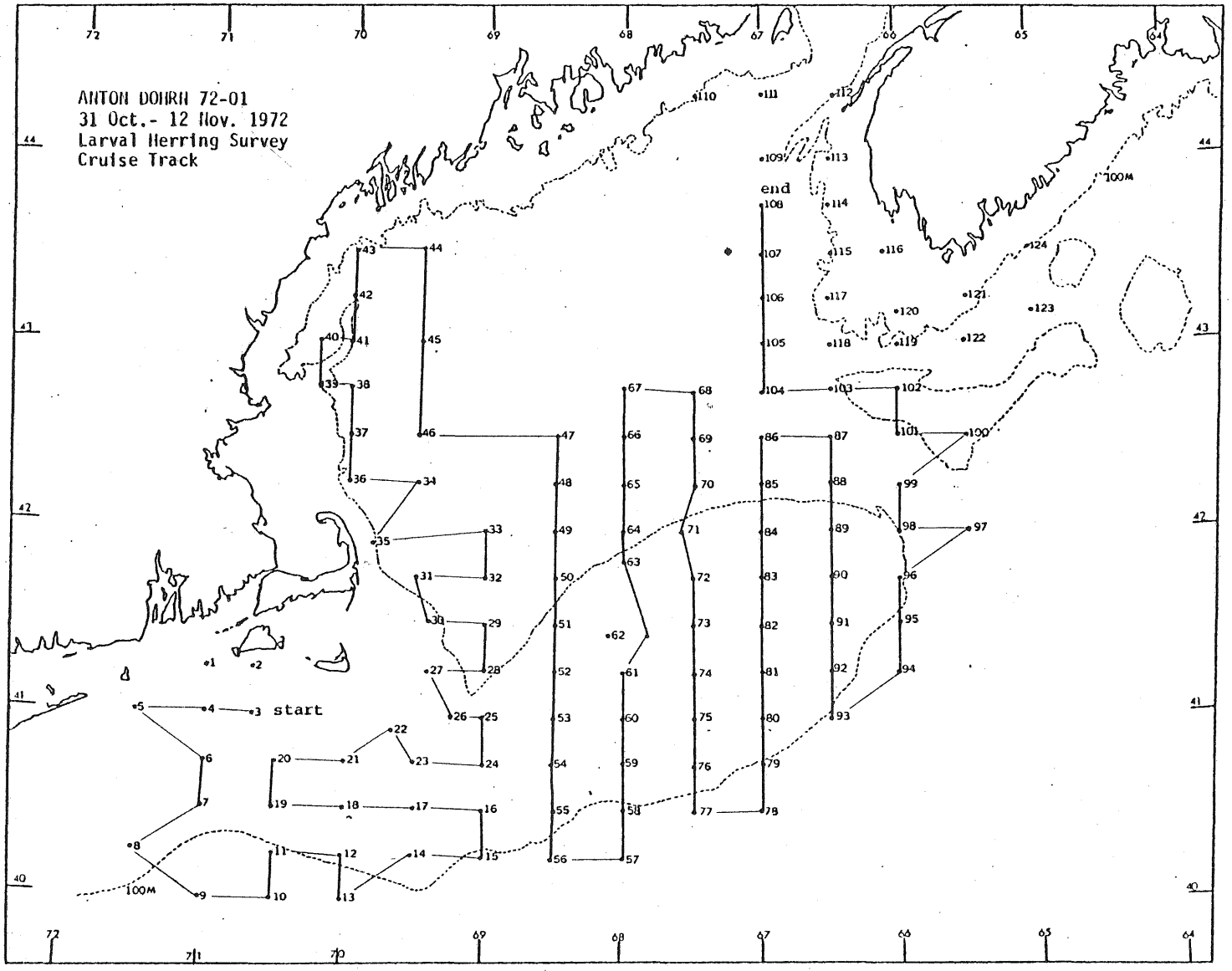

ANTON DOHRN 72-01
31 Oct.- 12 Nov. 1972
Larval Herring Survey
Cruise Track
start
end
100M

Figure 55.

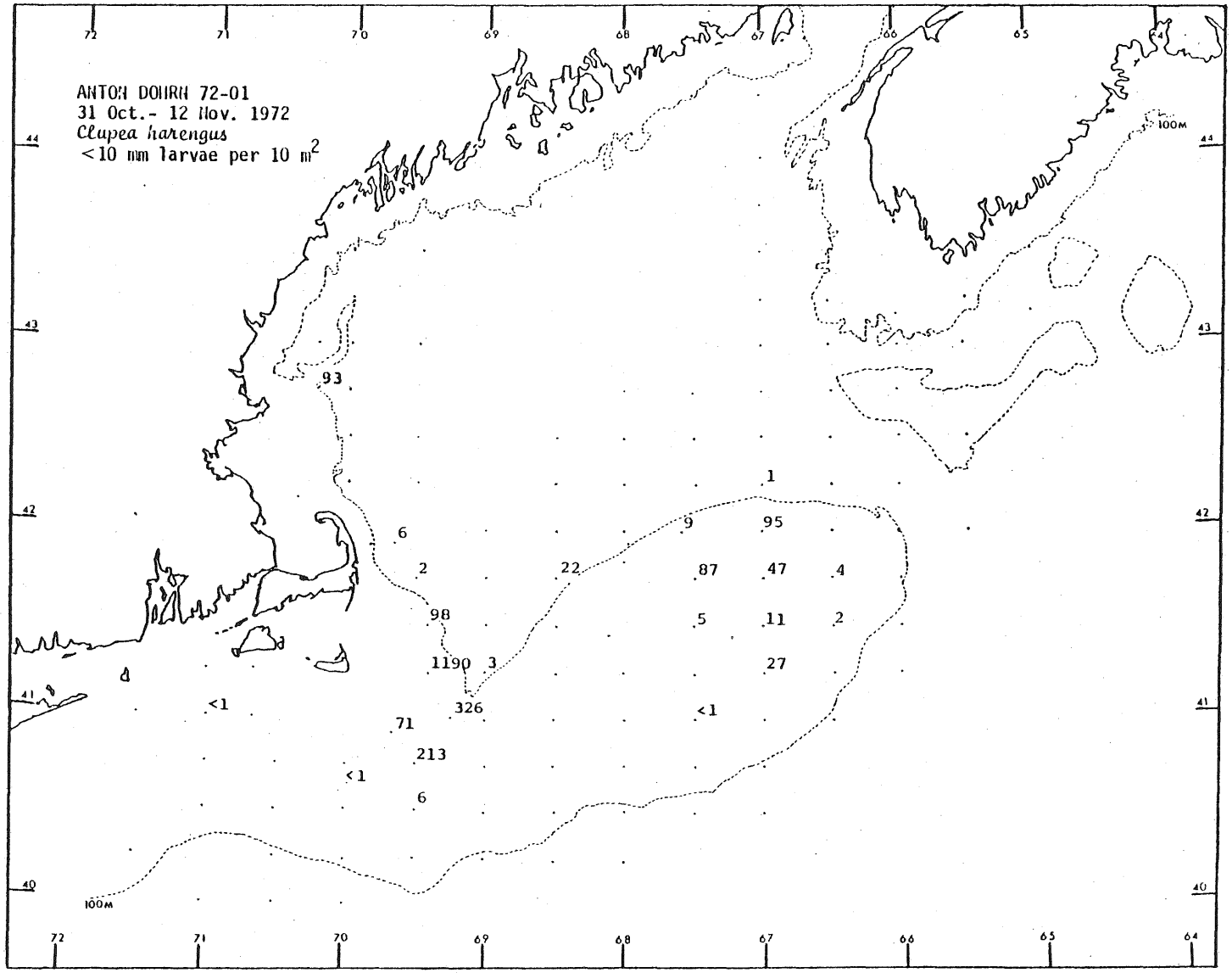

ANTON DOHRN 72-01
31 Oct.- 12 Nov. 1972
Clupea harengus
<10 mm larvae per 10 m2
100M
93
6
2
98
1190
3
326
71
213
6
<1
<1
22
1
9
95
87
47
4
5
11
2
27
<1
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 56.

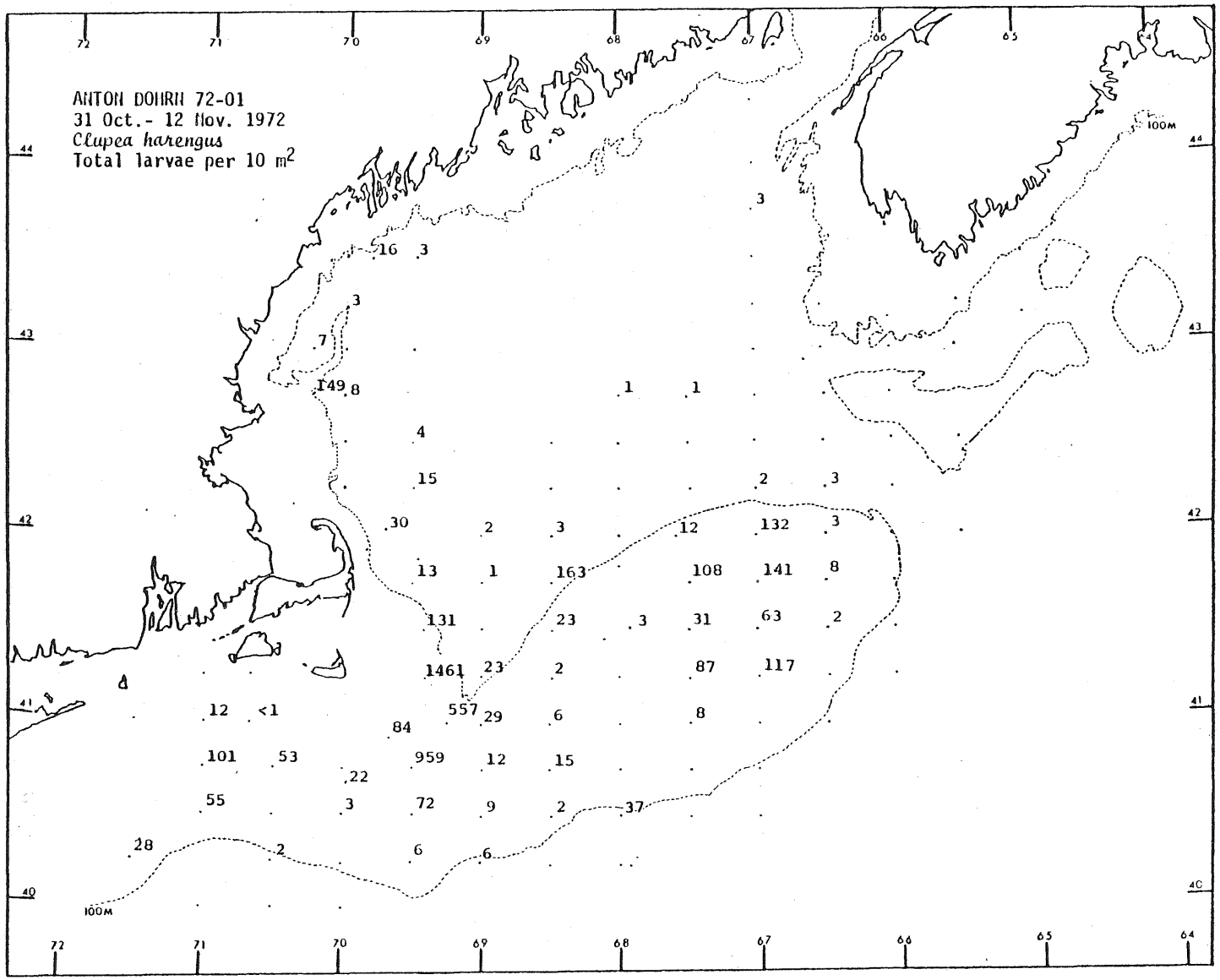

ANTON DOHRN 72-01
31 Oct.- 12 Nov. 1972
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 57.

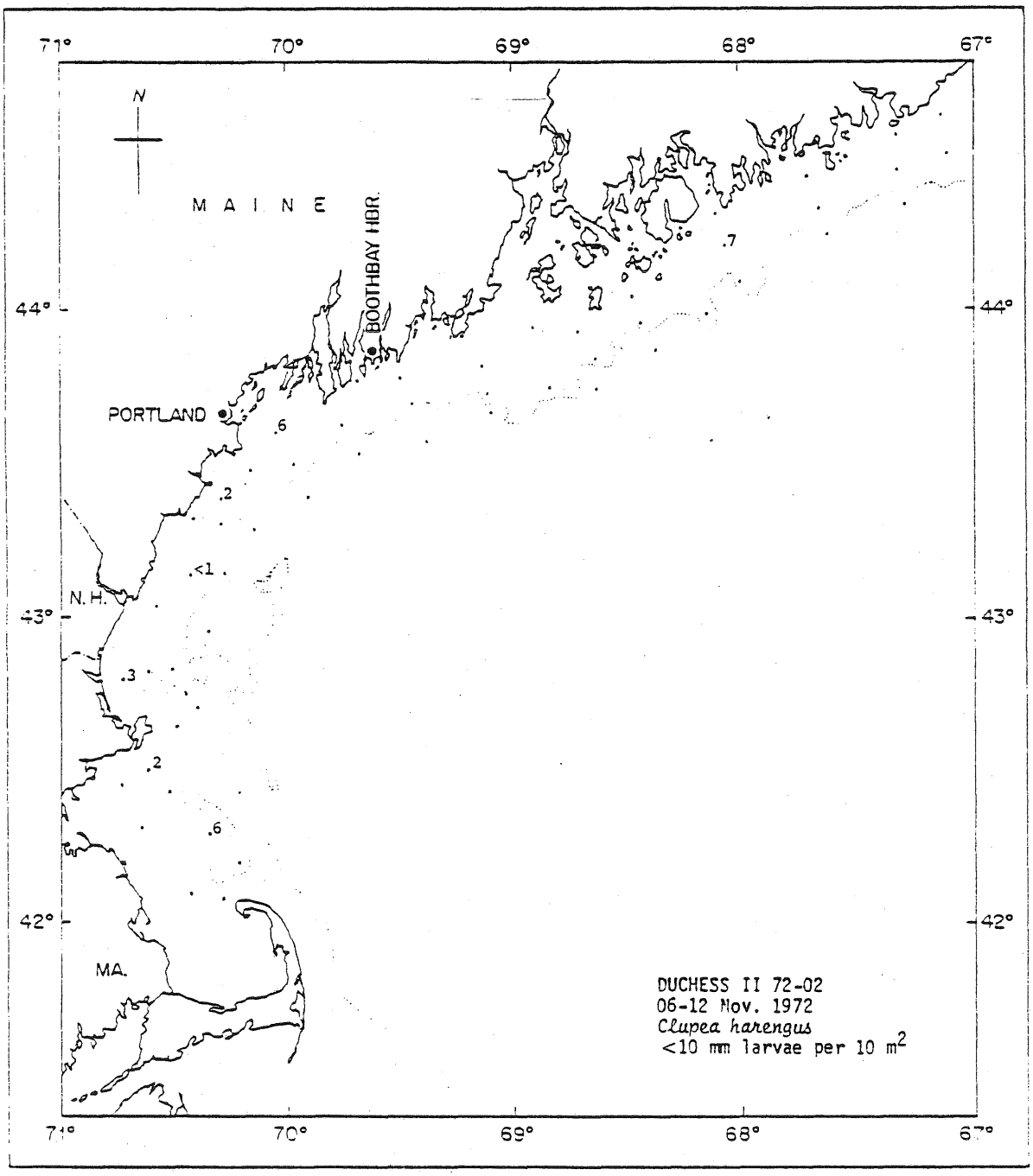

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
44°
43°
42°
N.H.
MA.
.7
.6
.2
<1
.3
.2
.6
DUCHESS II 72-02
06-12 Nov. 1972
Clupea harengus
<10 mm larvae per 10 m2

Figure 58.

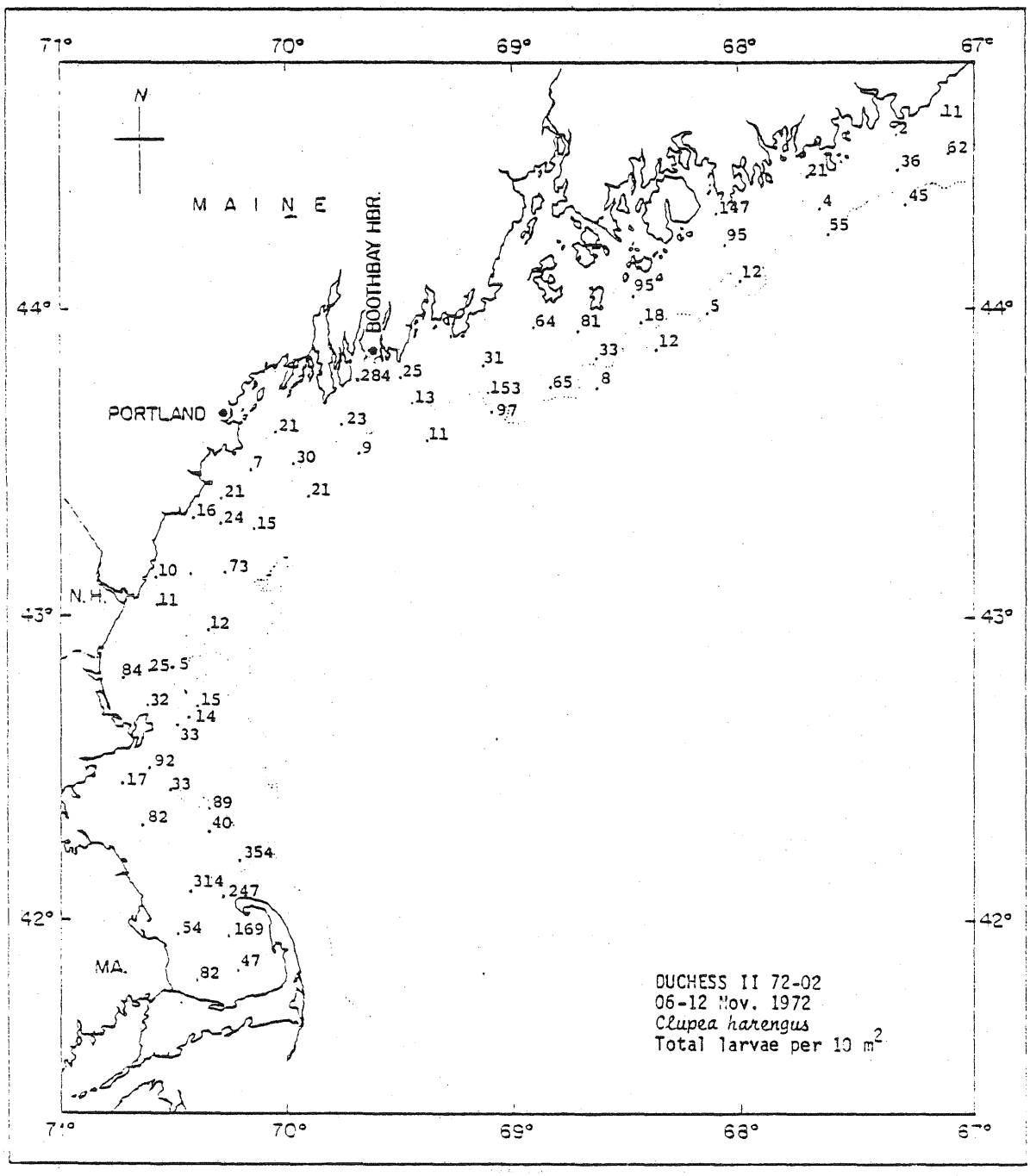

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
DUCHESS II 72-02
06-12 Nov. 1972
Clupea harengus
Total larvae per 10 m2

Figure 59.

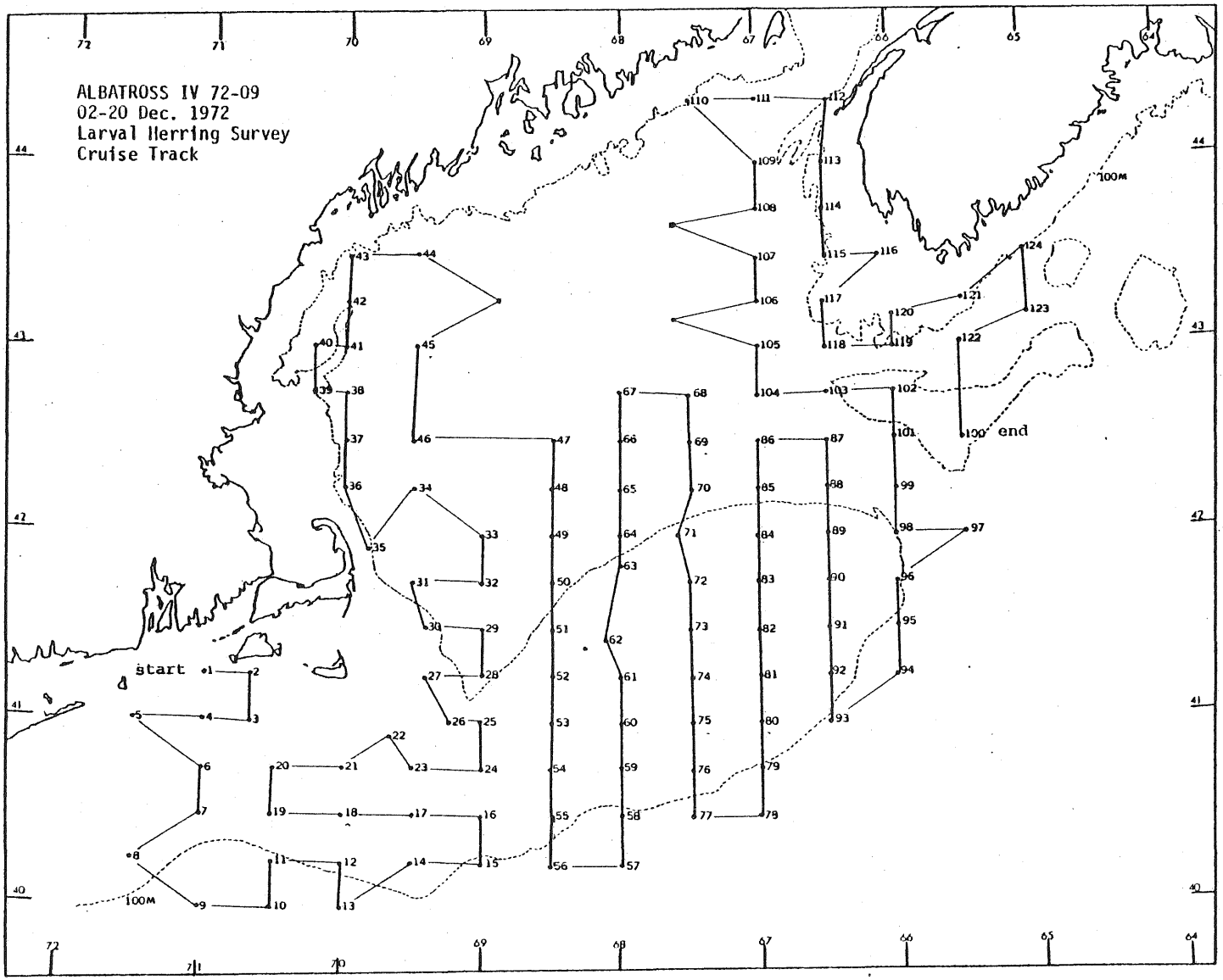

ALBATROSS IV 72-09
02-20 Dec. 1972
Larval Herring Survey
Cruise Track
start
end
100M

Figure 60.

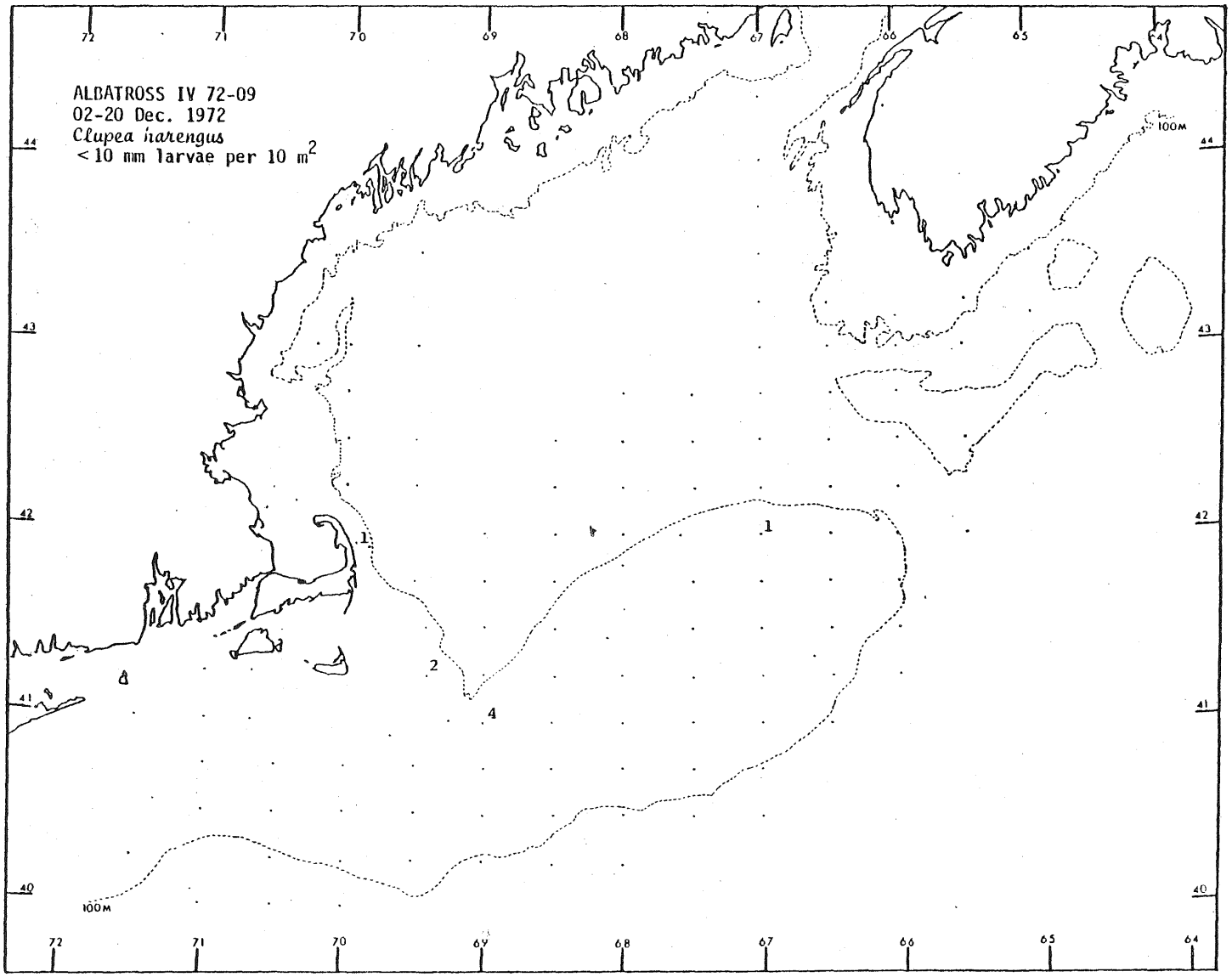

ALBATROSS IV 72-09
02-20 Dec. 1972
Clupea harengus
< 10 mm larvae per 10 m²
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 61.

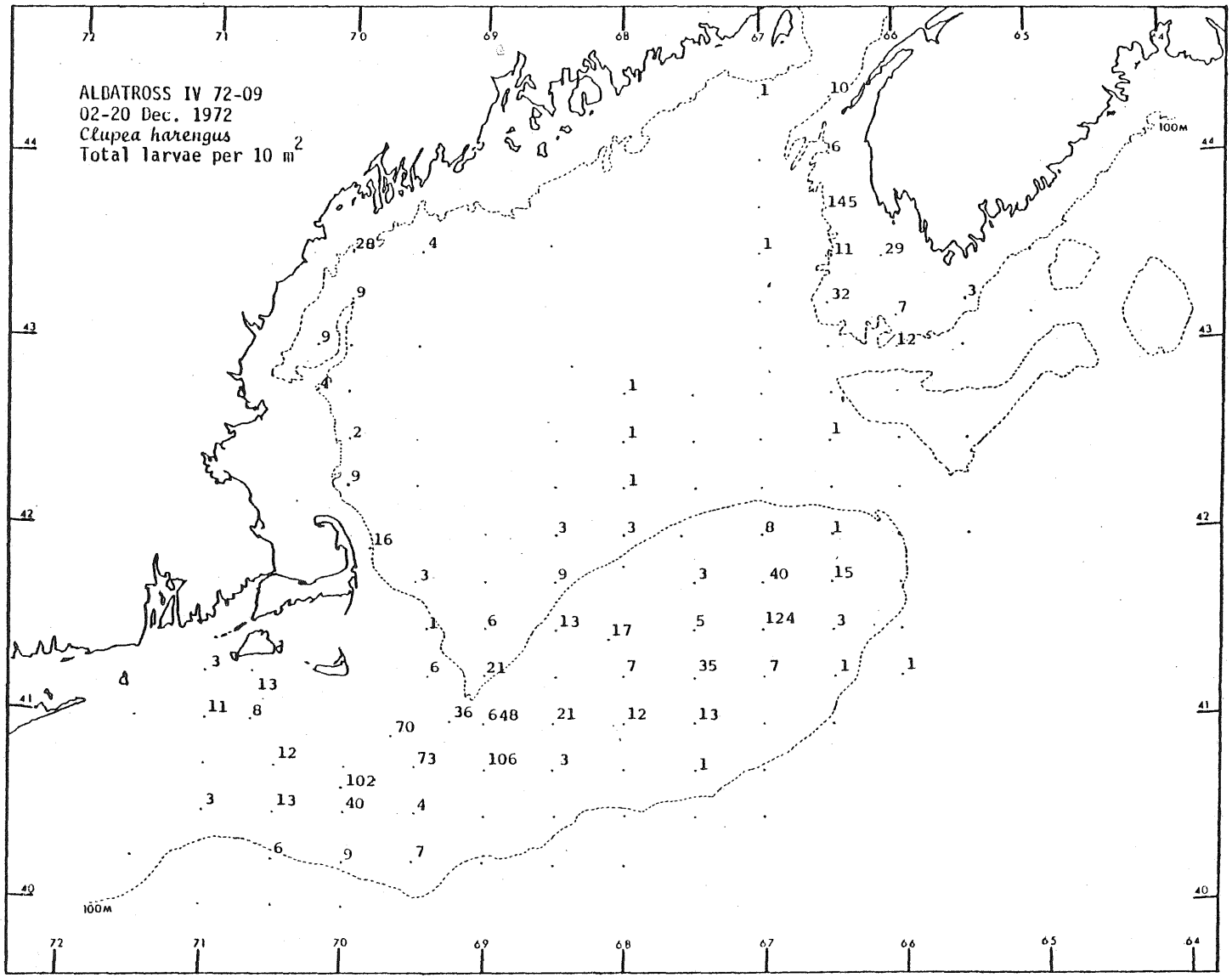

ALBATROSS IV 72-09
02-20 Dec. 1972
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 62.

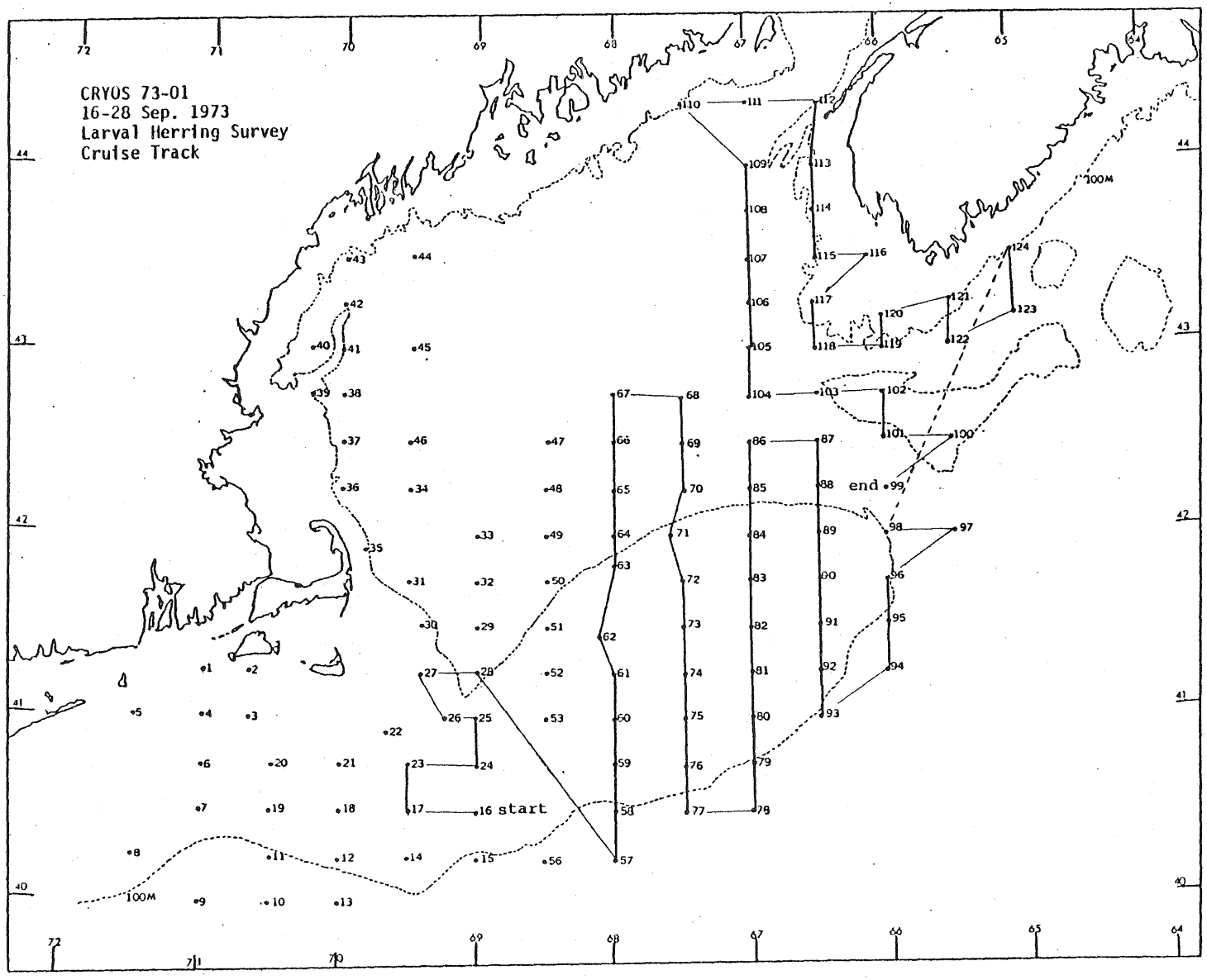

CRYOS 73-01
16-28 Sep. 1973
Larval Herring Survey
Cruise Track
start
end
100M

Figure 63.

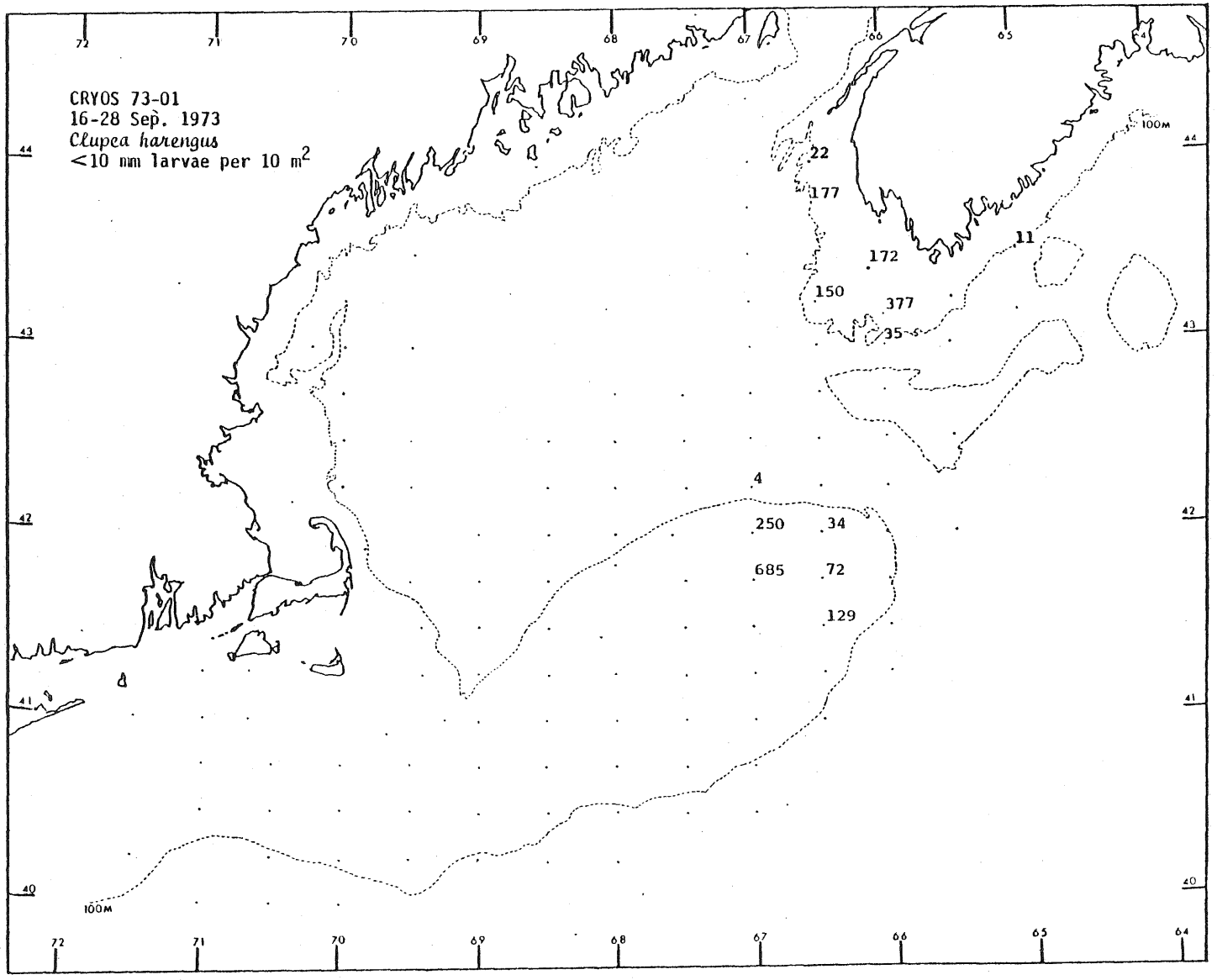

CRYOS 73-01
16-28 Sep. 1973
Clupea harengus
<10 mm larvae per 10 m2
22
177
172
11
150
377
35
4
250
34
685
72
129
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 64.

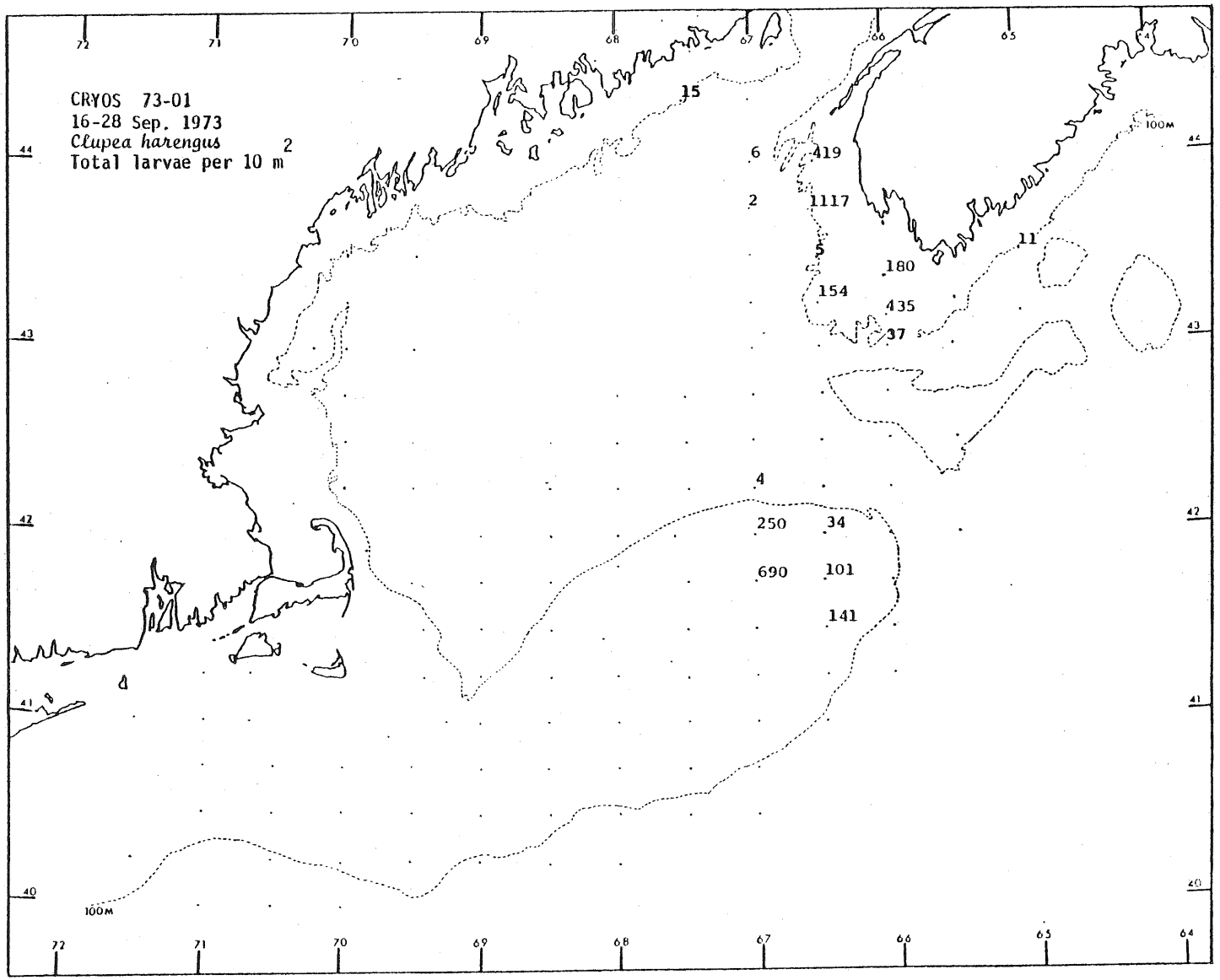

CRYOS 73-01
16-28 Sep. 1973
Clupea harengus
Total larvae per 10 m2
15
6
419
2
1117
5
180
154
435
37
11
4
250
34
690
101
141
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 65.

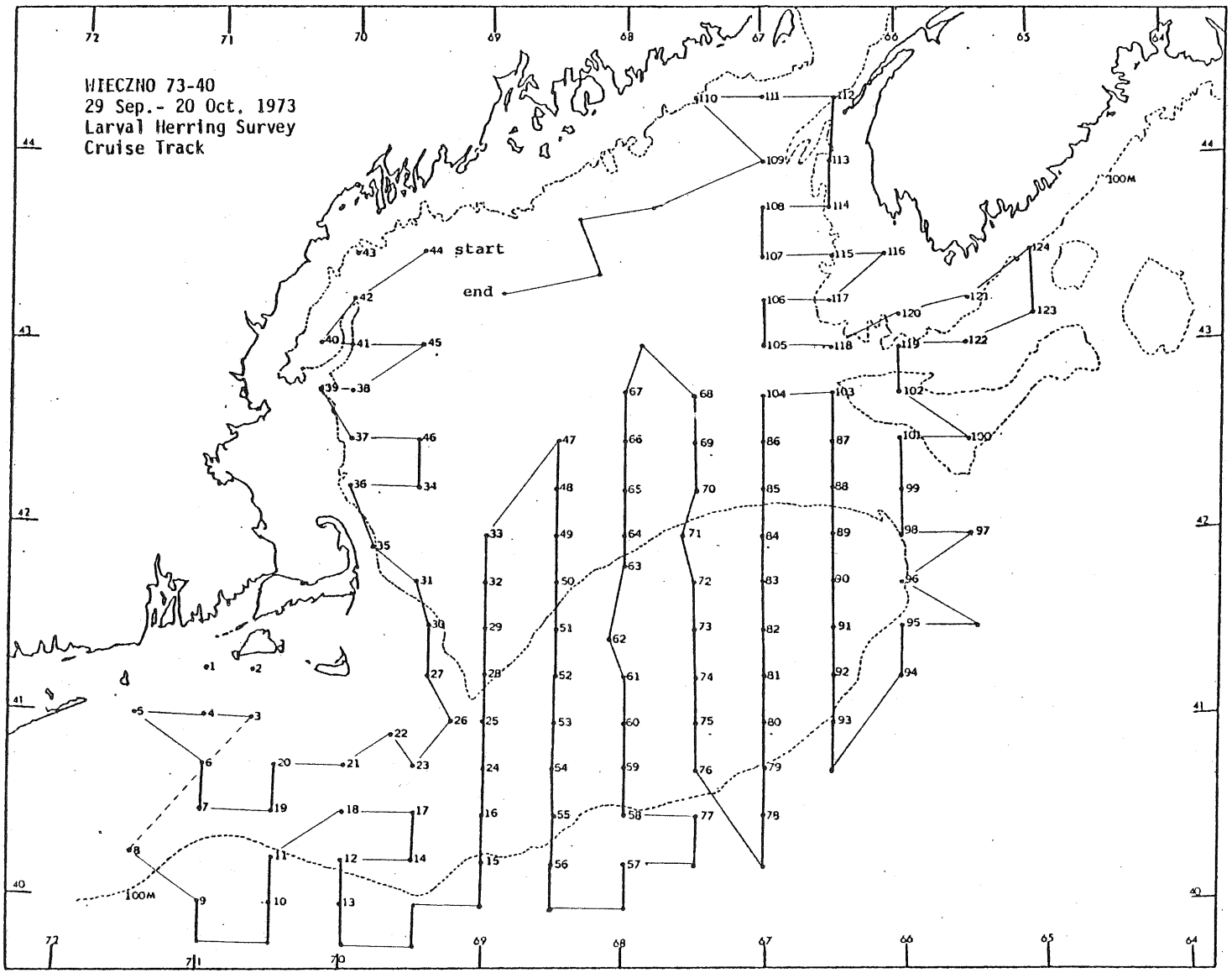

WIECZNO 73-40
29 Sep.- 20 Oct. 1973
Larval Herring Survey
Cruise Track
start
end
100M

Figure 66.

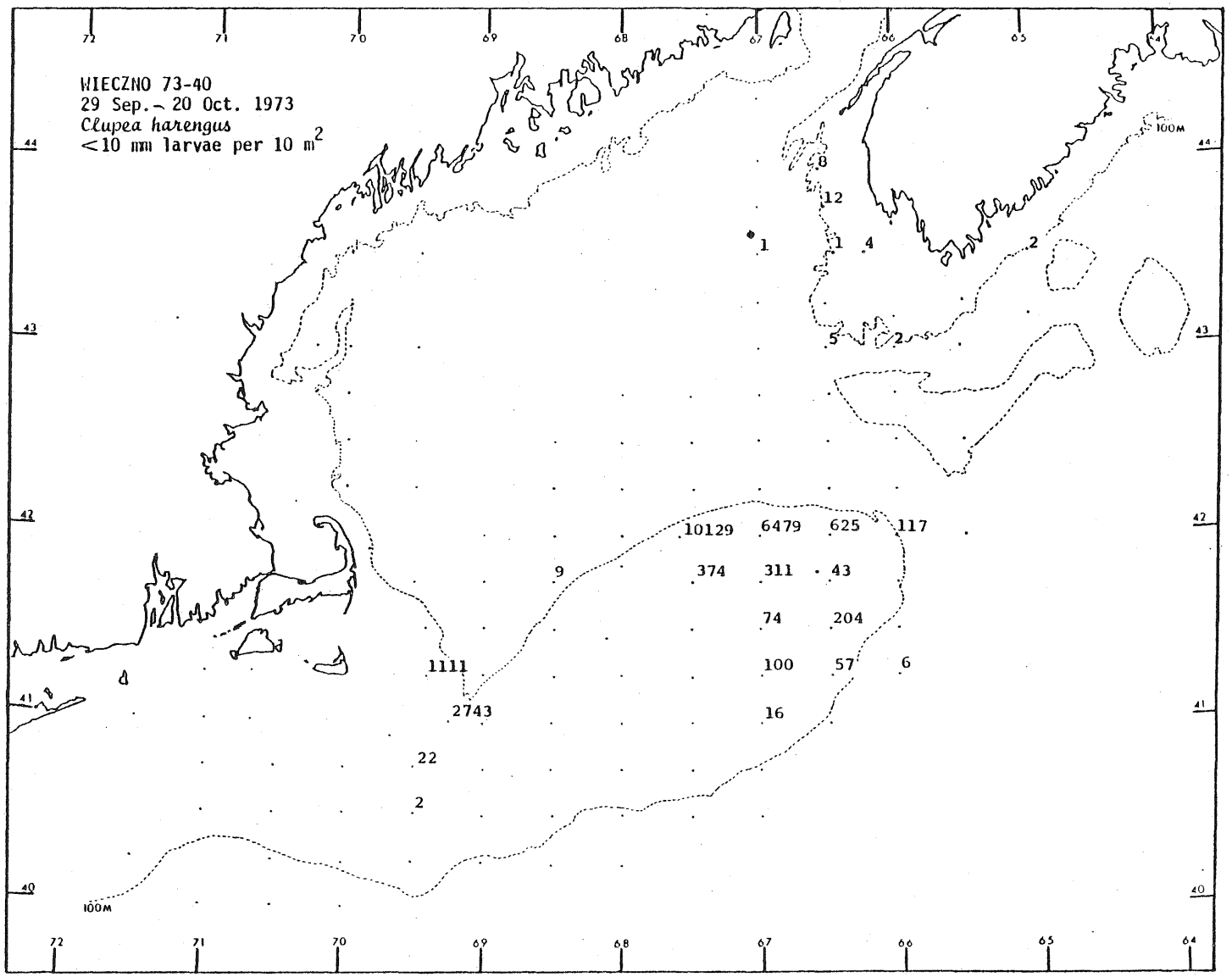

WIECZNO 73-40
29 Sep. – 20 Oct. 1973
Clupea harengus
<10 mm larvae per 10 m2
100M
8
12
1
1
4
2
5
2
10129
6479
625
117
374
311
43
9
74
204
1111
100
57
6
2743
16
22
2
100M

Figure 67.

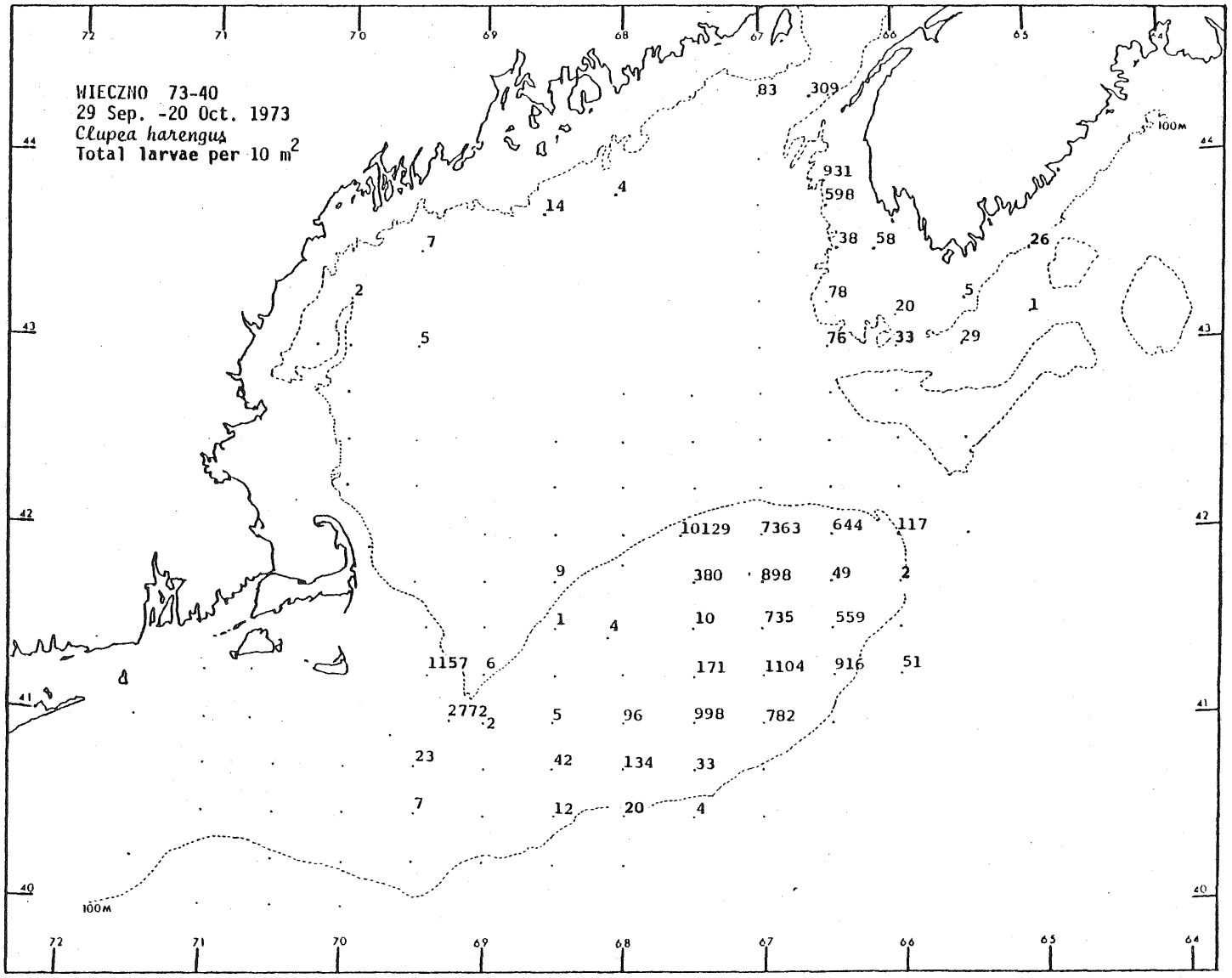

WIECZNO 73-40
29 Sep. -20 Oct. 1973
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
83
309
931
598
38
58
26
78
20
5
1
76
33
29
14
4
7
2
5
10129
7363
644
117
380
898
49
2
9
1
4
10
735
559
1157
6
171
1104
916
51
2772
2
5
96
998
782
23
42
134
33
7
12
20
4

Figure 68.

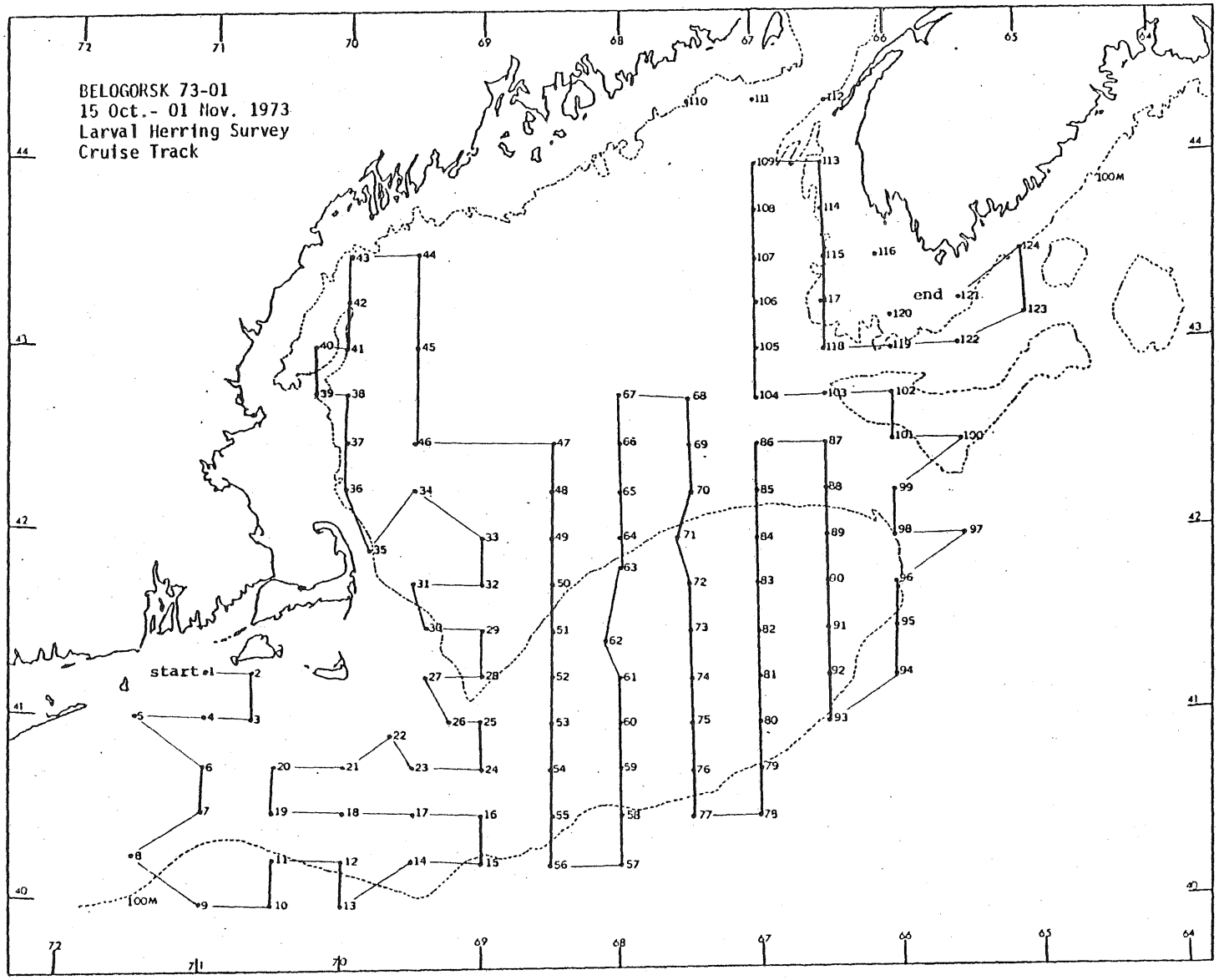

BELOGORSK 73-01
15 Oct.- 01 Nov. 1973
Larval Herring Survey
Cruise Track
start
end
100M

Figure 69.

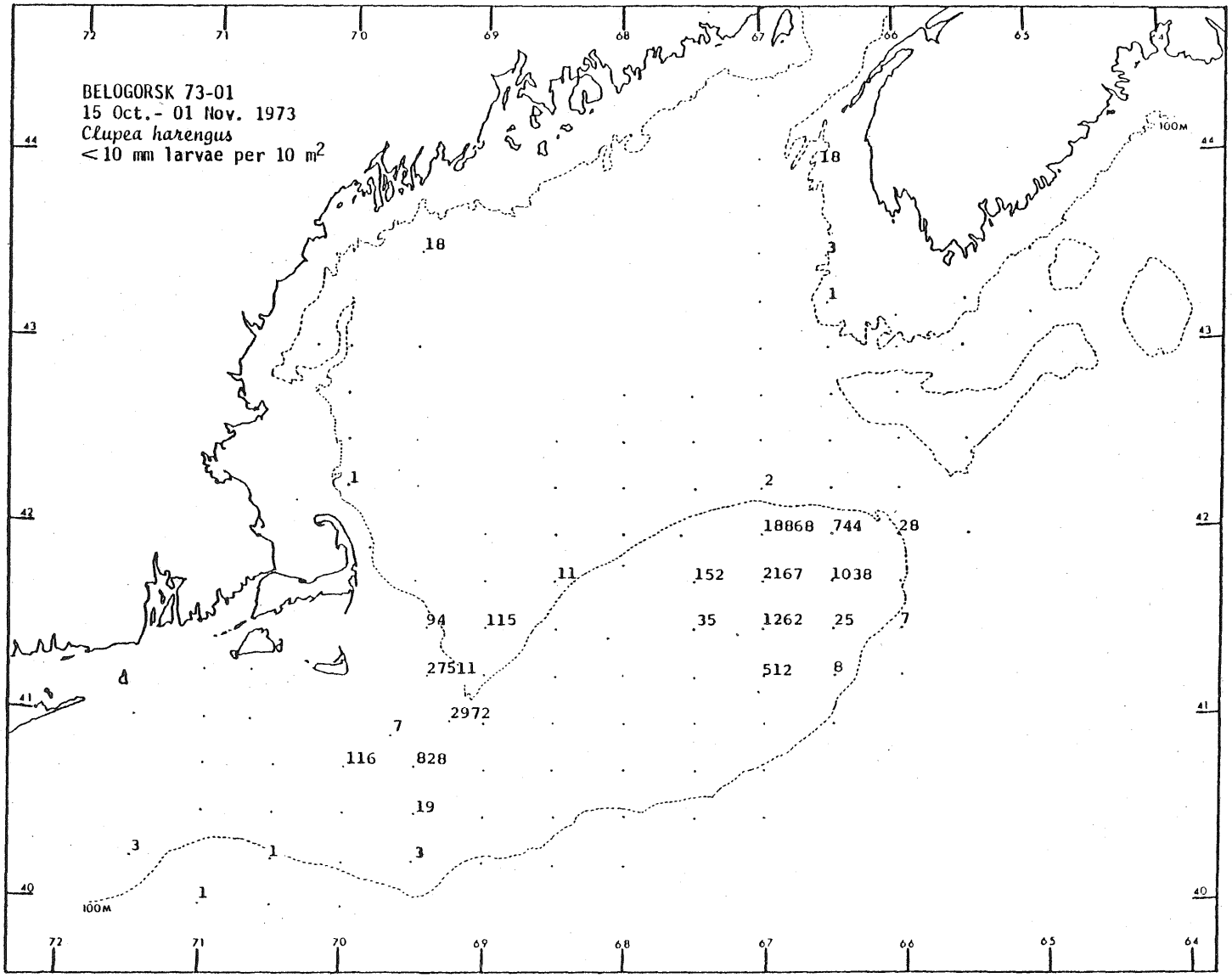

BELOGORSK 73-01
15 Oct.- 01 Nov. 1973
Clupea harengus
<10 mm larvae per 10 m2
100M
18
18
3
1
1
2
18868
744
28
11
152
2167
1038
94
115
35
1262
25
7
27511
512
8
2972
7
116
828
19
3
1
3
1
100M

Figure 70.

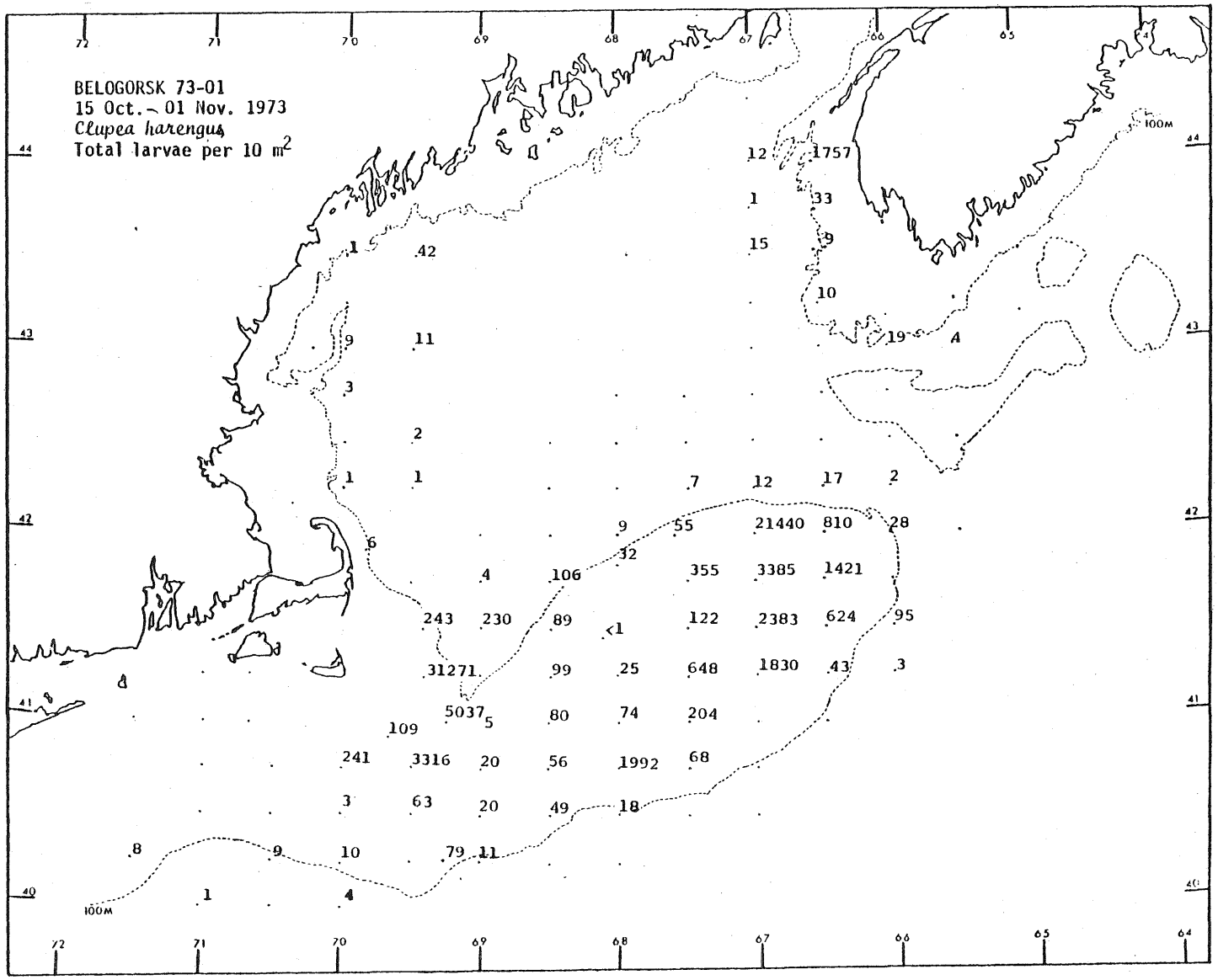

BELOGORSK 73-01
15 Oct. – 01 Nov. 1973
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 71.

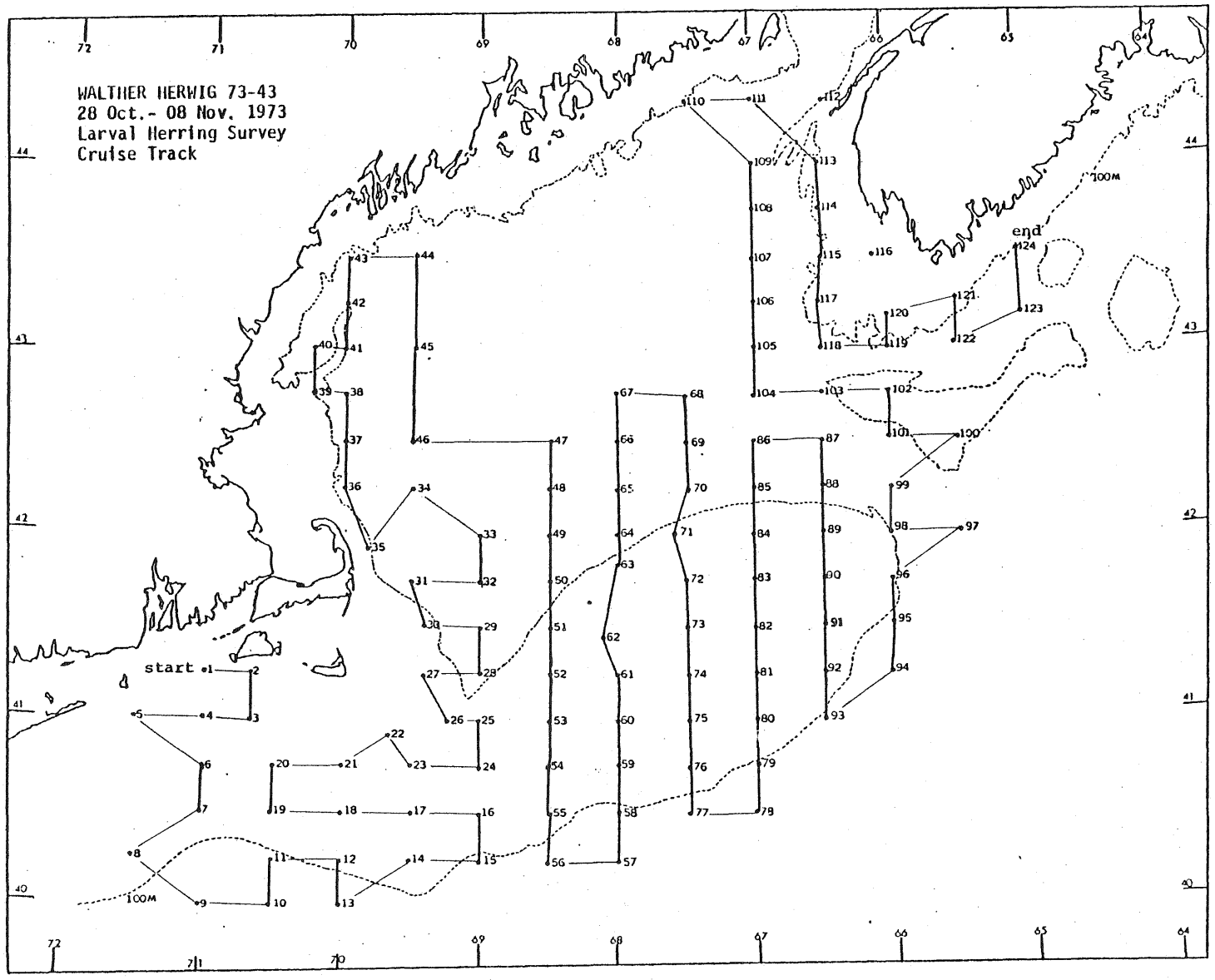

WALTHER HERWIG 73-43
28 Oct.- 08 Nov. 1973
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 72.

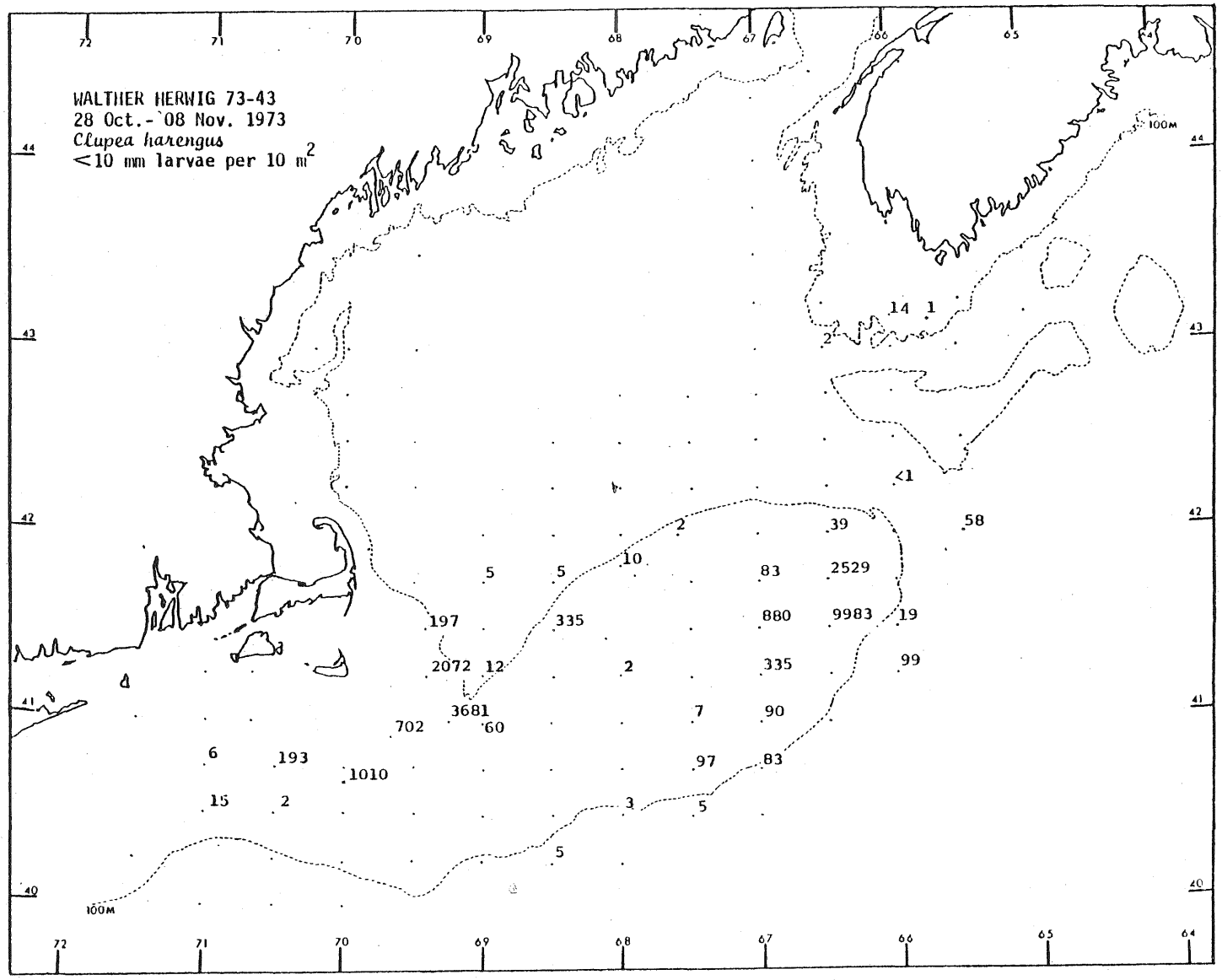

WALTHER HERWIG 73-43
28 Oct.- 08 Nov. 1973
Clupea harengus
<10 mm larvae per 10 m2
100M
14
1
2
<1
39
58
2
10
5
5
83
2529
197
335
880
9983
19
2072
12
2
335
99
3681
7
90
702
60
6
193
97
83
1010
15
2
3
5
5
100M

Figure 73.

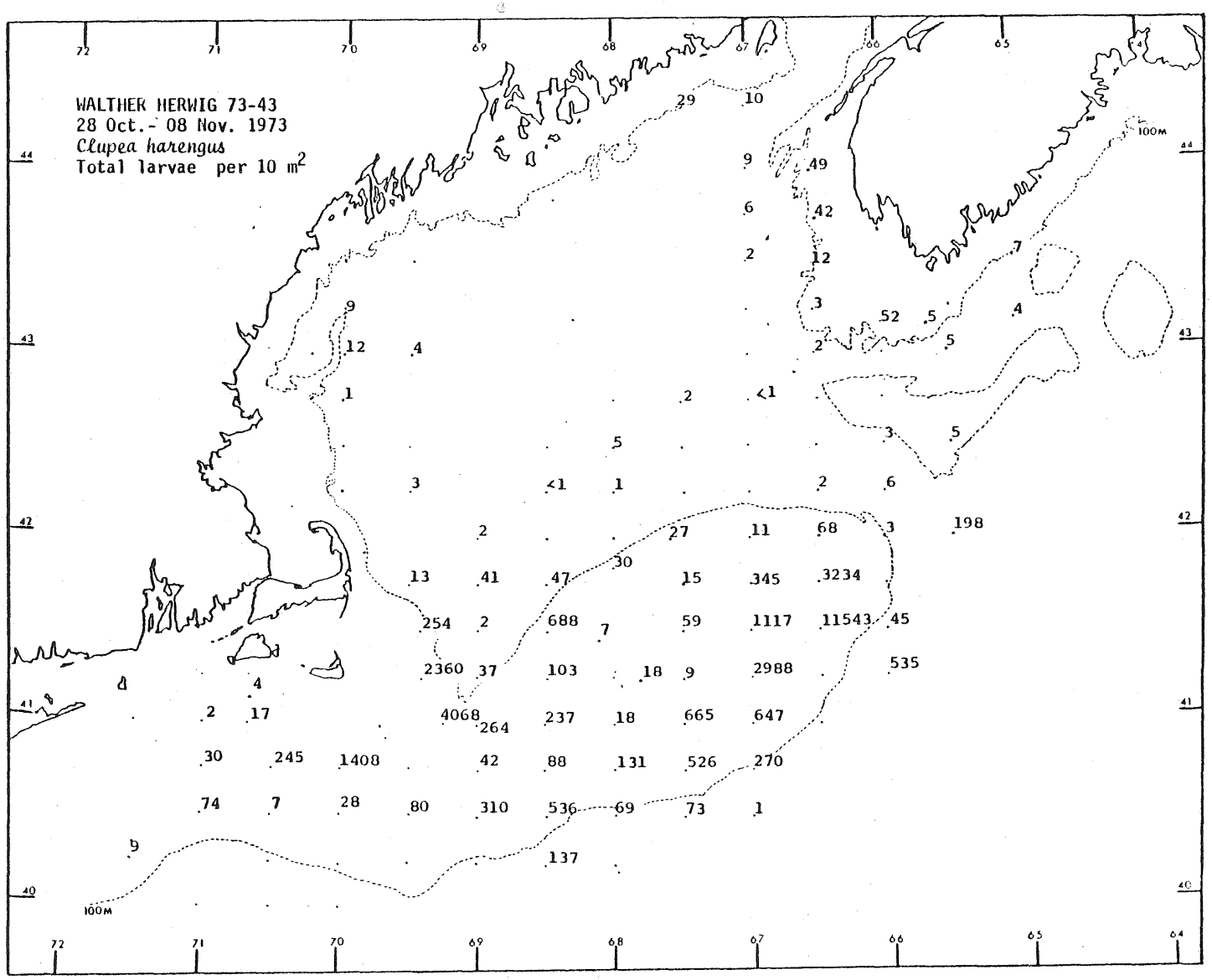

WALTHER HERWIG 73-43
28 Oct.- 08 Nov. 1973
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 74.

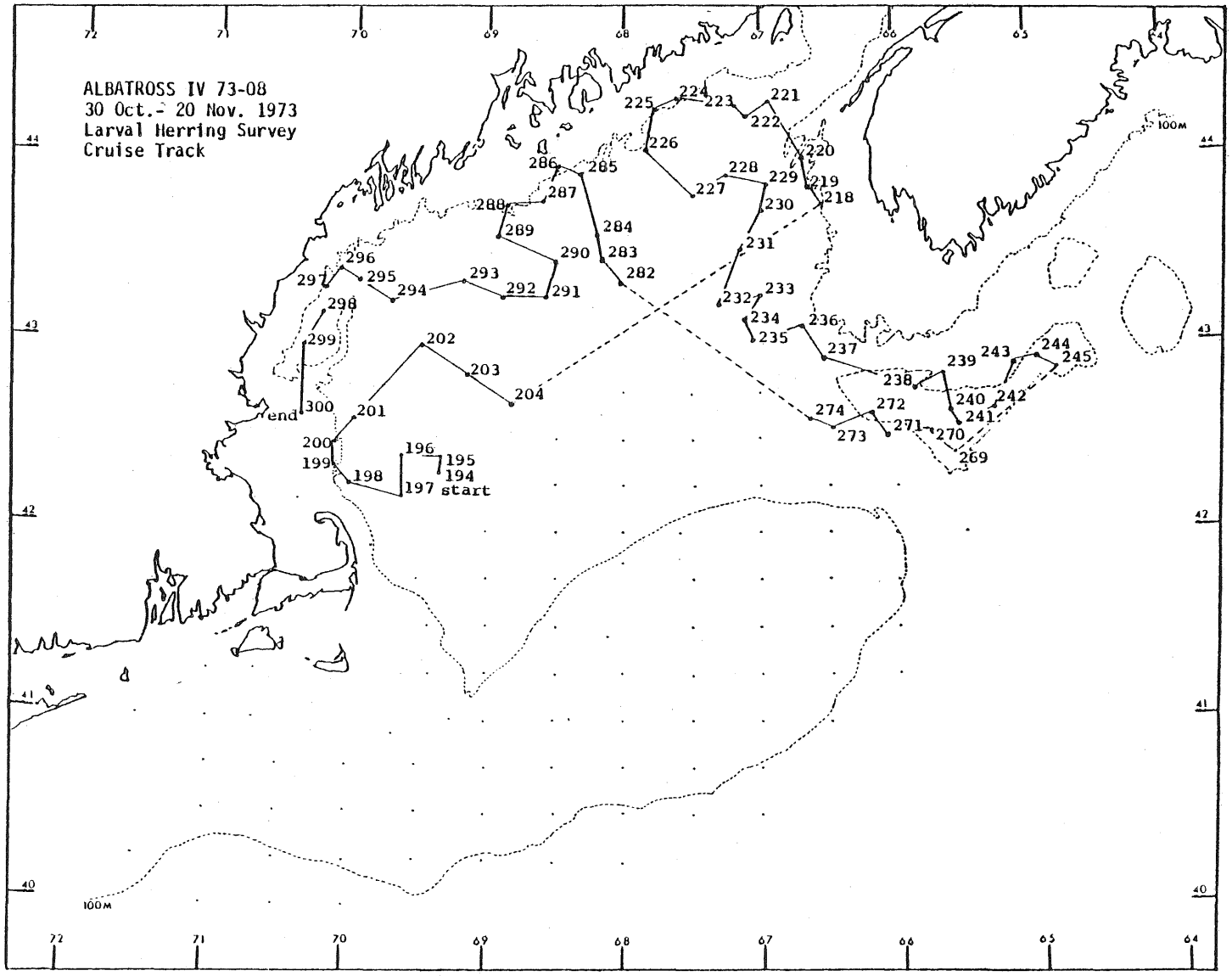

ALBATROSS IV 73-08
30 Oct.- 20 Nov. 1973
Larval Herring Survey
Cruise Track
100M
start
end

Figure 75.

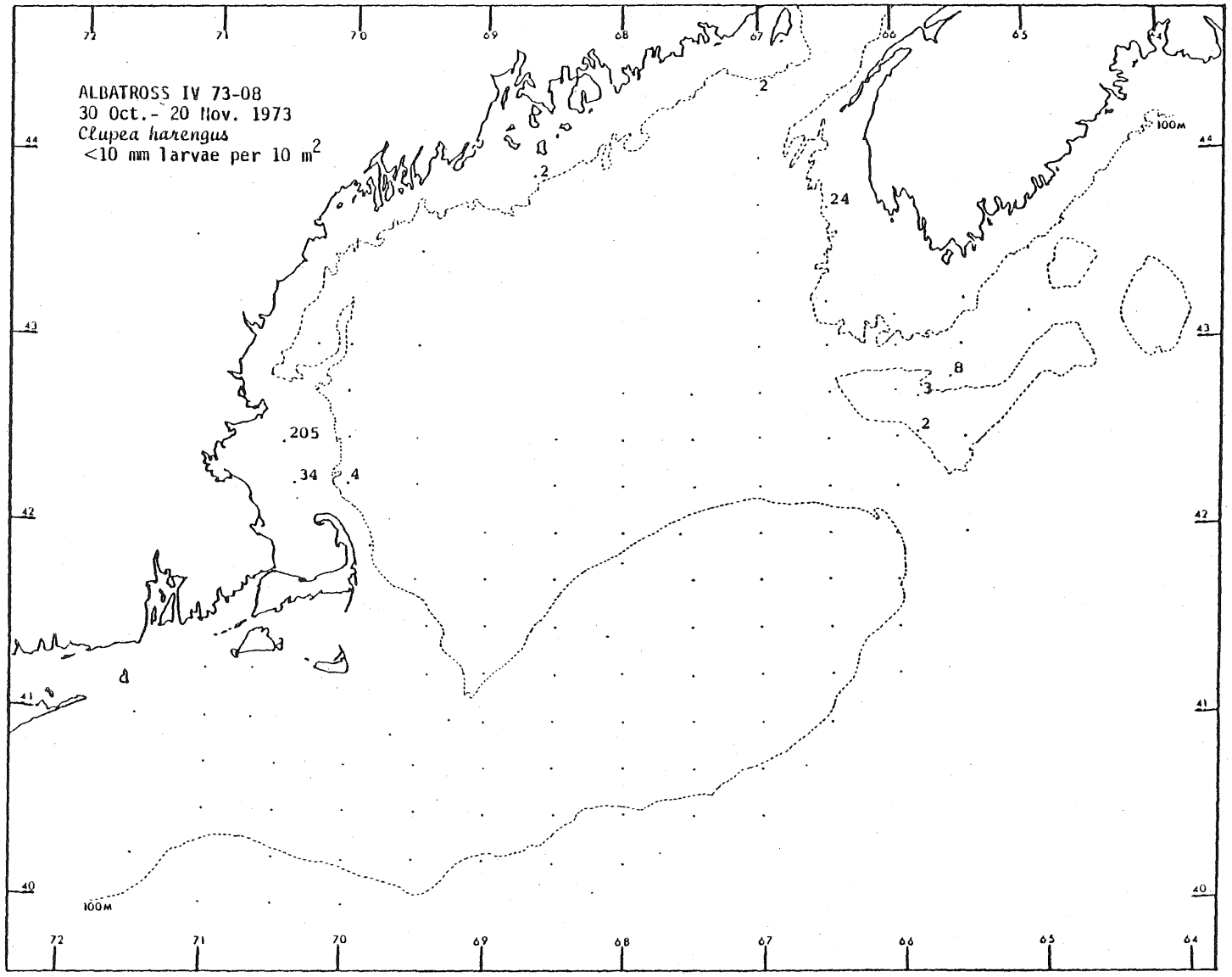

ALBATROSS IV 73-08
30 Oct.- 20 Nov. 1973
Clupea harengus
<10 mm larvae per 10 m2
100M
205
34
4
2
2
24
8
3
2
100M

Figure 76.

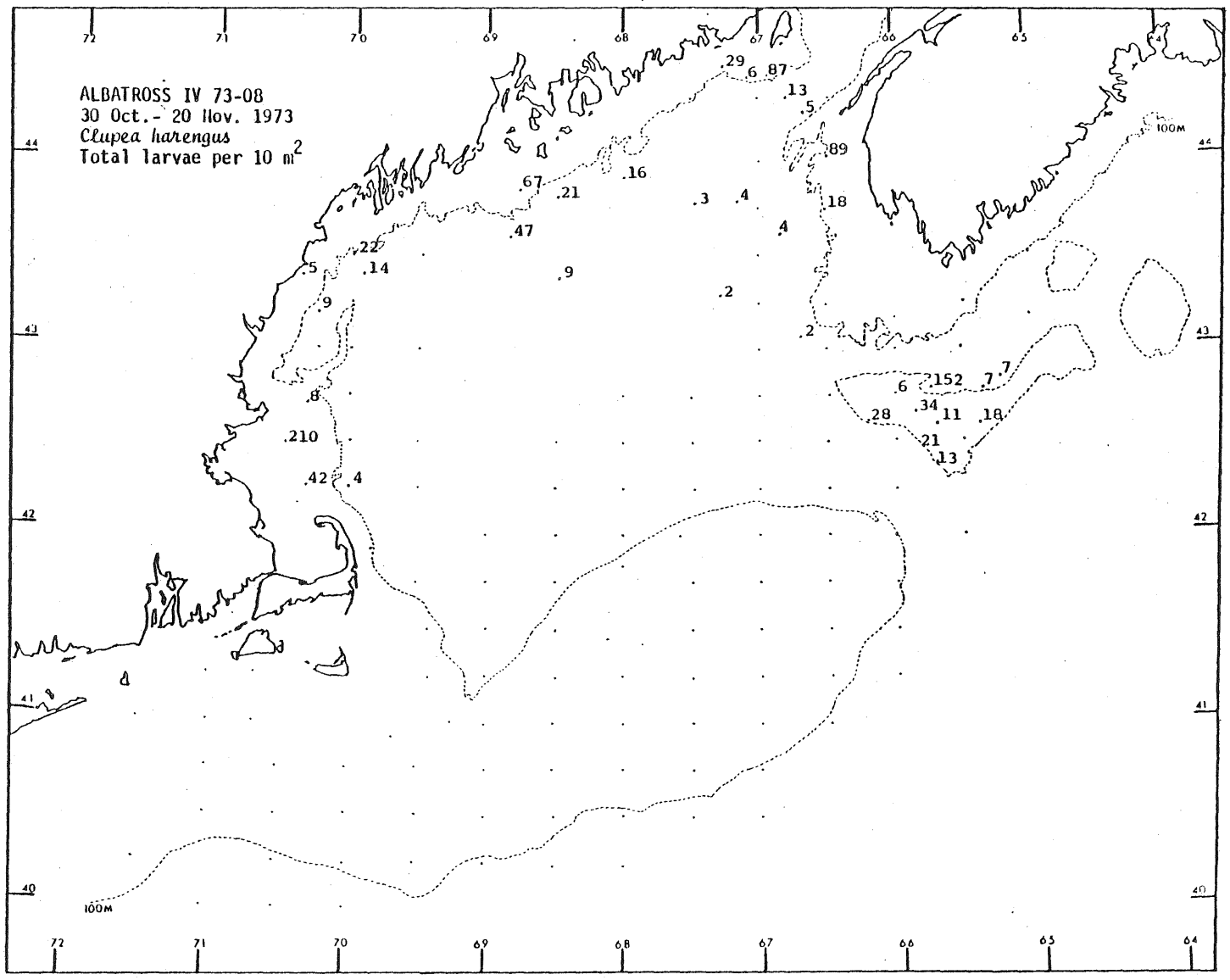

ALBATROSS IV 73-08
30 Oct.- 20 Nov. 1973
Clupea harengus
Total larvae per 10 m2
100M
100M
.29
.6
.87
.13
.5
.89
.18
.16
.67
.21
.3
.4
.4
.47
.22
.5
.14
.9
.2
.9
.2
.8
.210
.42
.4
.6
.152
.7
.7
.34
.11
.28
.18
.21
.13

Figure 77.

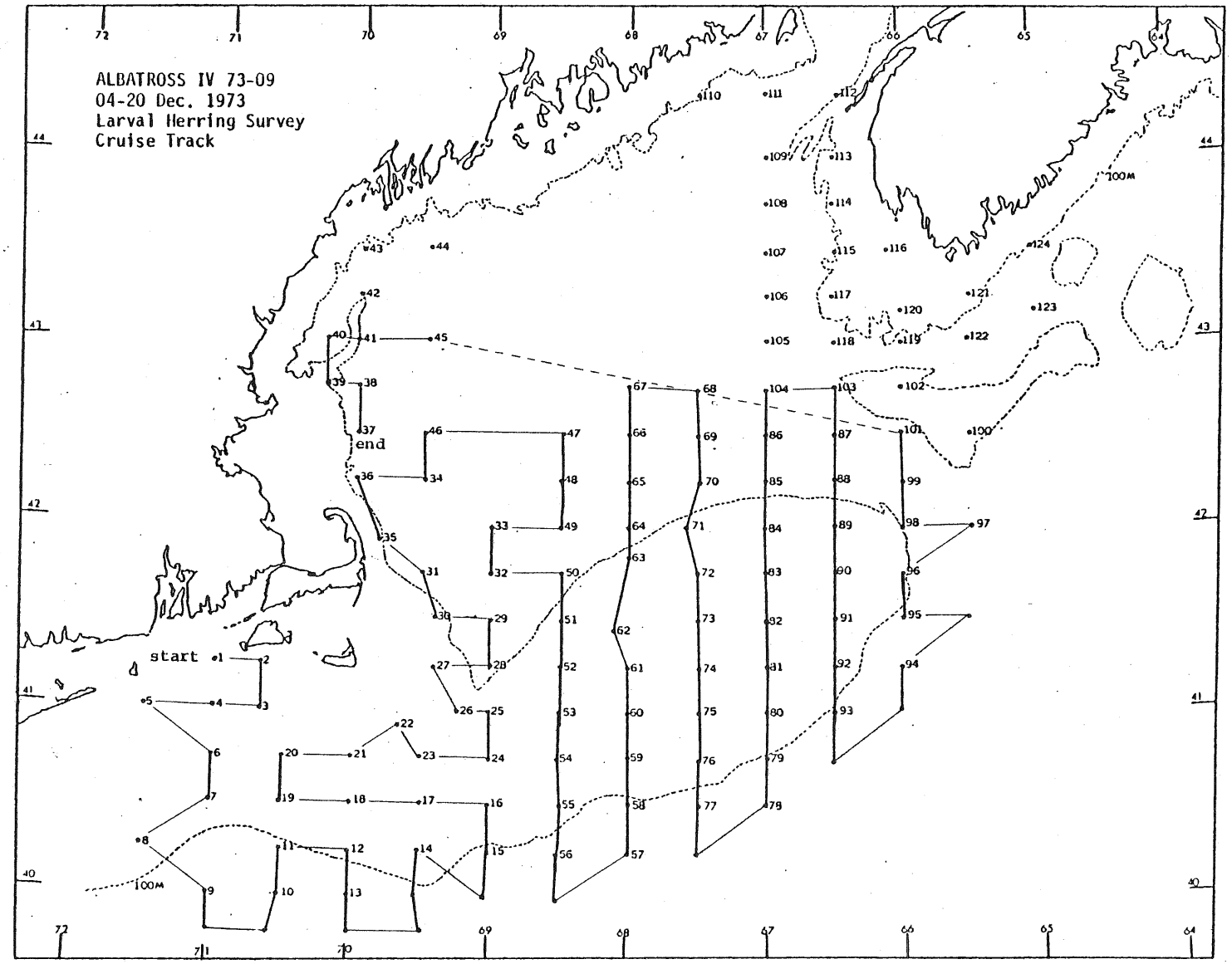

ALBATROSS IV 73-09
04-20 Dec. 1973
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 78.

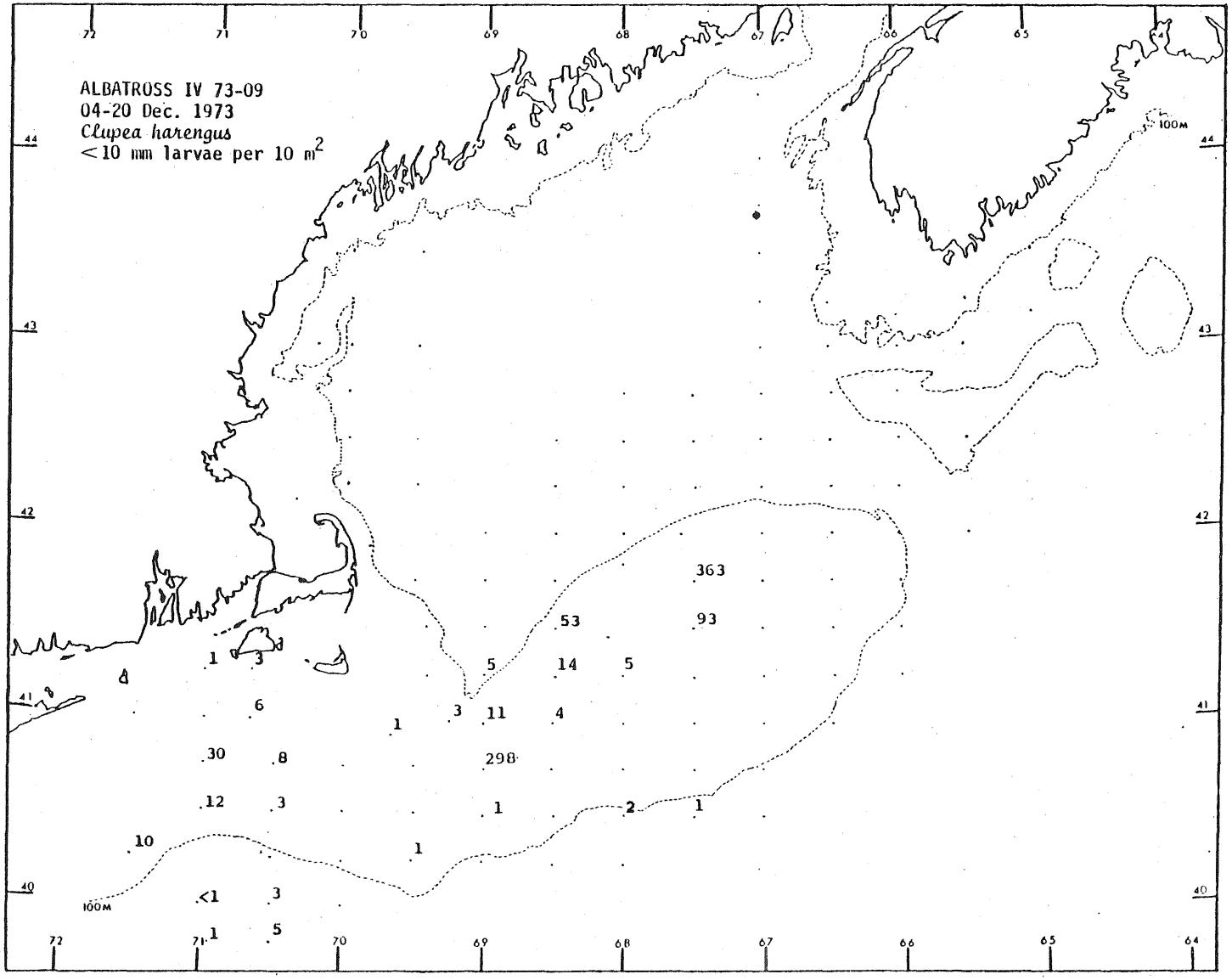

ALBATROSS IV 73-09
04-20 Dec. 1973
Clupea harengus
<10 mm larvae per 10 m^2
100M
363
93
53
14
5
5
3
11
4
1
298
1
2
1
1
1
6
30
8
12
3
10
<1
3
1
5
100M

Figure 79.

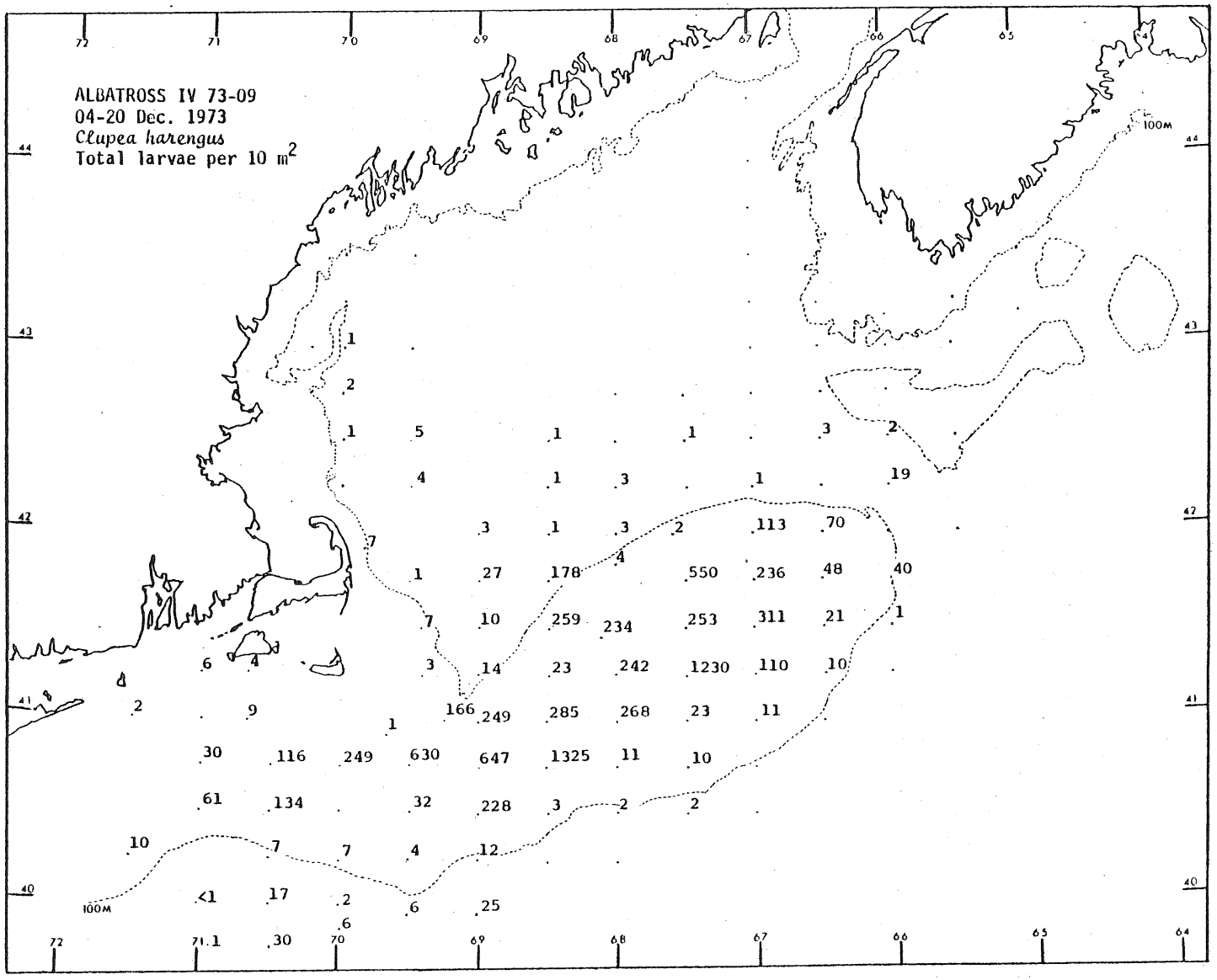

ALBATROSS IV 73-09
04-20 Dec. 1973
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 80.

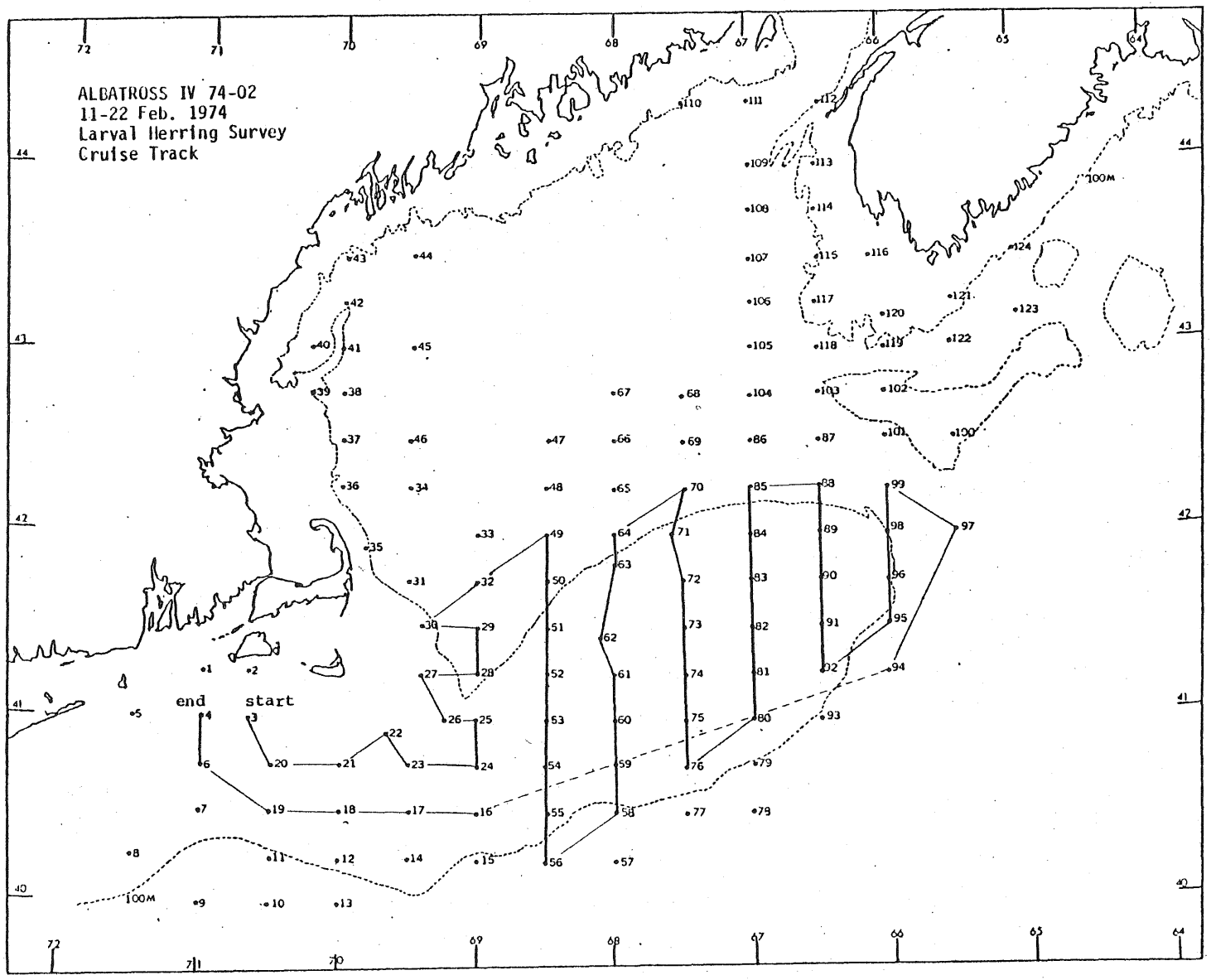

ALBATROSS IV 74-02
11-22 Feb. 1974
Larval Herring Survey
Cruise Track
end
start
100M
100M

Figure 81.

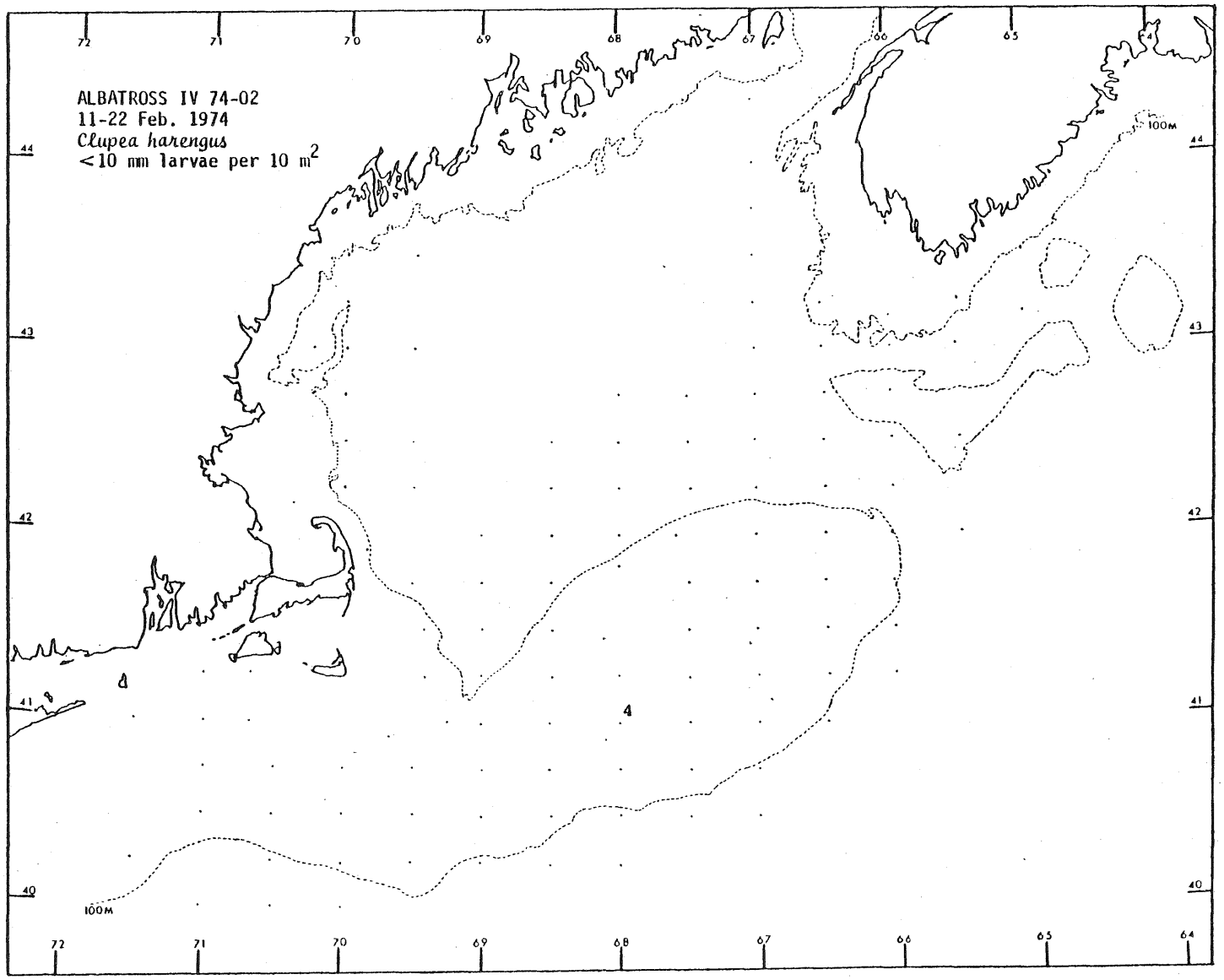

ALBATROSS IV 74-02
11-22 Feb. 1974
Clupea harengus
<10 mm larvae per 10 m^2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 82.

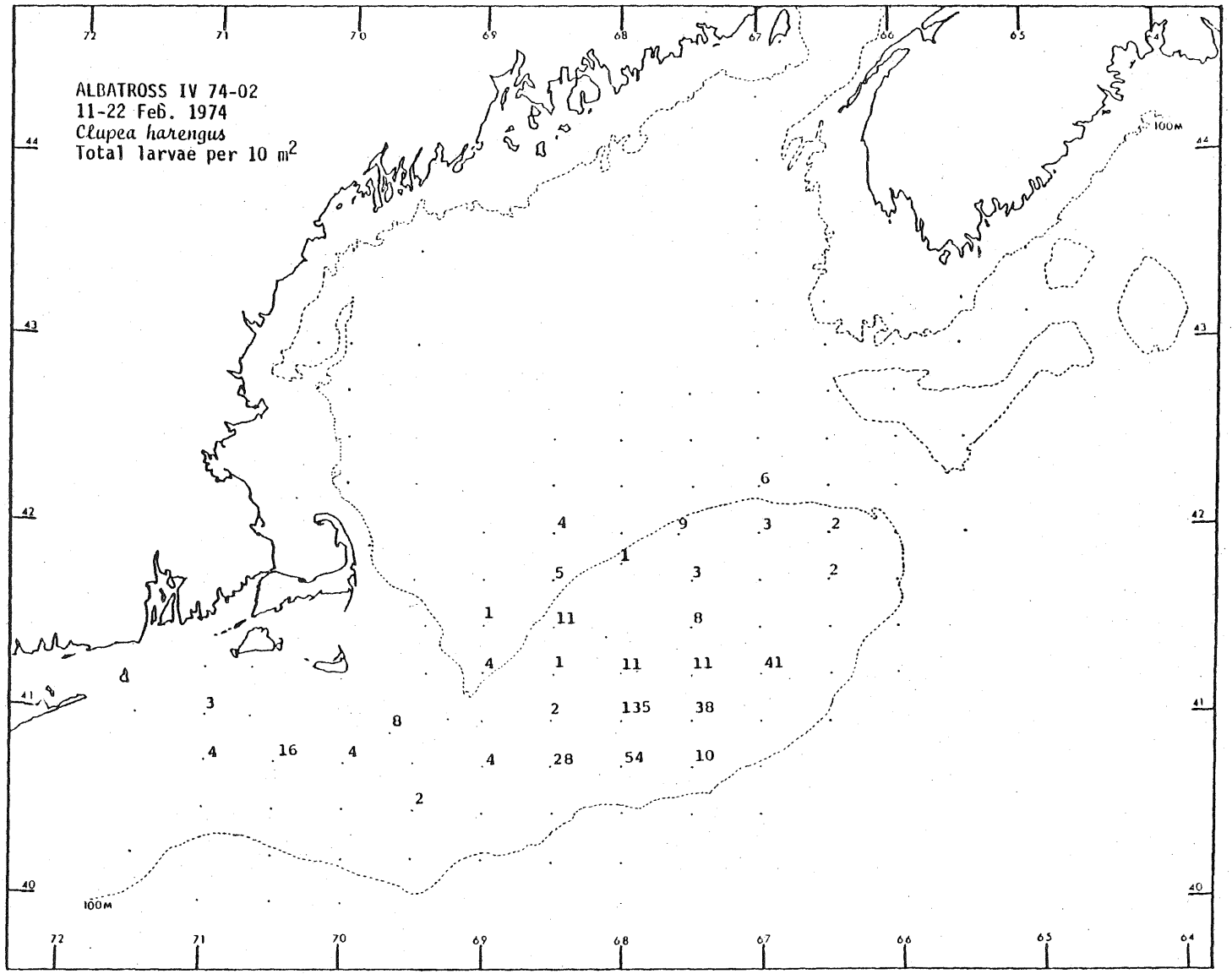

ALBATROSS IV 74-02
11-22 Feb. 1974
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
6
4
9
3
2
1
5
3
2
1
11
8
4
1
11
11
41
3
2
135
38
8
4
16
4
4
28
54
10
2

Figure 83.

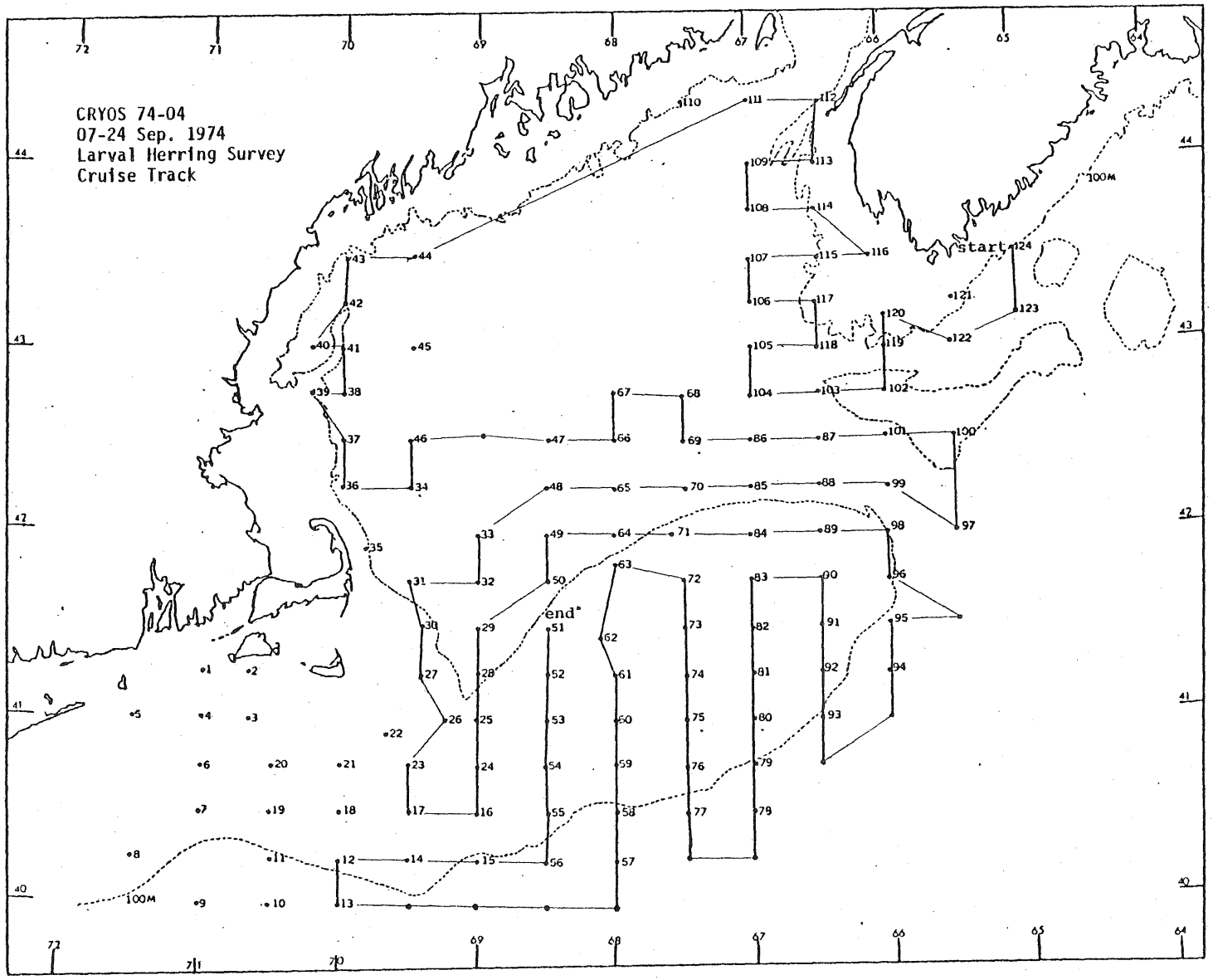

CRYOS 74-04
07-24 Sep. 1974
Larval Herring Survey
Cruise Track
start
end
100M

Figure 84.

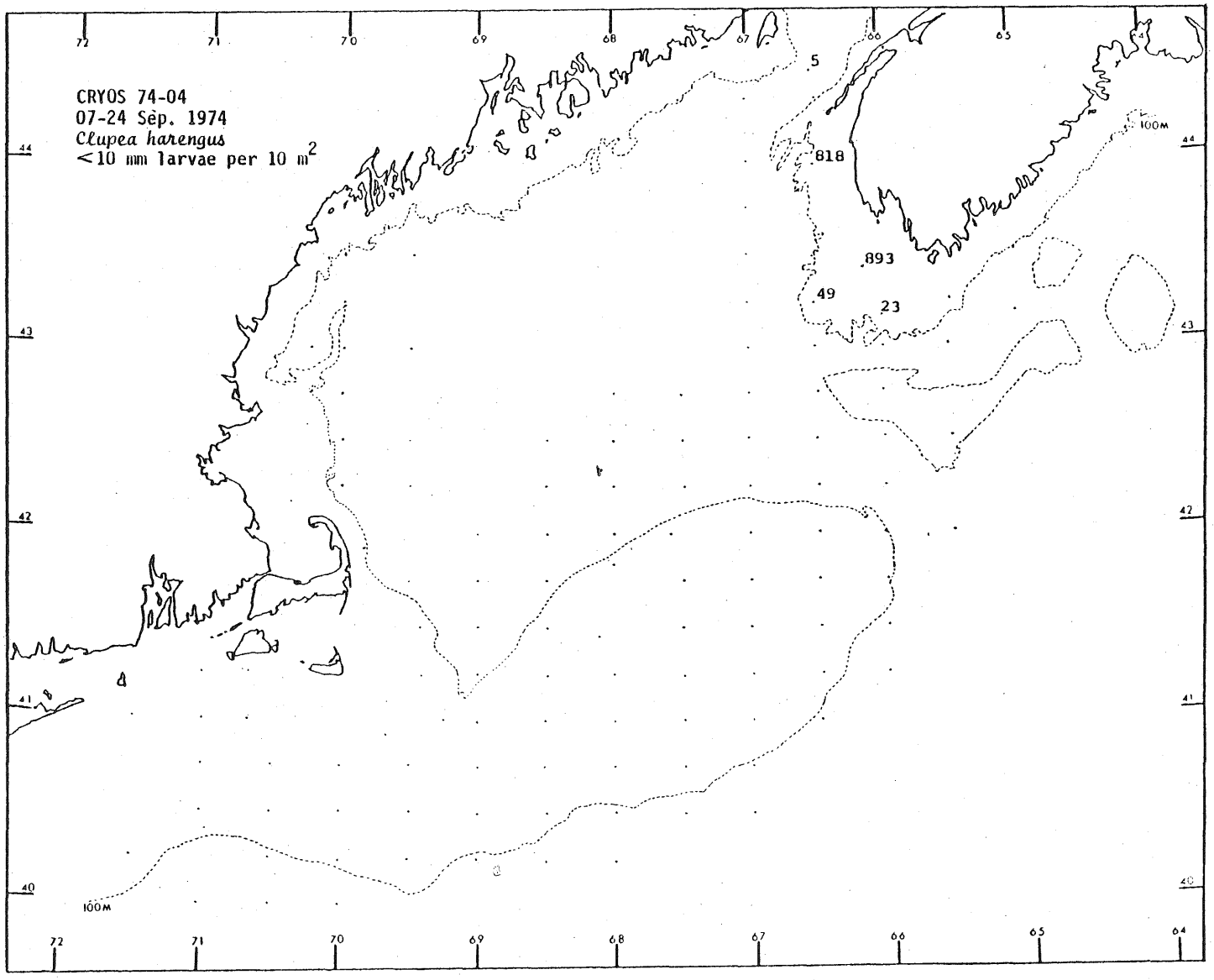

CRYOS 74-04
07-24 Sep. 1974
Clupea harengus
<10 mm larvae per 10 m2
5
818
893
49
23
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 85.

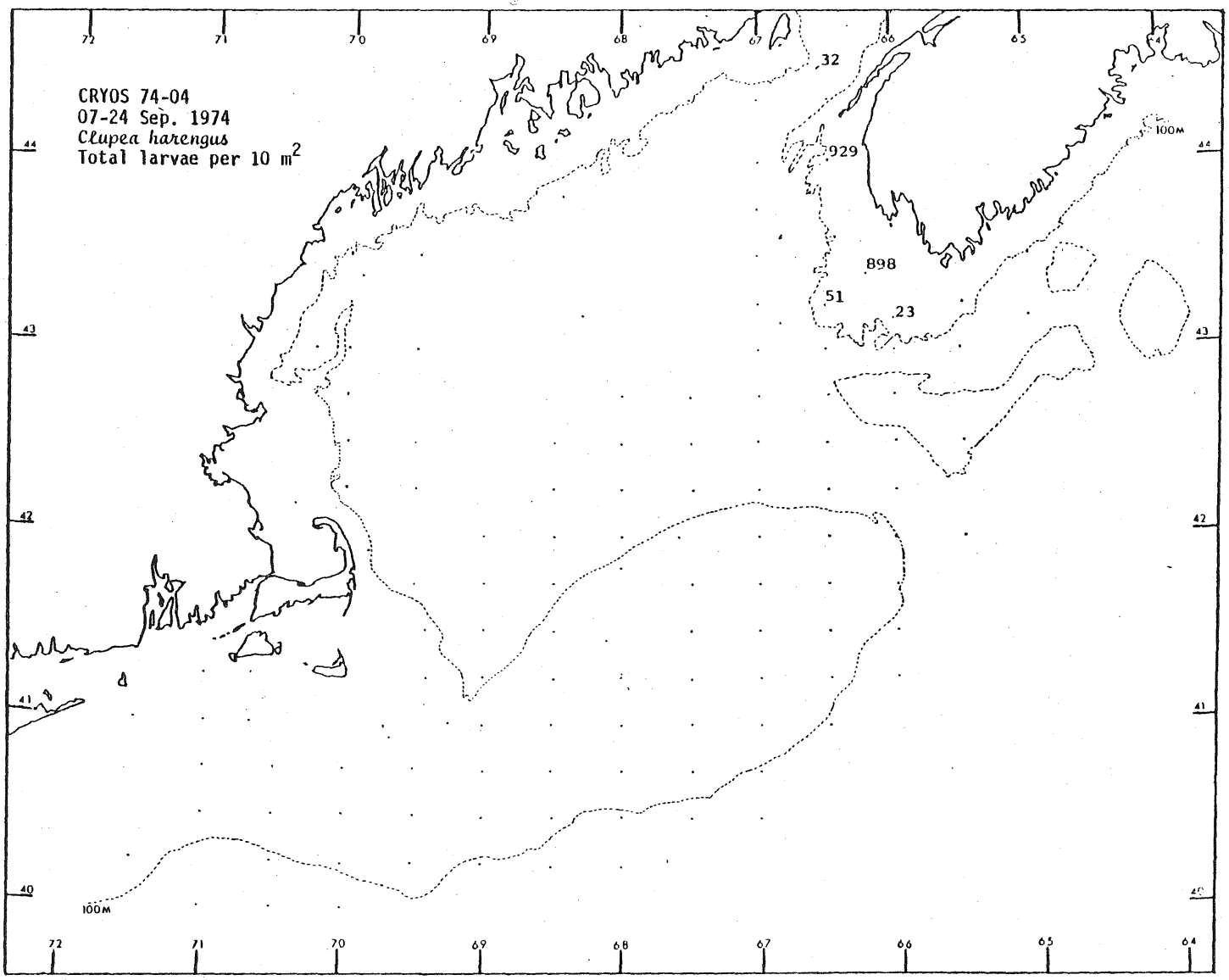

CRYOS 74-04
07-24 Sep. 1974
Clupea harengus
Total larvae per 10 m2
32
929
898
51
23
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 86.

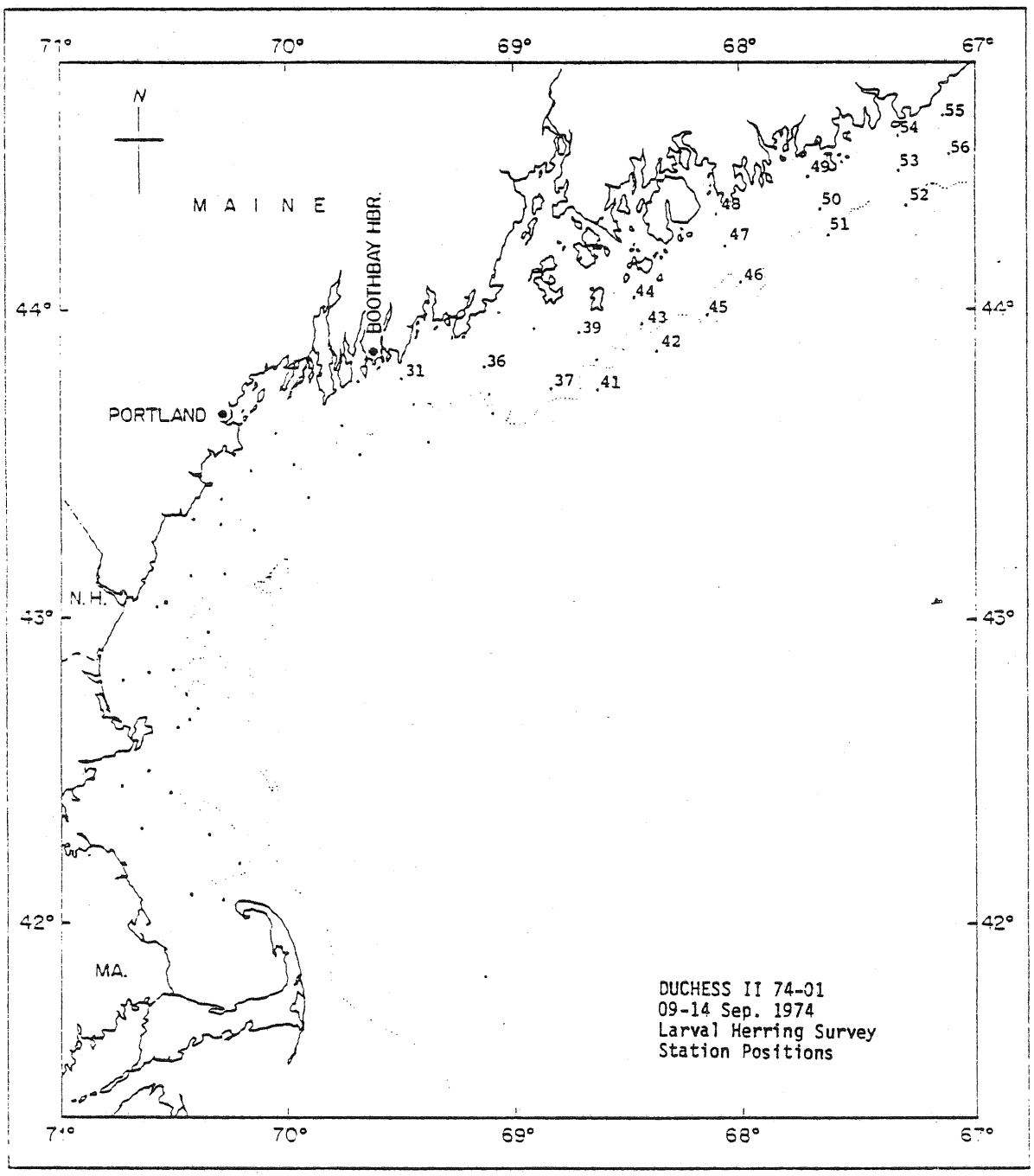

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
31
36
37
39
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
DUCHESS II 74-01
09-14 Sep. 1974
Larval Herring Survey
Station Positions

Figure 87.

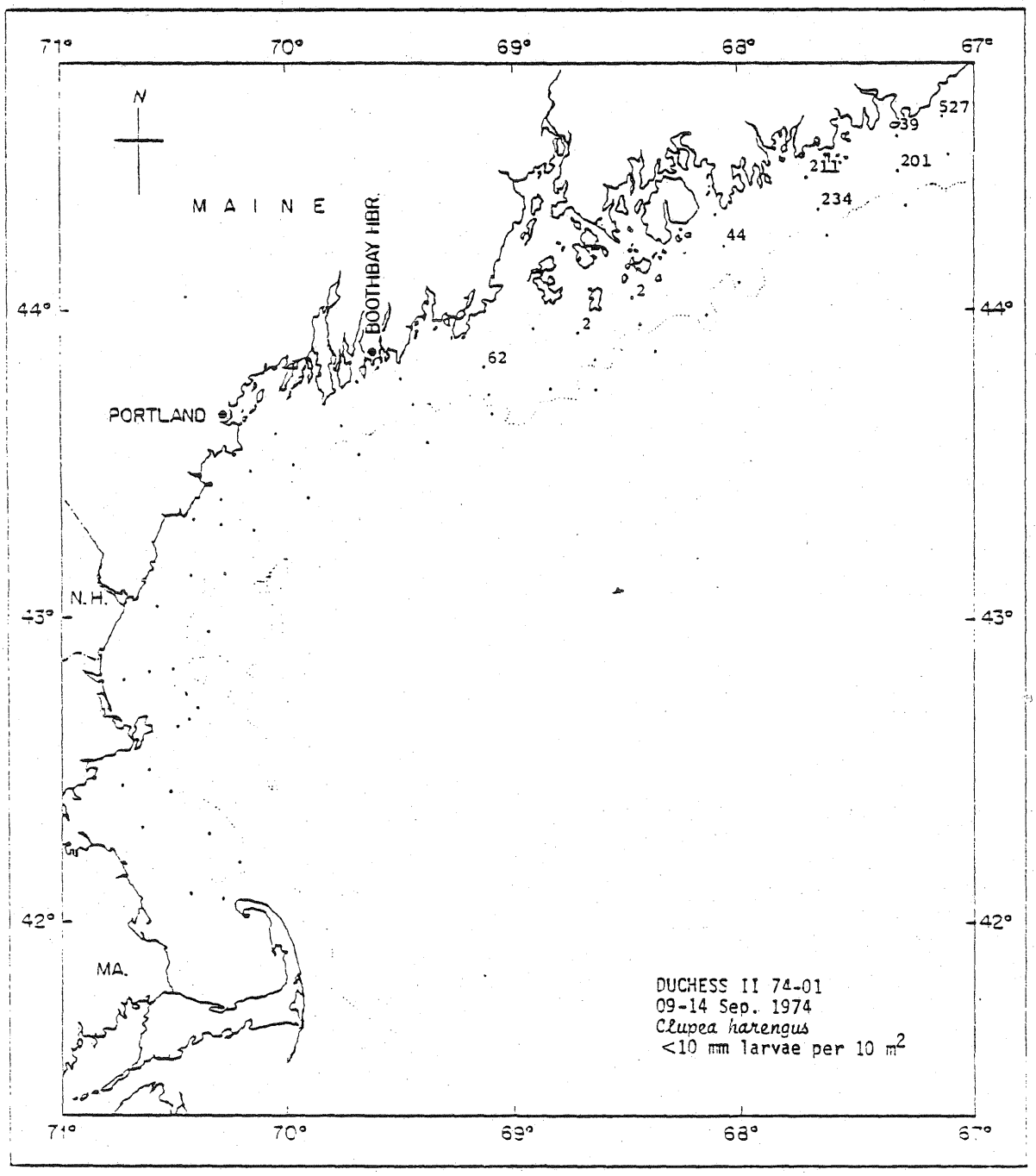

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
527
39
211
201
234
44
2
2
62
DUCHESS II 74-01
09-14 Sep. 1974
Clupea harengus
<10 mm larvae per 10 m2

Figure 88.

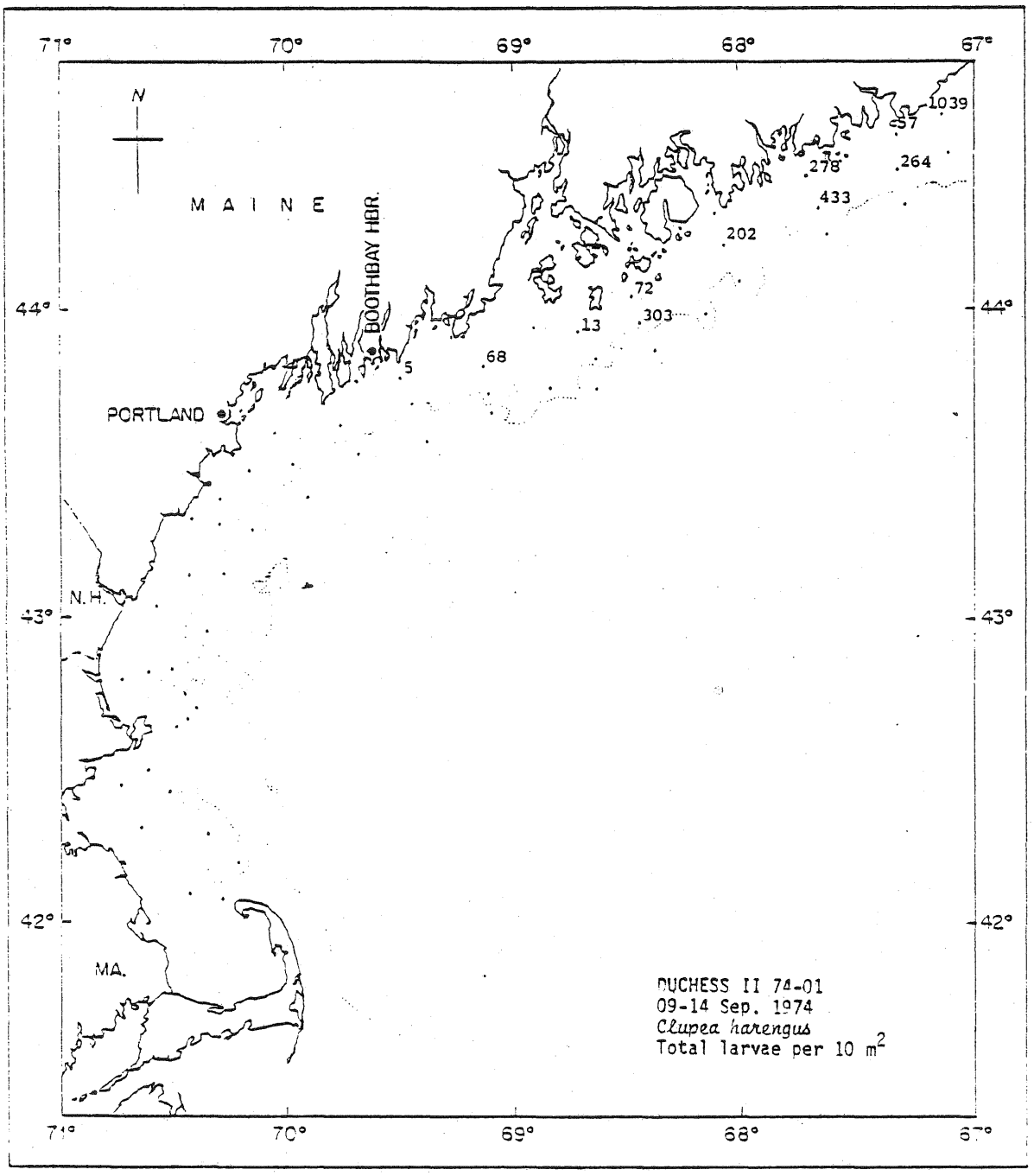

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
1039
57
278
264
433
202
72
303
13
68
5
DUCHESS II 74-01
09-14 Sep. 1974
Clupea harengus
Total larvae per 10 m2

Figure 89.

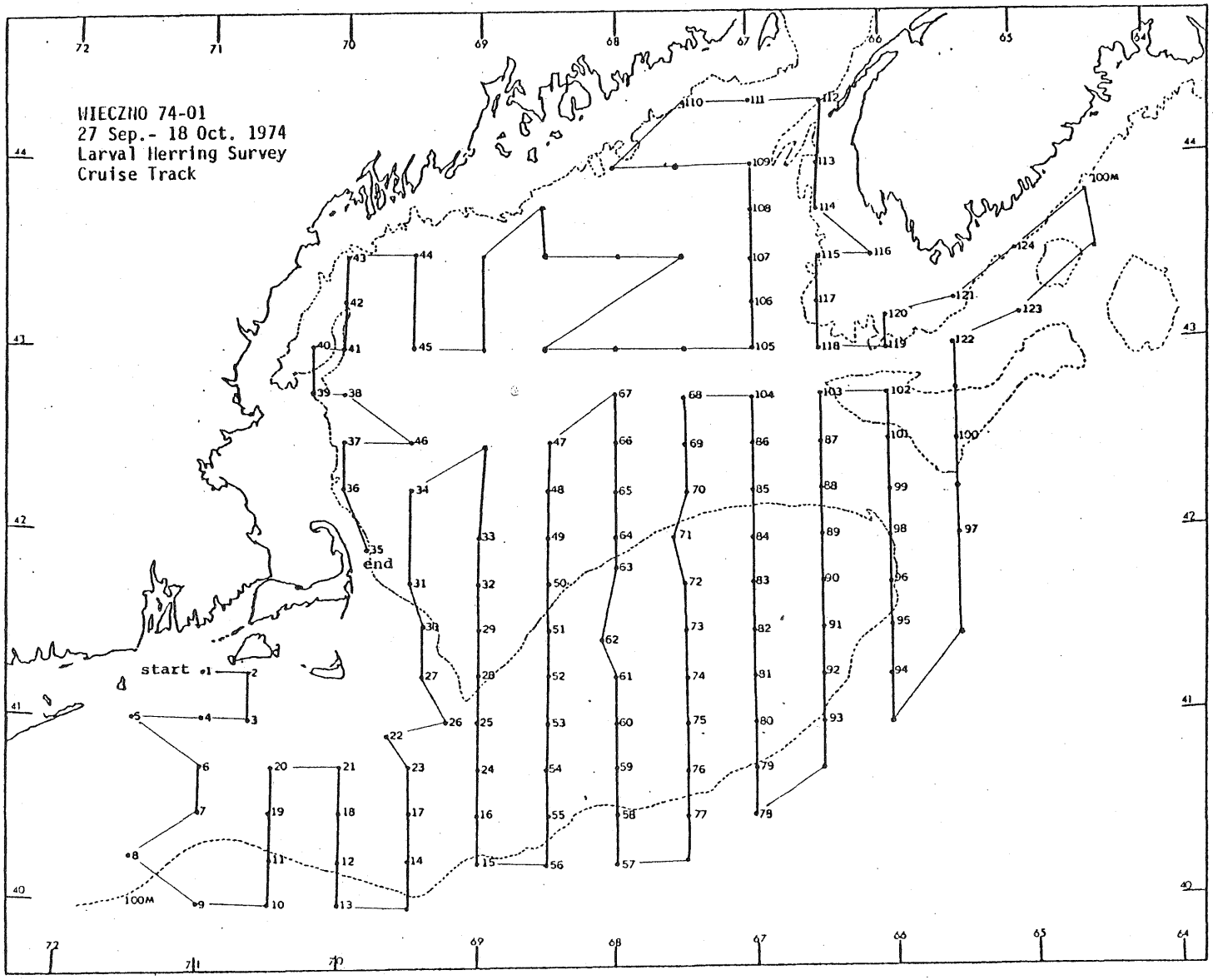

WIECZNO 74-01
27 Sep.- 18 Oct. 1974
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 90.

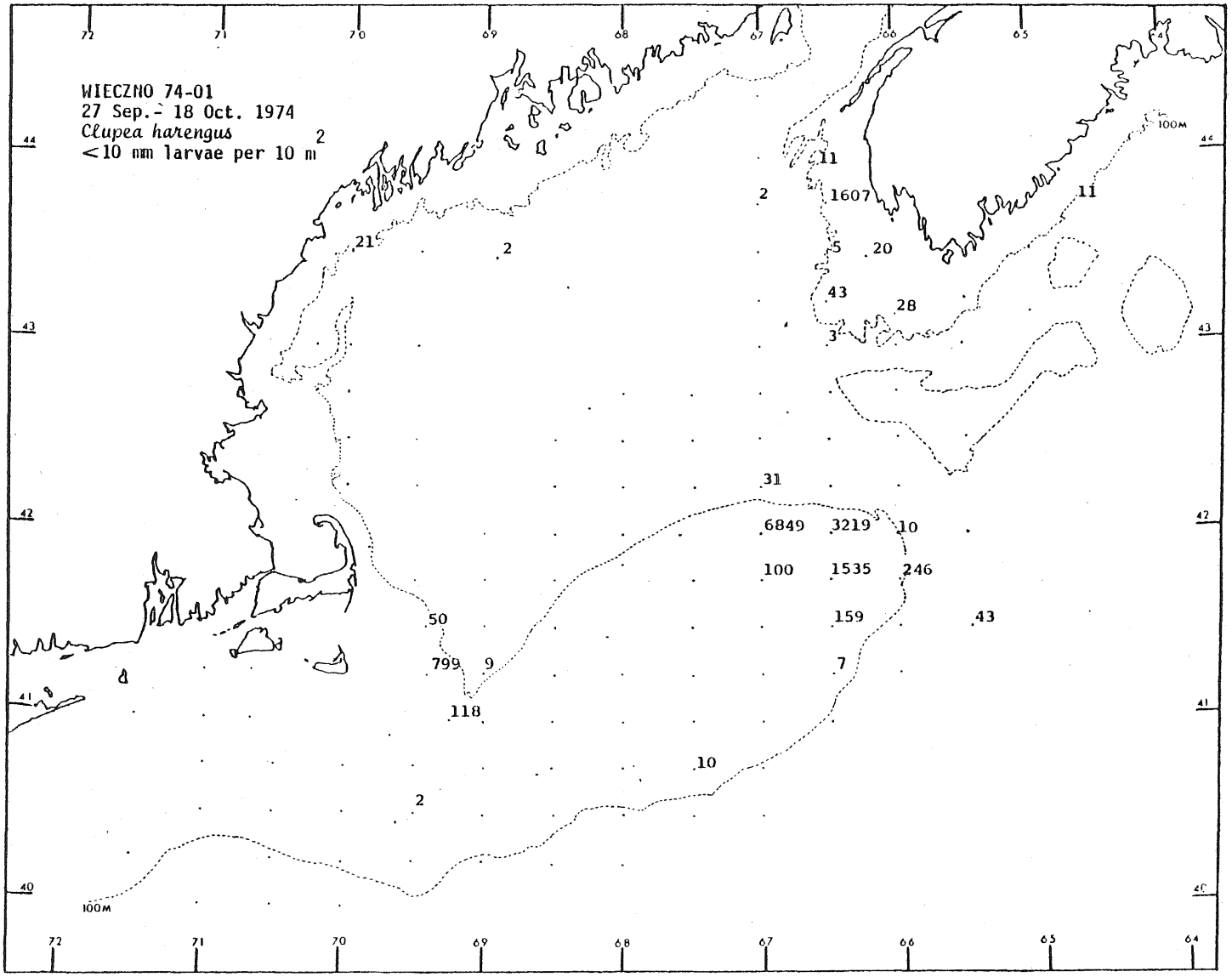

WIECZNO 74-01
27 Sep.- 18 Oct. 1974
Clupea harengus
<10 mm larvae per 10 m2
100M
11
2
1607
11
21
2
5
20
43
28
3
31
6849
3219
10
100
1535
246
50
159
43
799
9
7
118
10
2
100M

Figure 91.

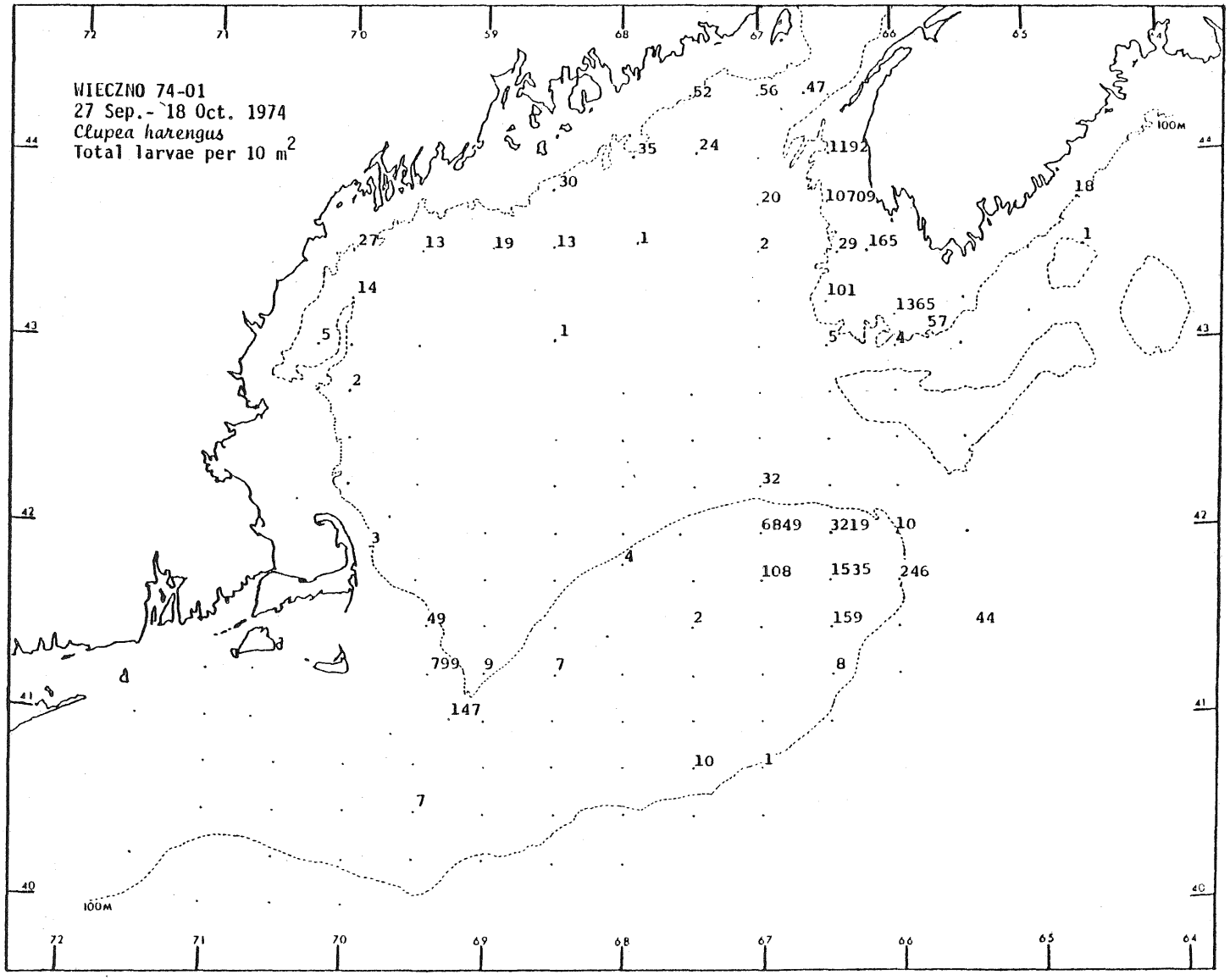

WIECZNO 74-01
27 Sep.- 18 Oct. 1974
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 92.

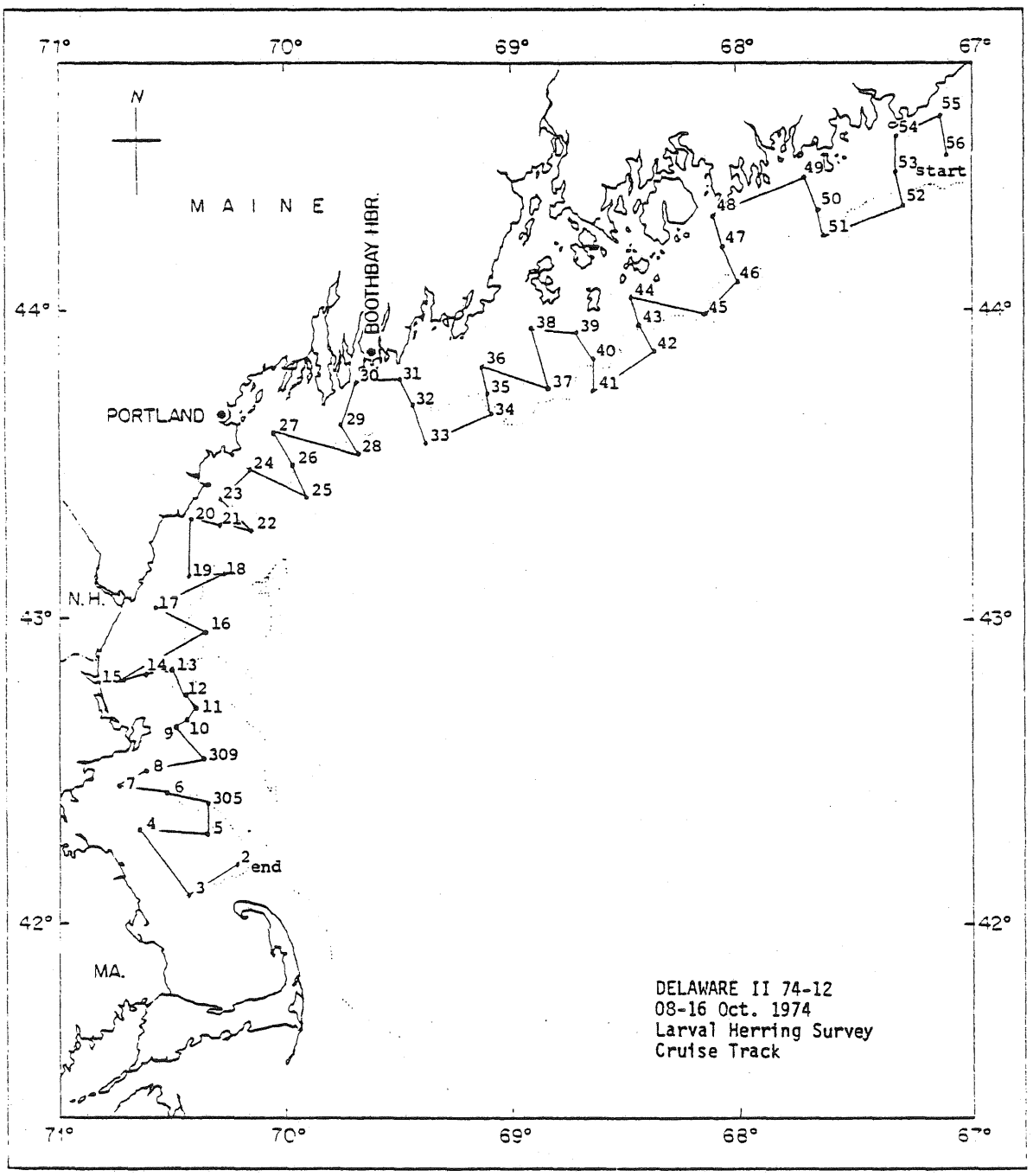

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
start
end
DELAWARE II 74-12
08-16 Oct. 1974
Larval Herring Survey
Cruise Track

Figure 93.

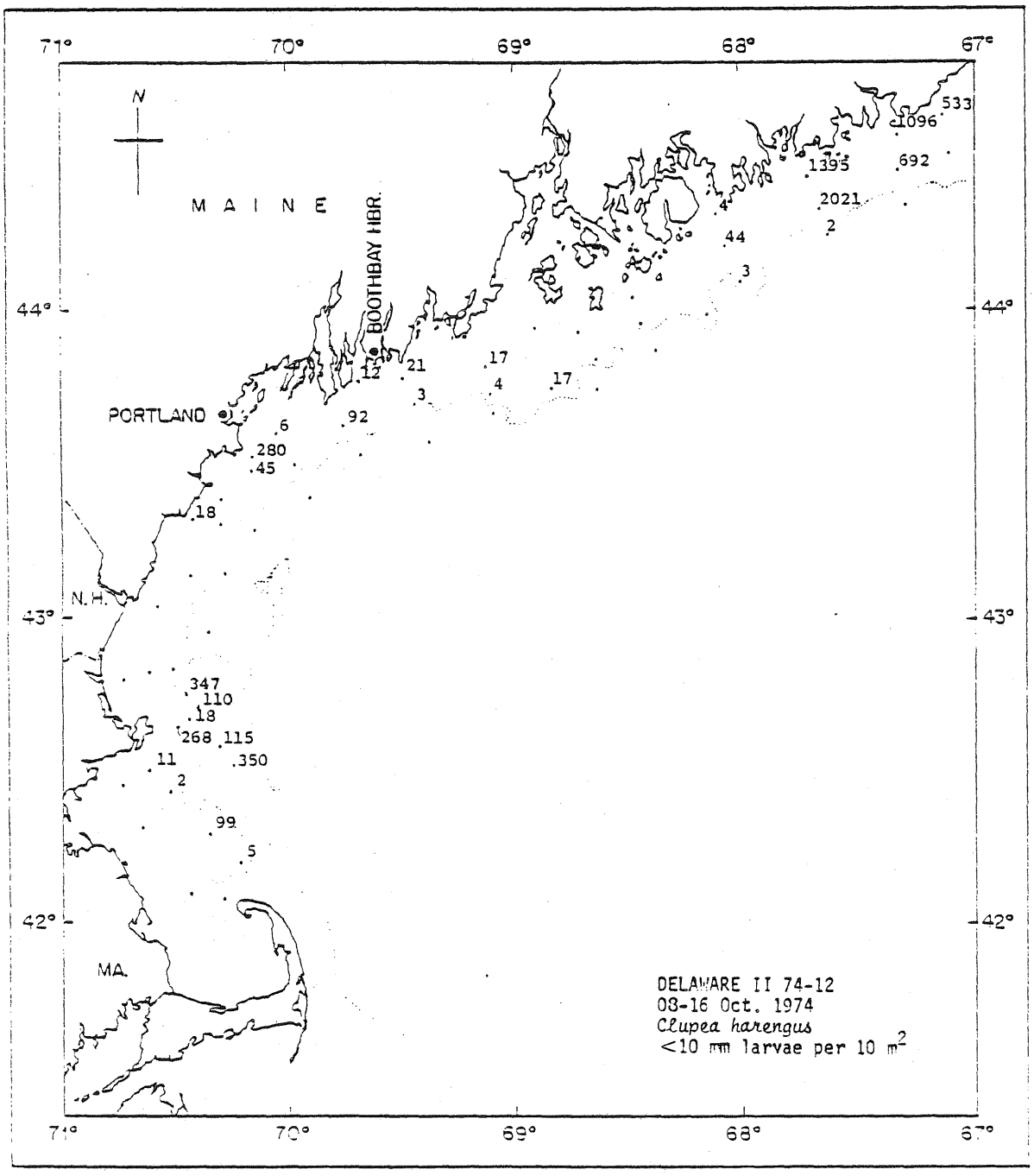

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
533
1096
692
1395
2021
2
4
44
3
17
4
17
21
12
3
6
92
280
45
18
347
110
18
268
115
11
350
2
99
5
DELAWARE II 74-12
08-16 Oct. 1974
Clupea harengus
<10 mm larvae per 10 m²

Figure 94.

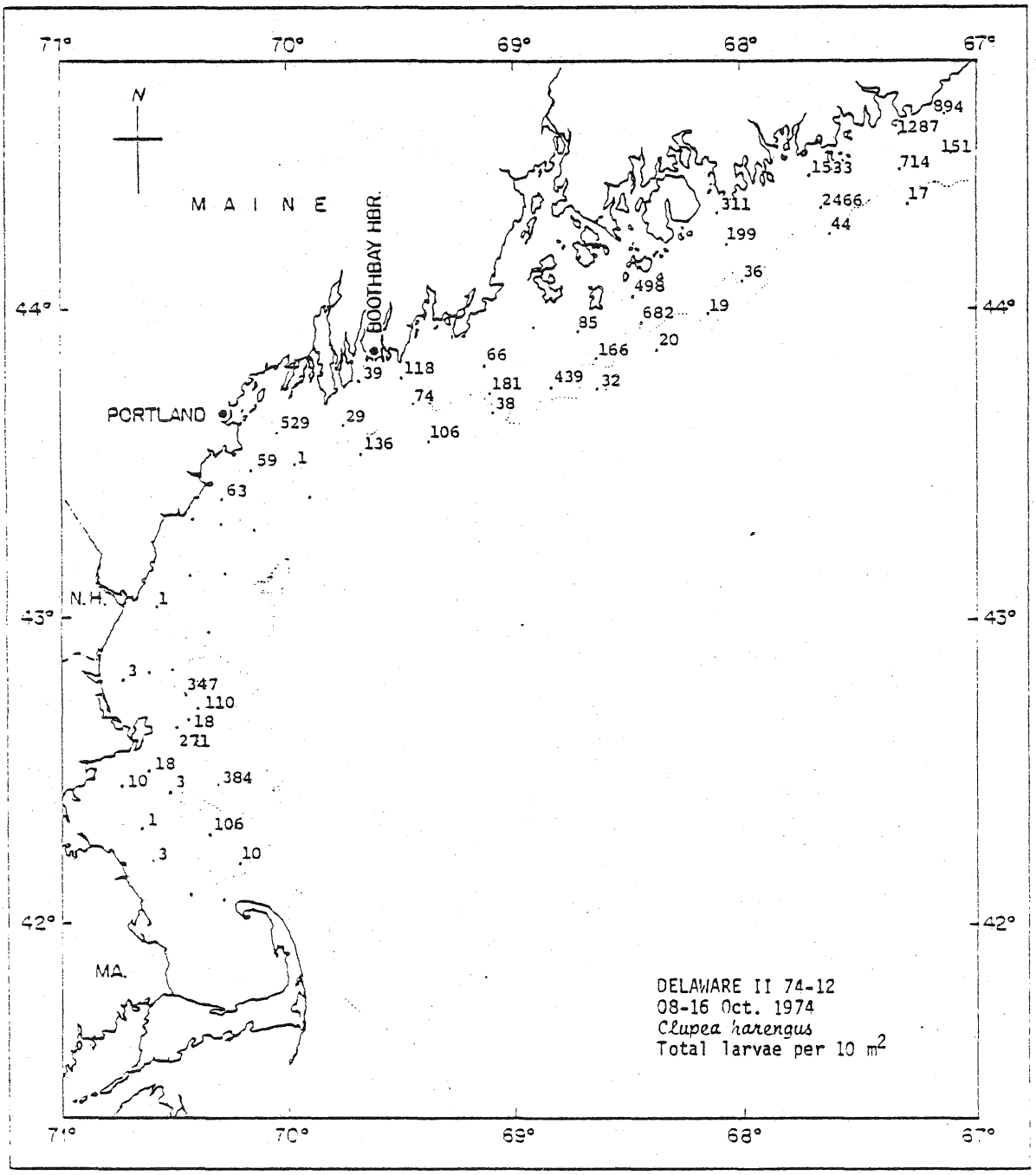

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
894
1287
151
1533
714
17
311
2466
44
199
36
498
682
19
85
20
166
66
439
32
181
38
118
39
74
529
29
106
136
59
1
63
1
3
347
110
18
271
18
10
3
384
1
106
3
10
DELAWARE II 74-12
08-16 Oct. 1974
Clupea harengus
Total larvae per 10 m2

Figure 95.

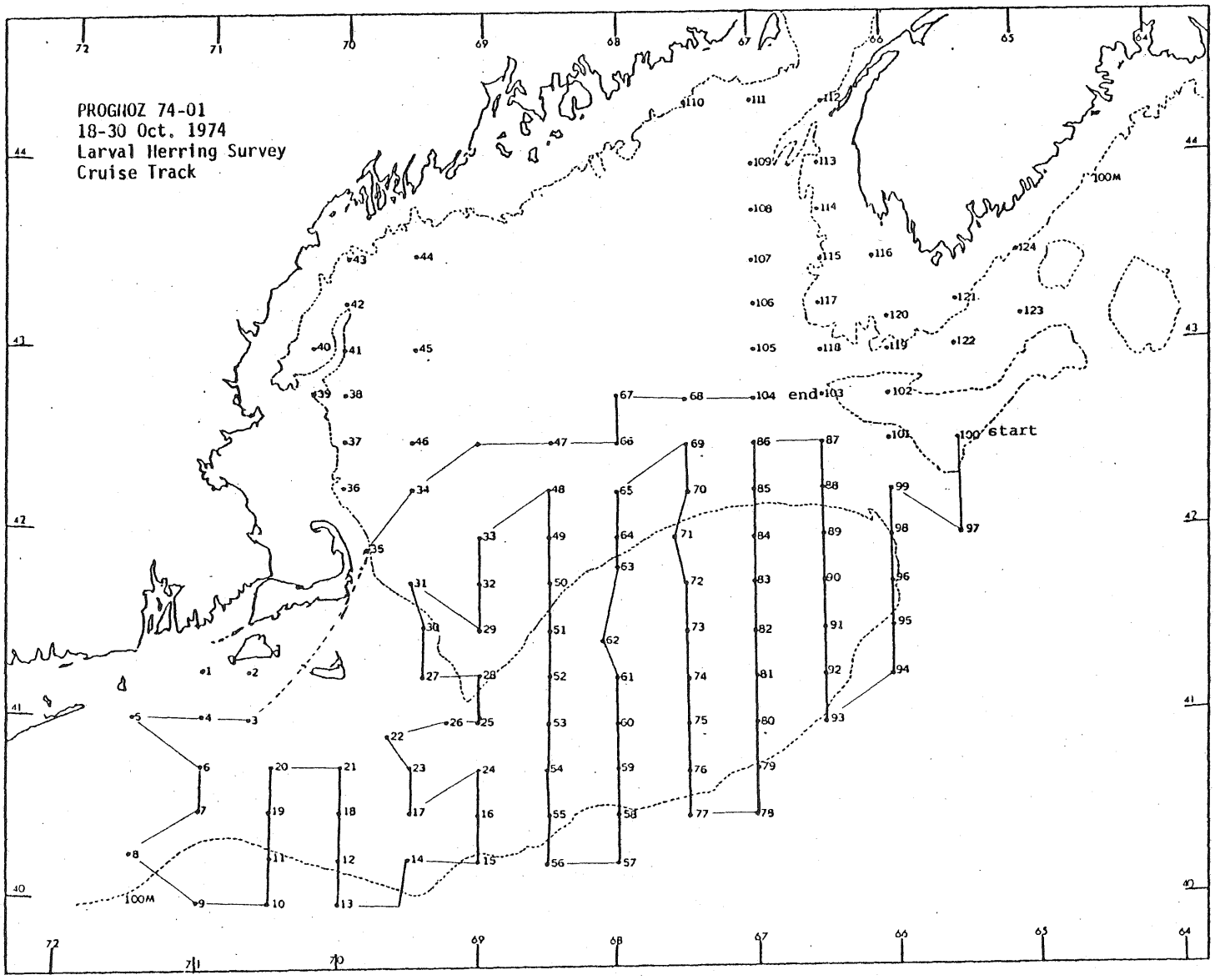

PROGNOZ 74-01
18-30 Oct. 1974
Larval Herring Survey
Cruise Track
start
end
100M

Figure 96.

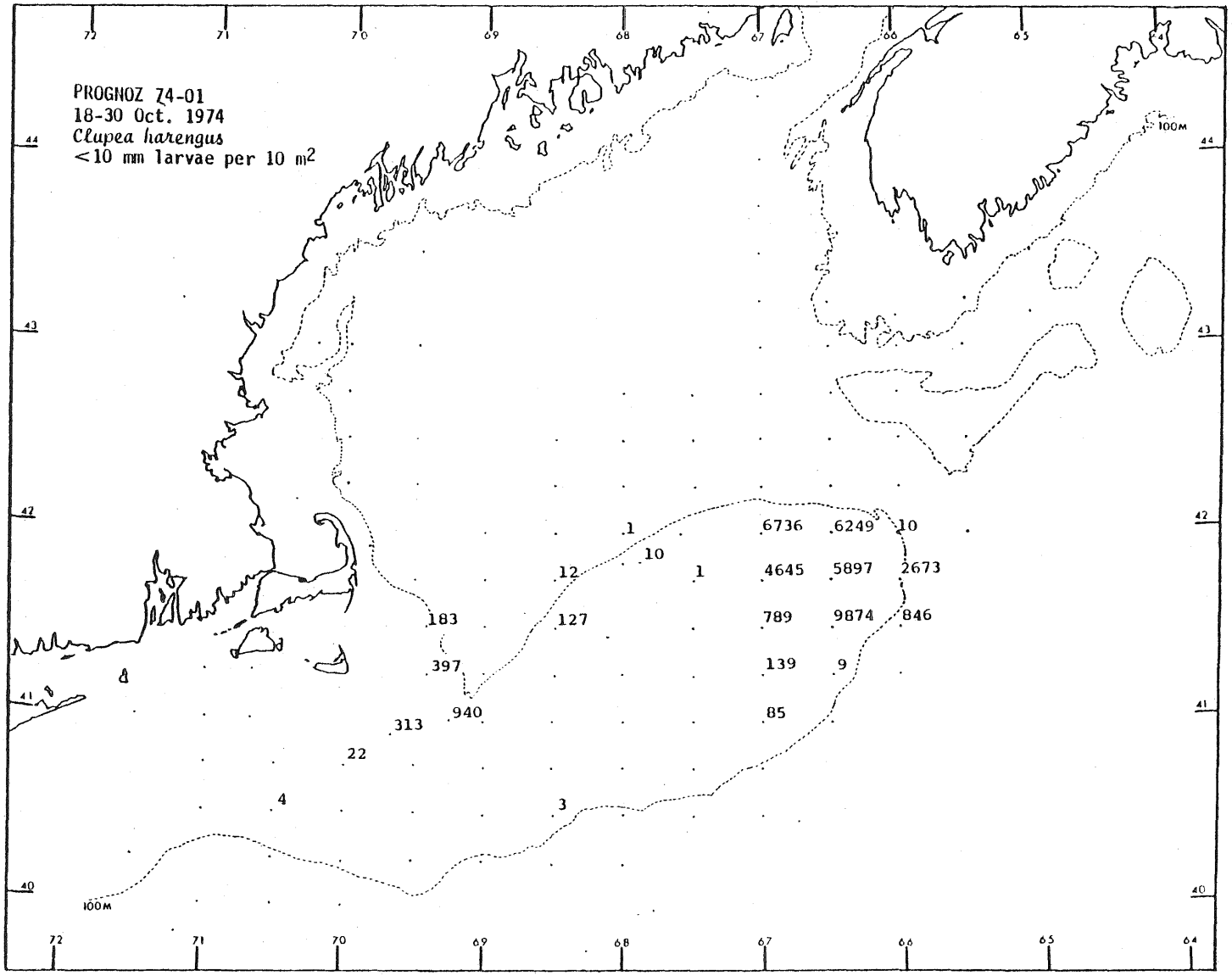

PROGNOZ 74-01
18-30 Oct. 1974
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
1
10
12
1
6736
6249
10
4645
5897
2673
183
127
789
9874
846
397
139
9
940
85
313
22
4
3

Figure 97.

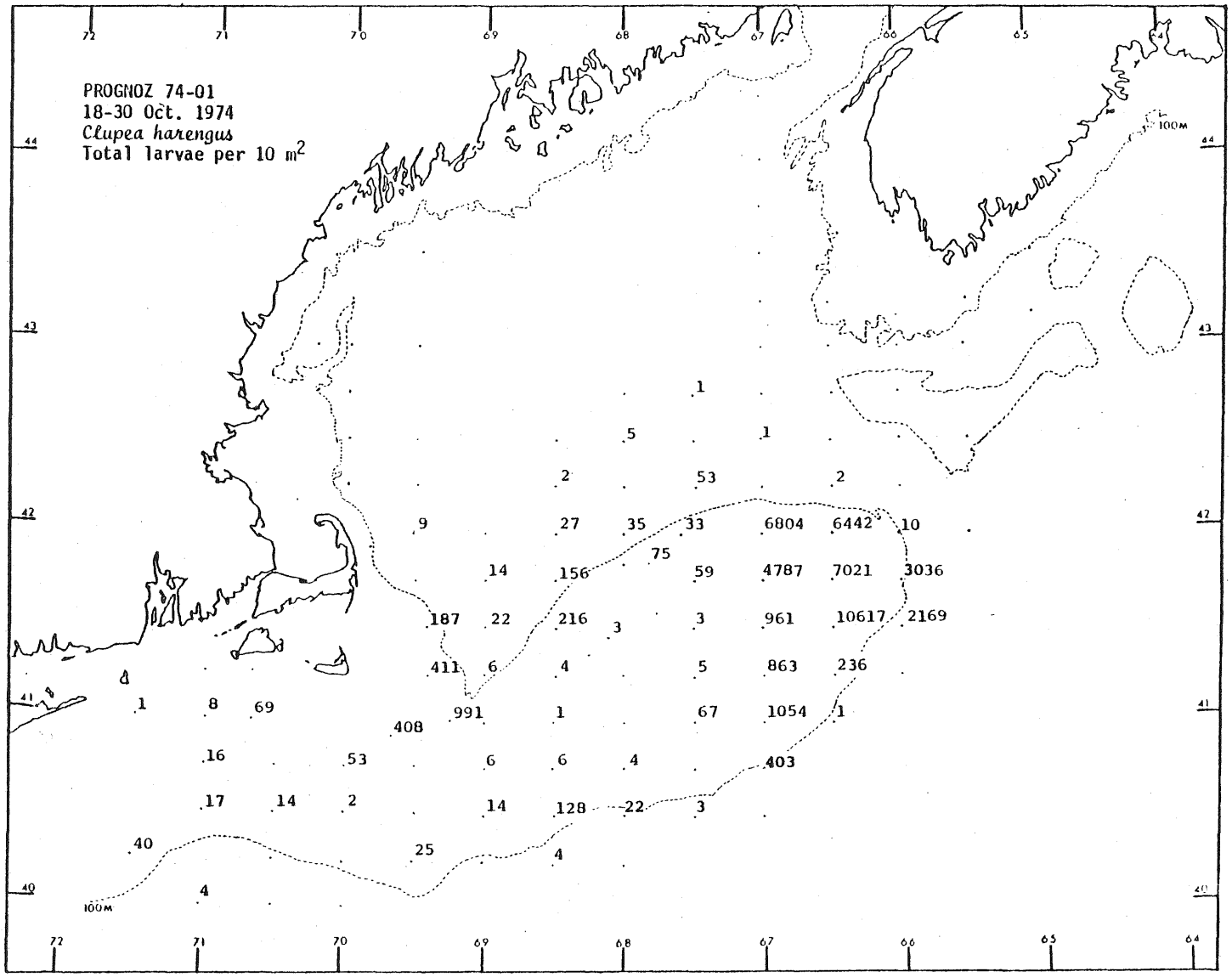

PROGNOZ 74-01
18-30 Oct. 1974
Clupea harengus
Total larvae per 10 m2
100M
1
5
1
2
53
2
9
27
35
33
6804
6442
10
75
14
156
59
4787
7021
3036
187
22
216
3
3
961
10617
2169
411
6
4
5
863
236
1
8
69
991
1
67
1054
1
408
16
53
6
6
4
403
17
14
2
14
128
22
3
40
25
4
4
100M

Figure 98.

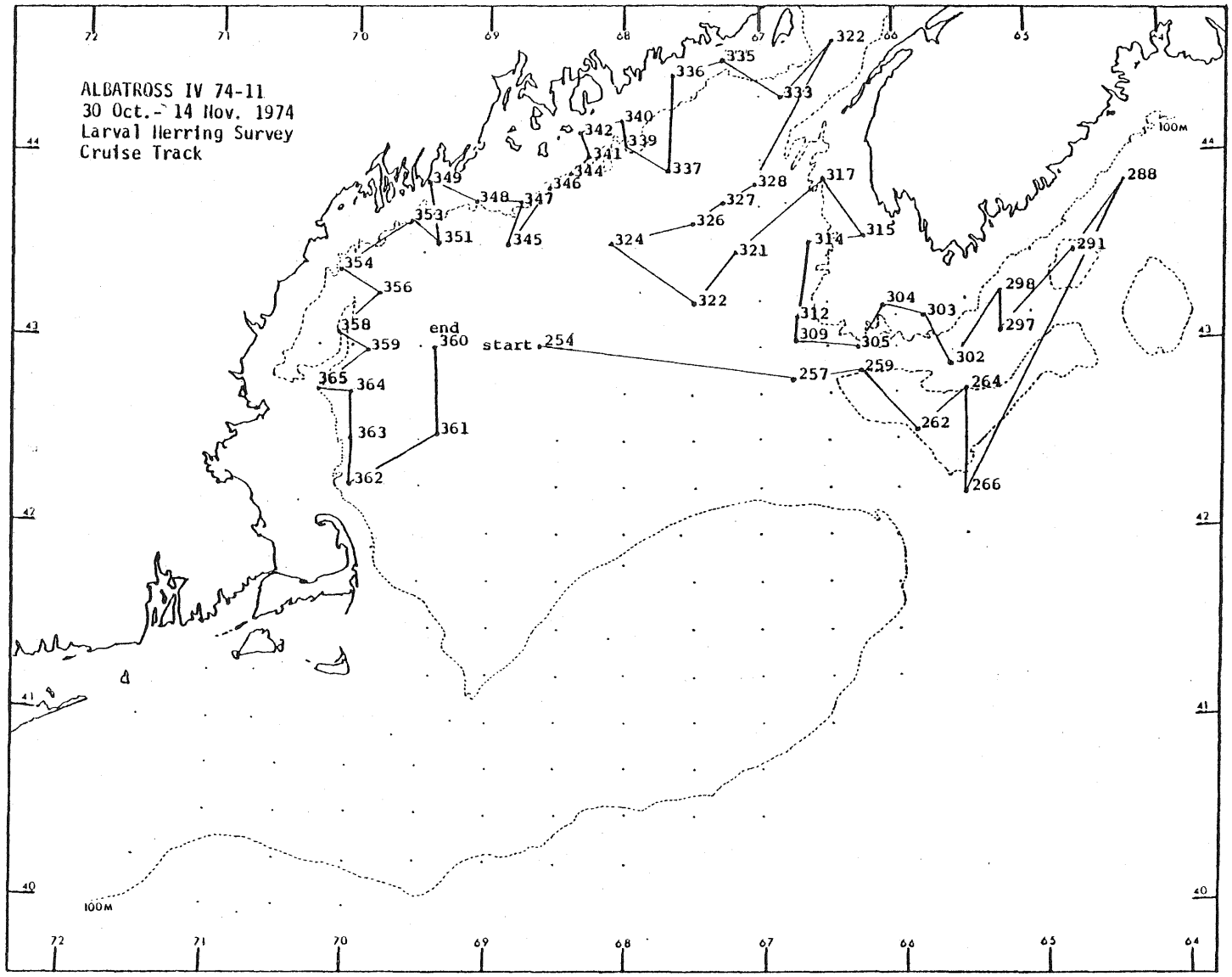

ALBATROSS IV 74-11
30 Oct.- 14 Nov. 1974
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 99.

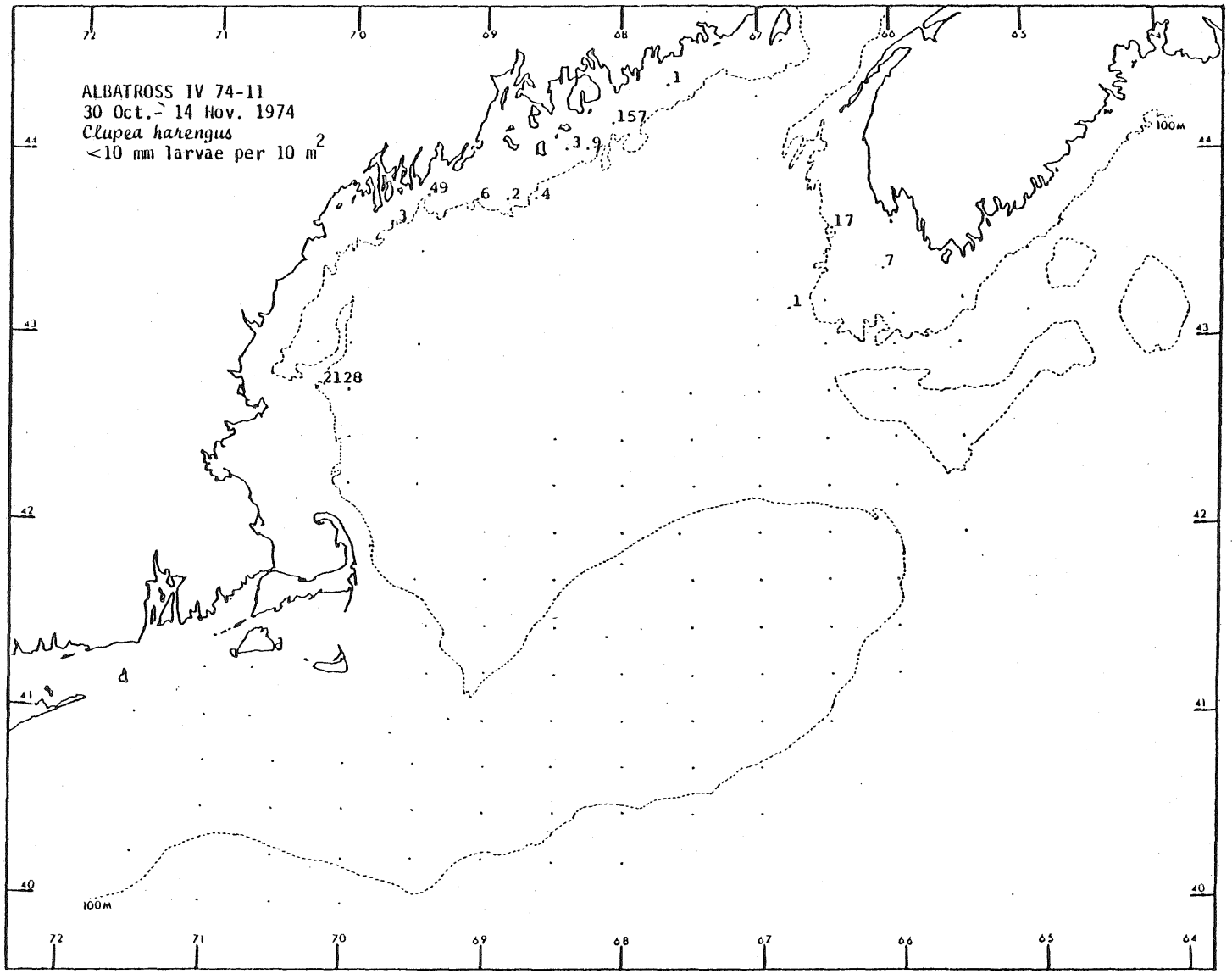

ALBATROSS IV 74-11
30 Oct.- 14 Nov. 1974
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
1
157
3
9
49
6
2
4
3
17
7
1
2128

Figure 100.

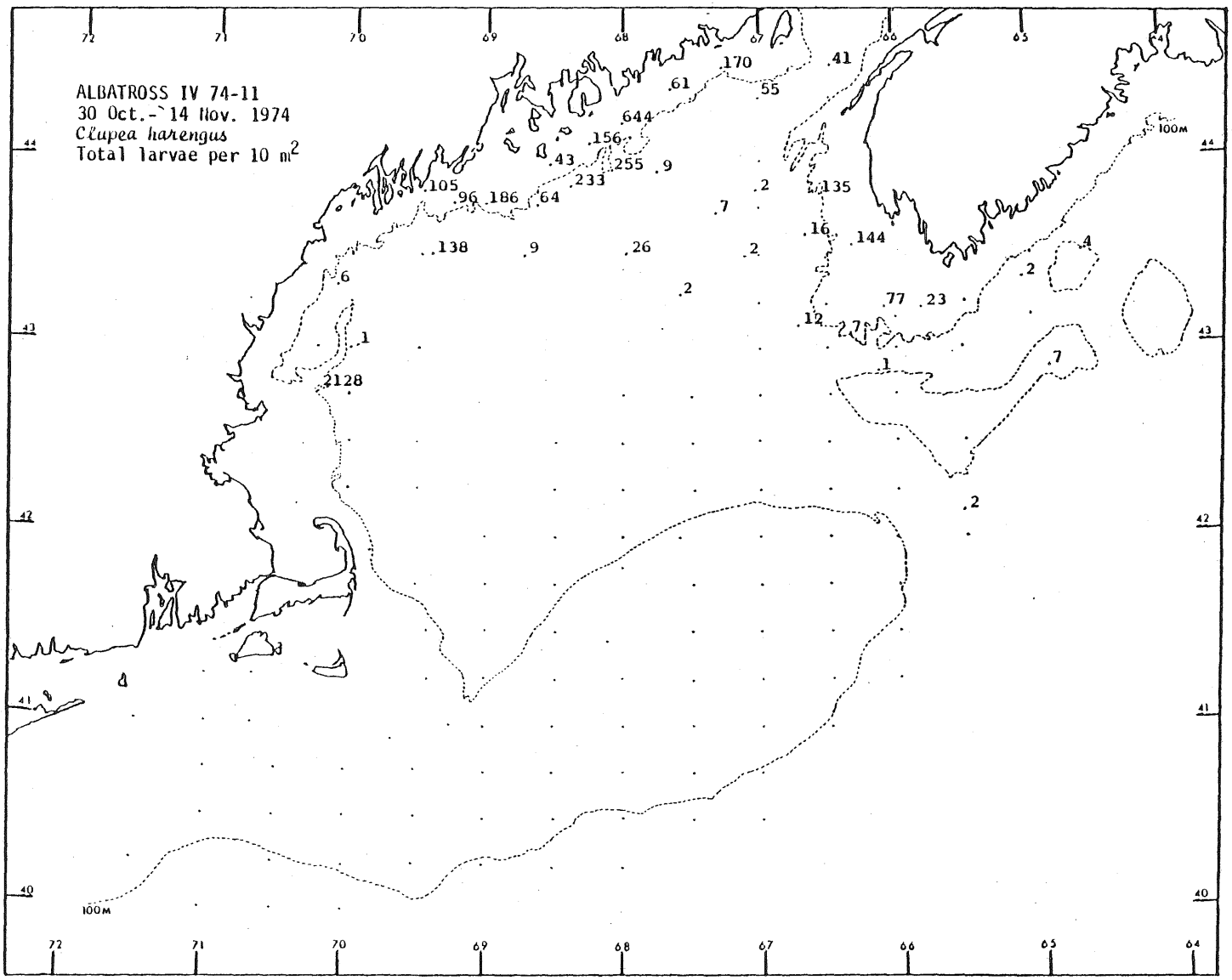

ALBATROSS IV 74-11
30 Oct.-14 Nov. 1974
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 101.

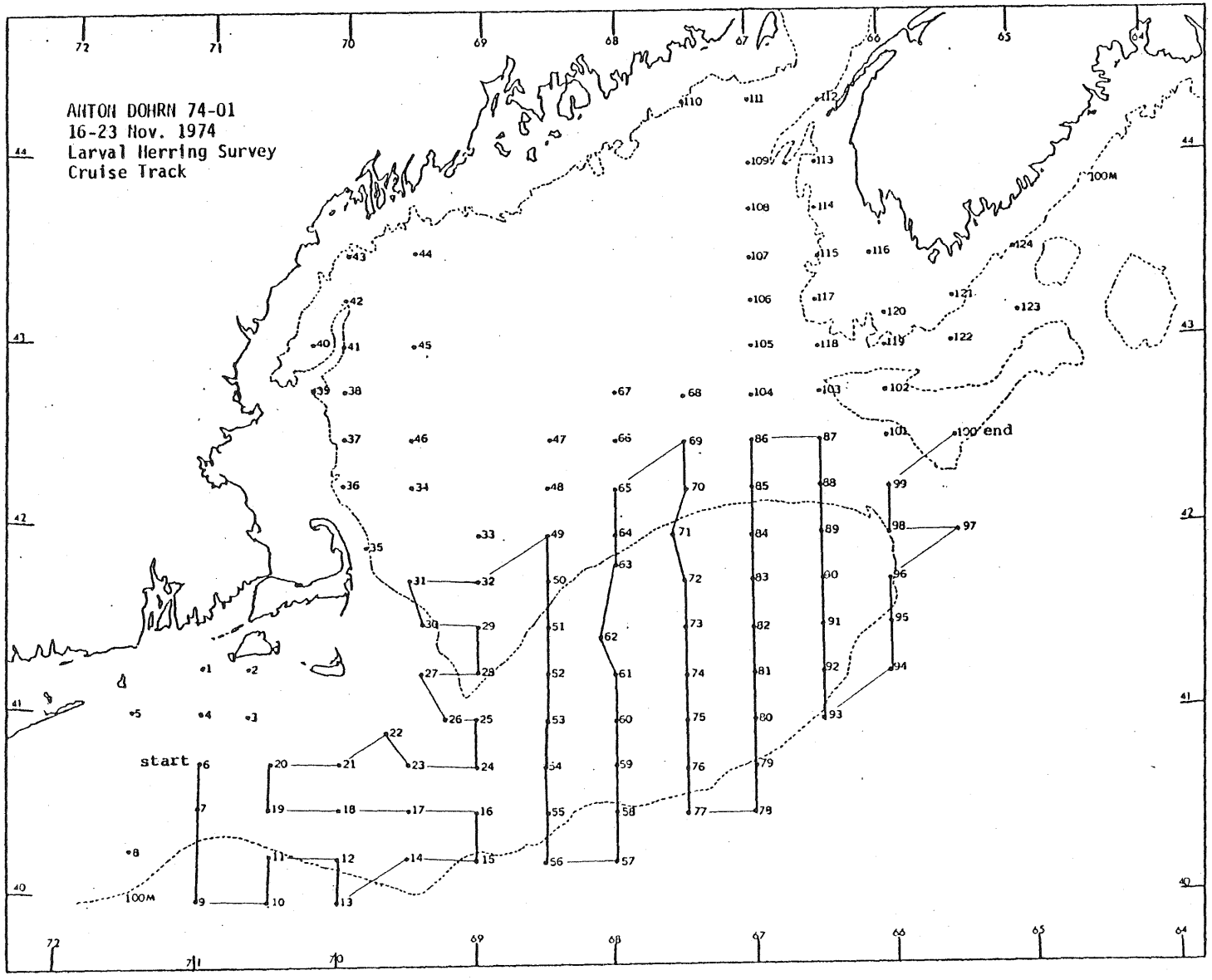

ANTON DOHRN 74-01
16-23 Nov. 1974
Larval Herring Survey
Cruise Track
start
end
100M

Figure 102.

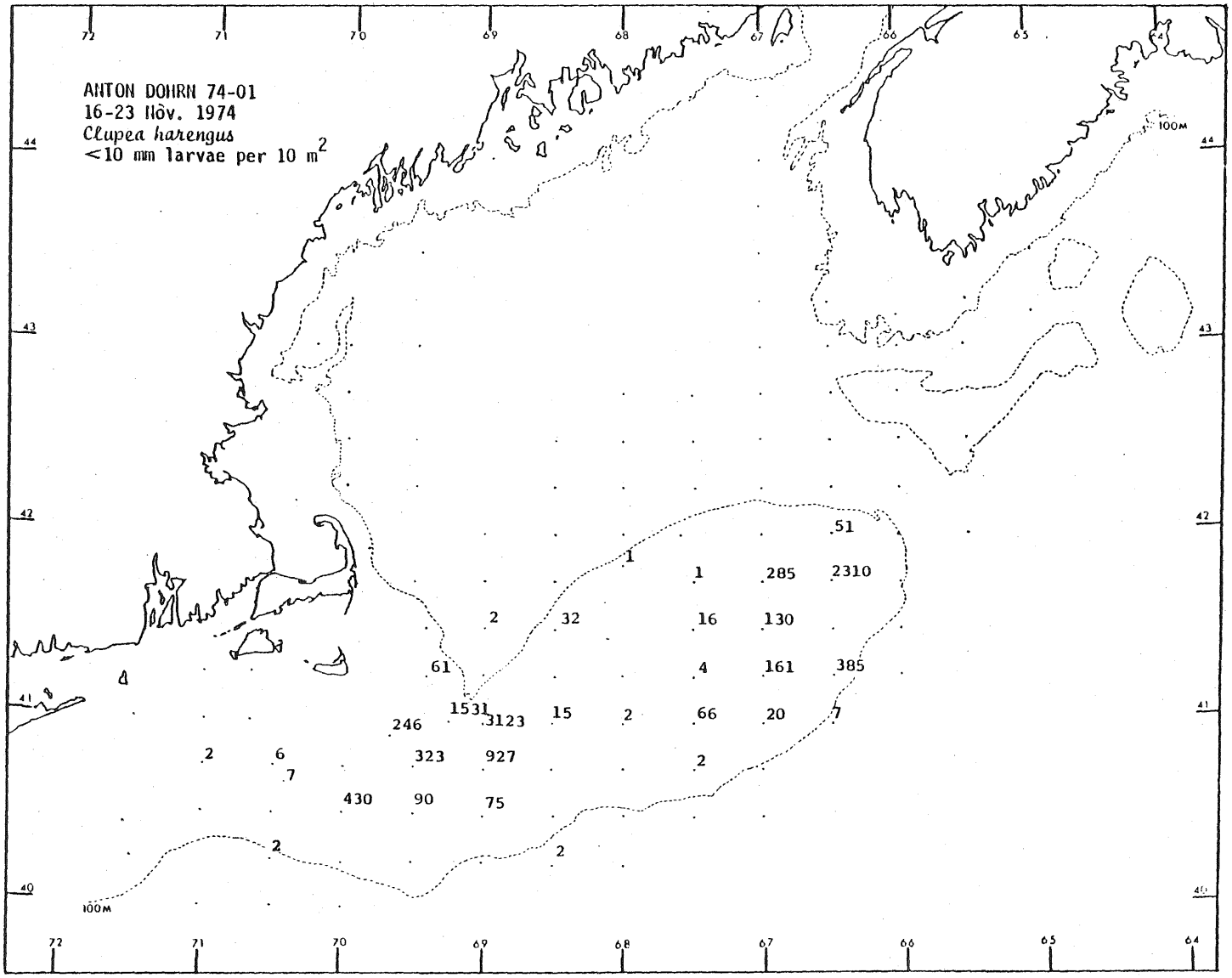

ANTON DOHRN 74-01
16-23 Nov. 1974
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
51
1
1
285
2310
2
32
16
130
61
4
161
385
1531
3123
15
2
66
20
7
246
2
6
323
927
2
7
430
90
75
2
2

Figure 103.

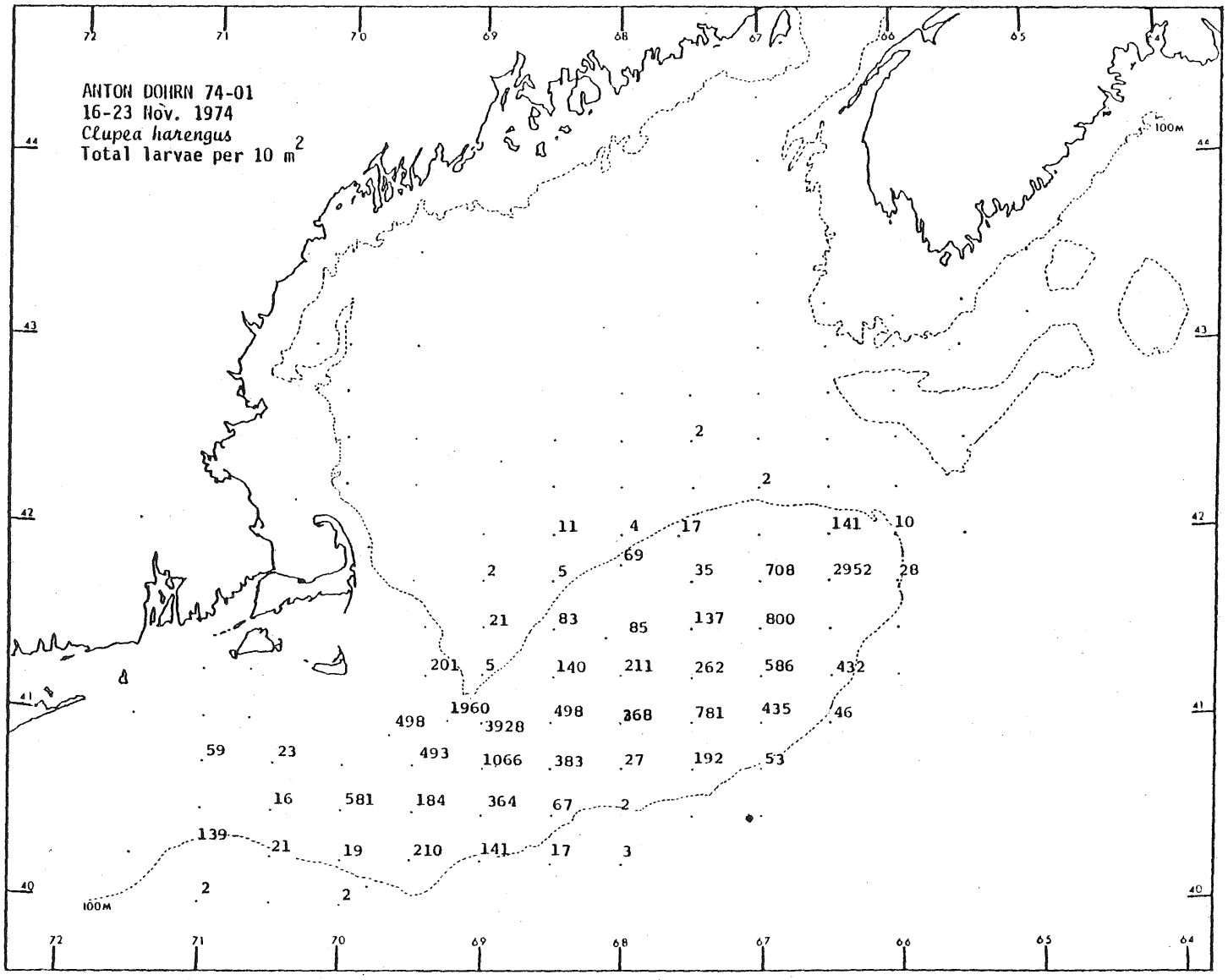

ANTON DOHRN 74-01
16-23 Nov. 1974
Clupea harengus
Total larvae per 10 m2
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
2
2
11
4
17
141
10
69
2
5
35
708
2952
28
21
83
85
137
800
201
5
140
211
262
586
432
1960
498
368
781
435
46
498
3928
59
23
493
1066
383
27
192
53
16
581
184
364
67
2
139
21
19
210
141
17
3
2
2

Figure 104.

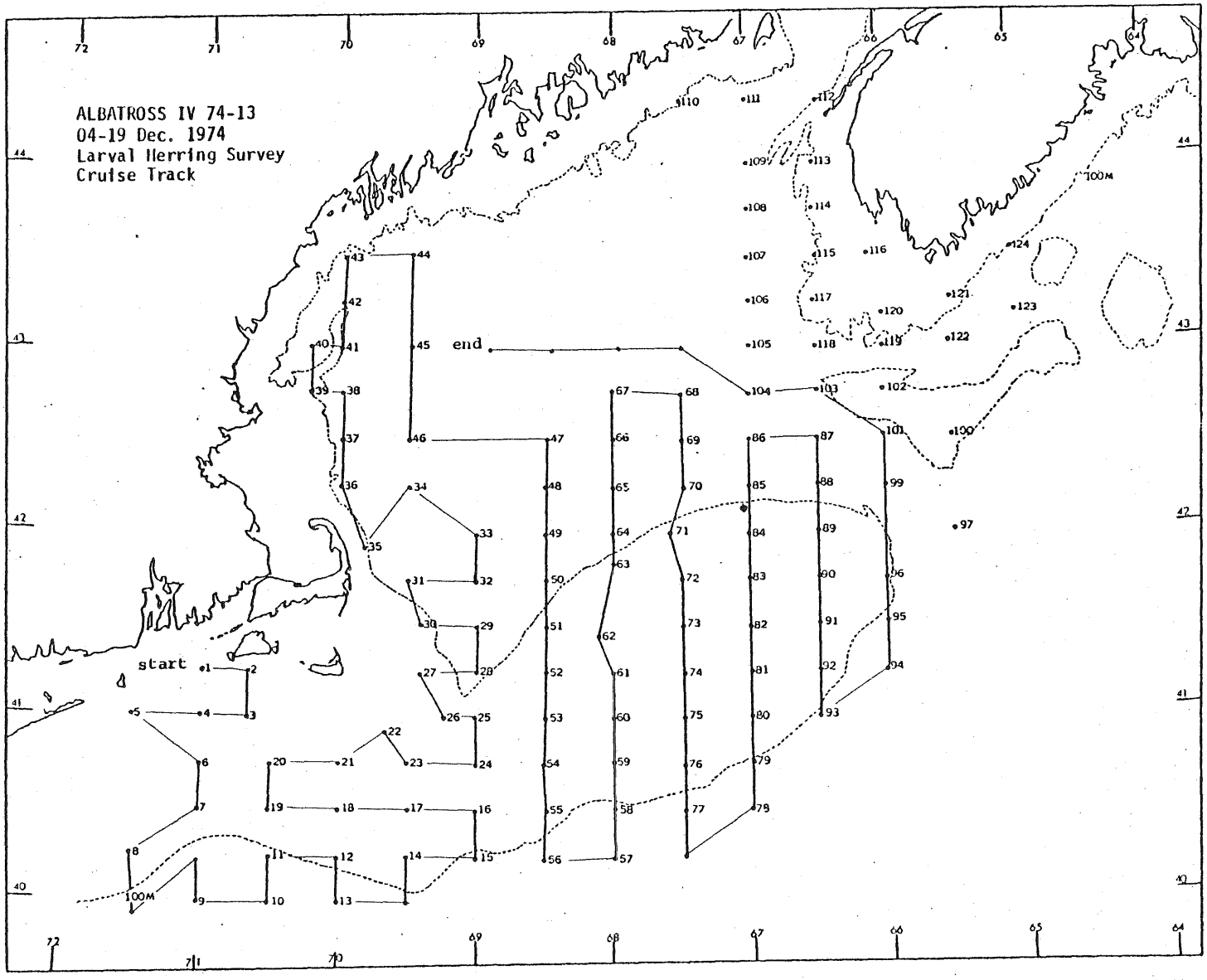

ALBATROSS IV 74-13
04-19 Dec. 1974
Larval Herring Survey
Cruise Track
start
end
100M

Figure 105.

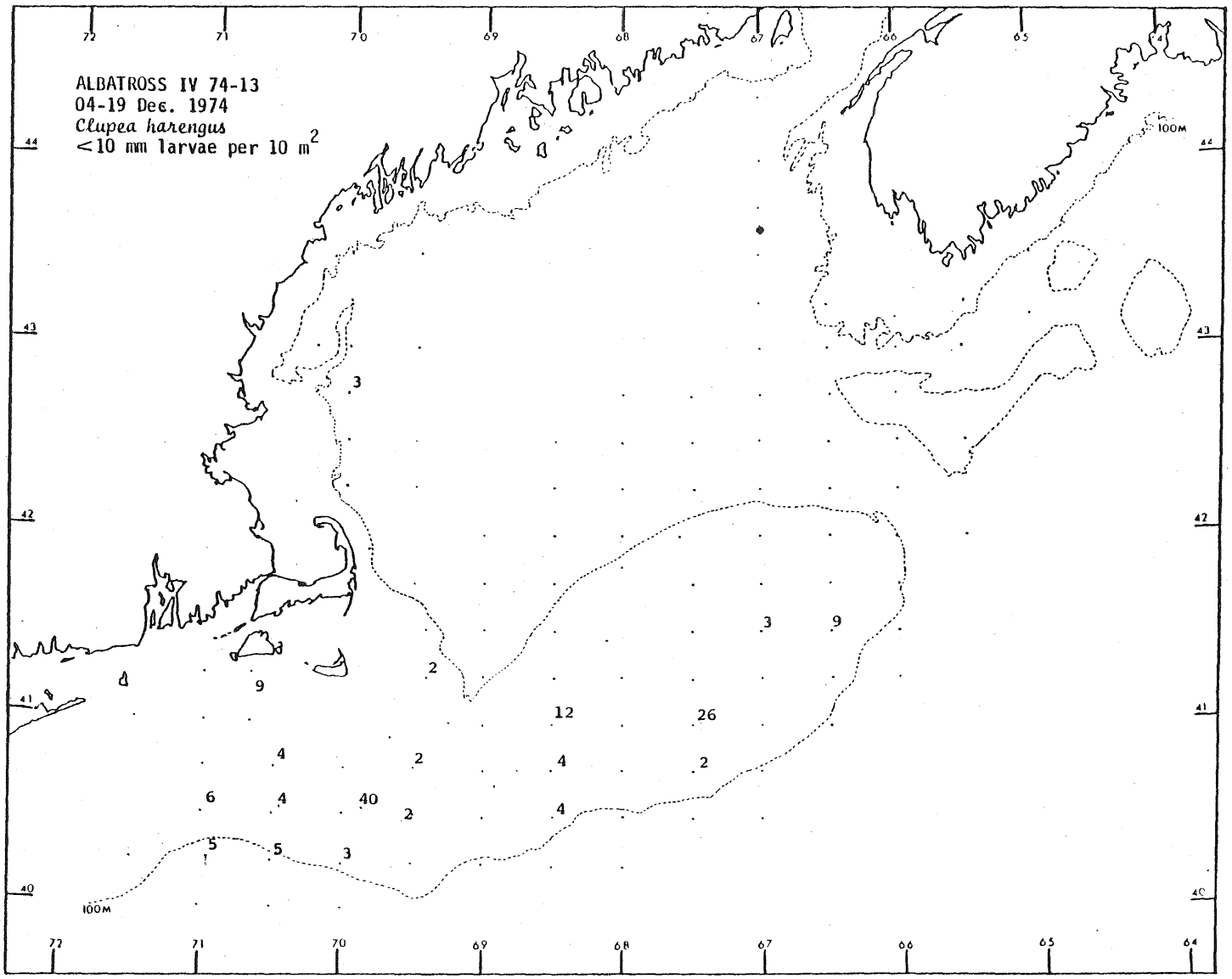

ALBATROSS IV 74-13
04-19 Dec. 1974
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
3
9
2
12
26
3
9
4
2
4
2
6
4
40
2
4
5
5
3

Figure 106.

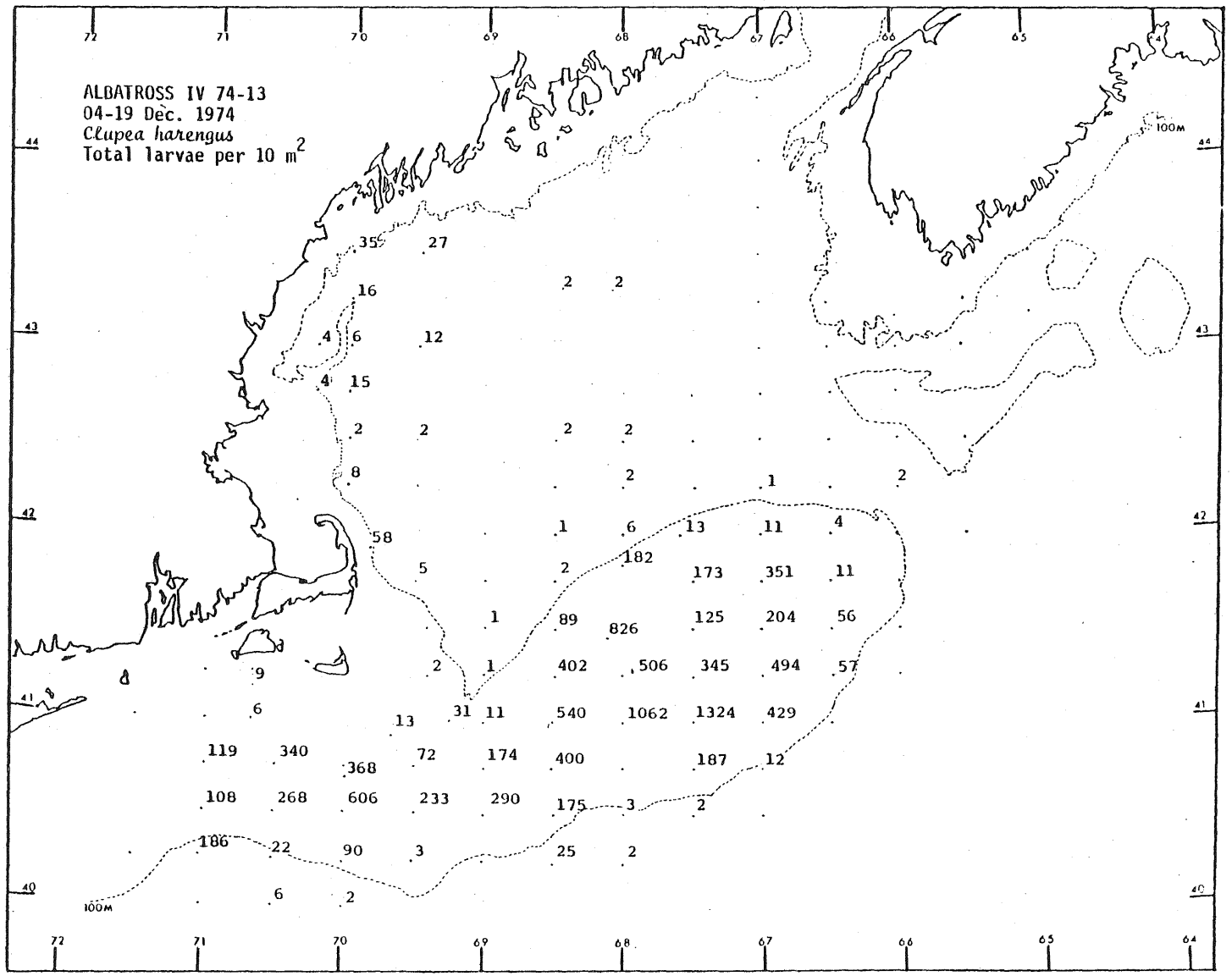

ALBATROSS IV 74-13
04-19 Dec. 1974
Clupea harengus
Total larvae per 10 m2
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 107.

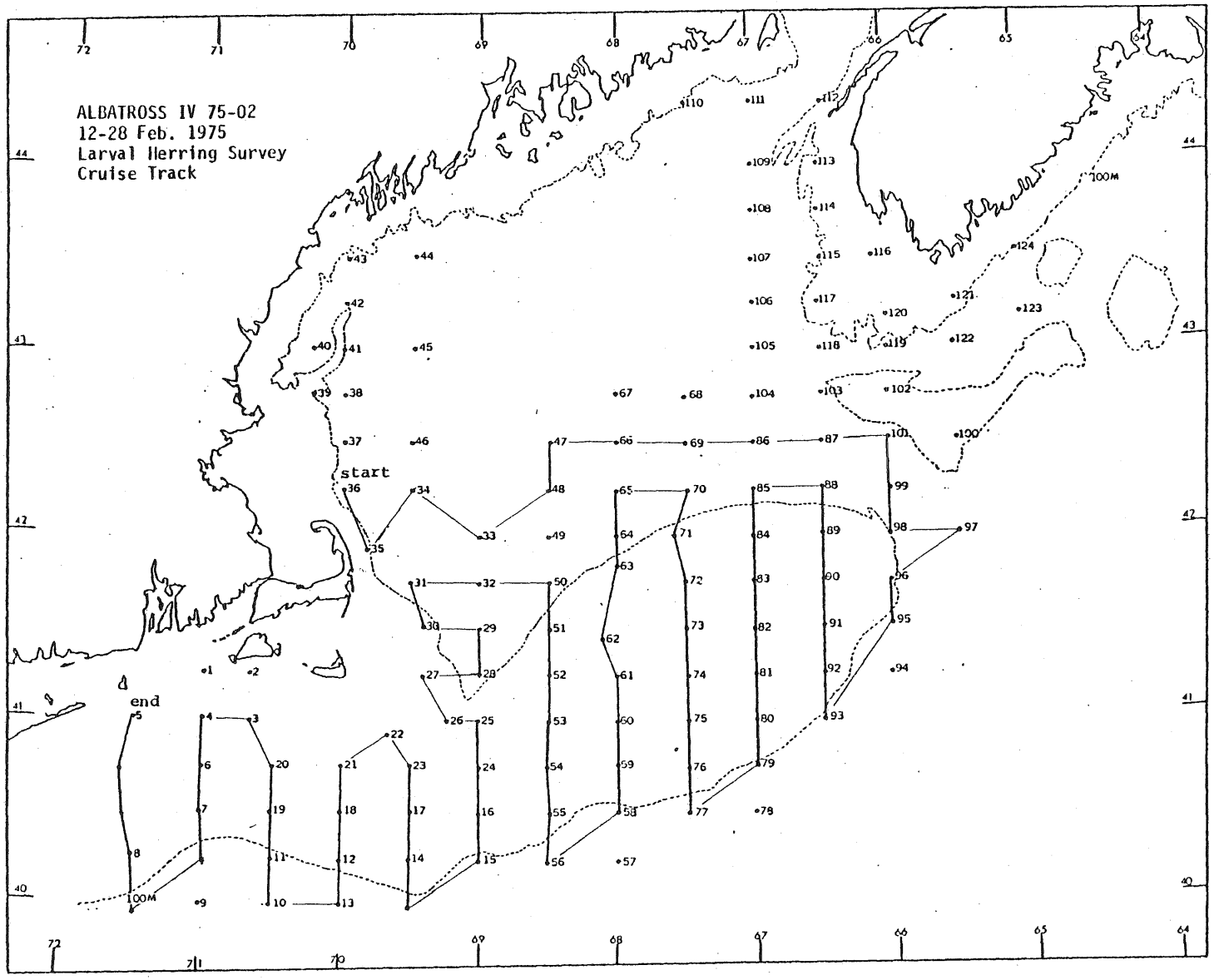

ALBATROSS IV 75-02
12-28 Feb. 1975
Larval Herring Survey
Cruise Track
start
end
100M

Figure 108.

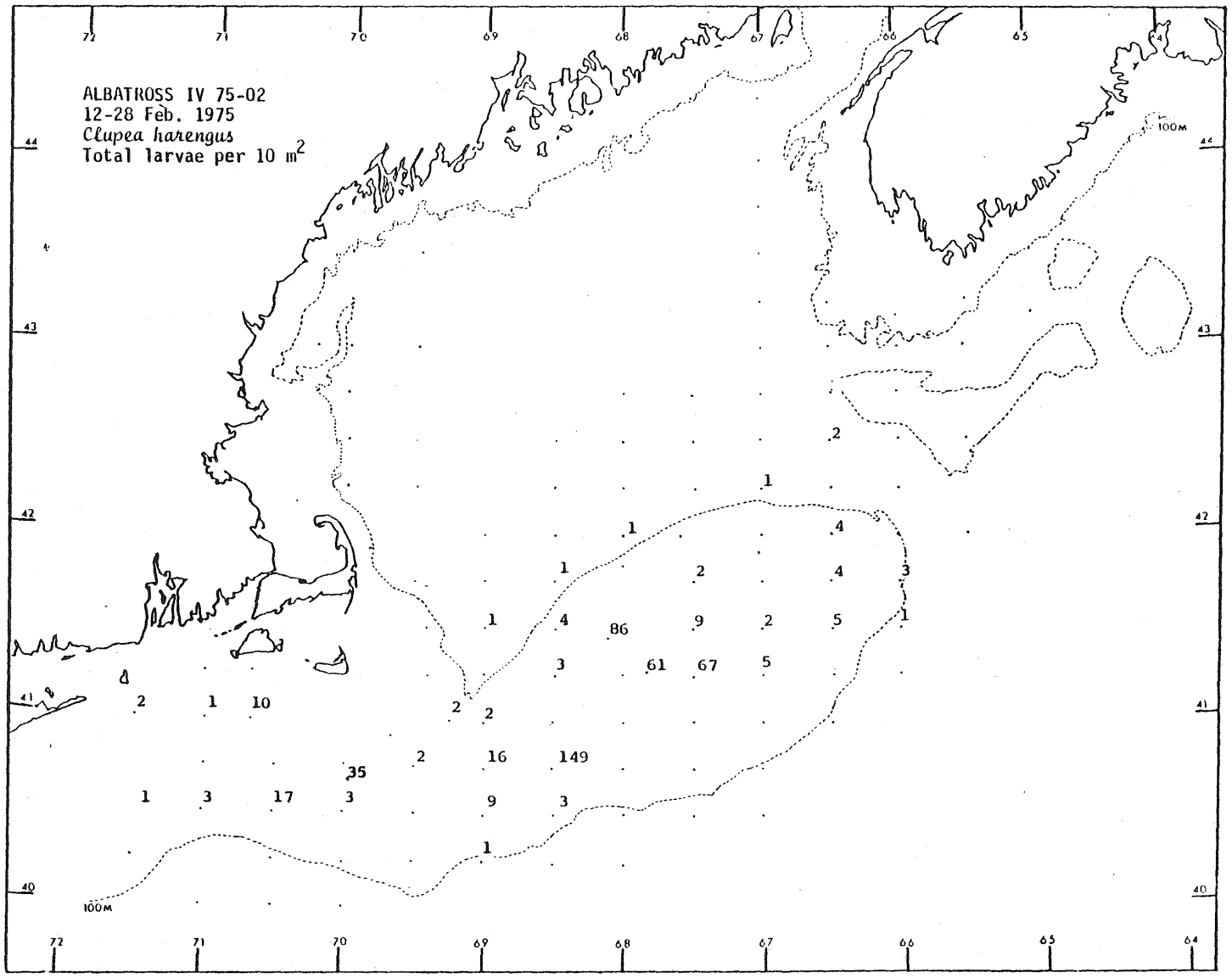

ALBATROSS IV 75-02
12-28 Feb. 1975
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 109.

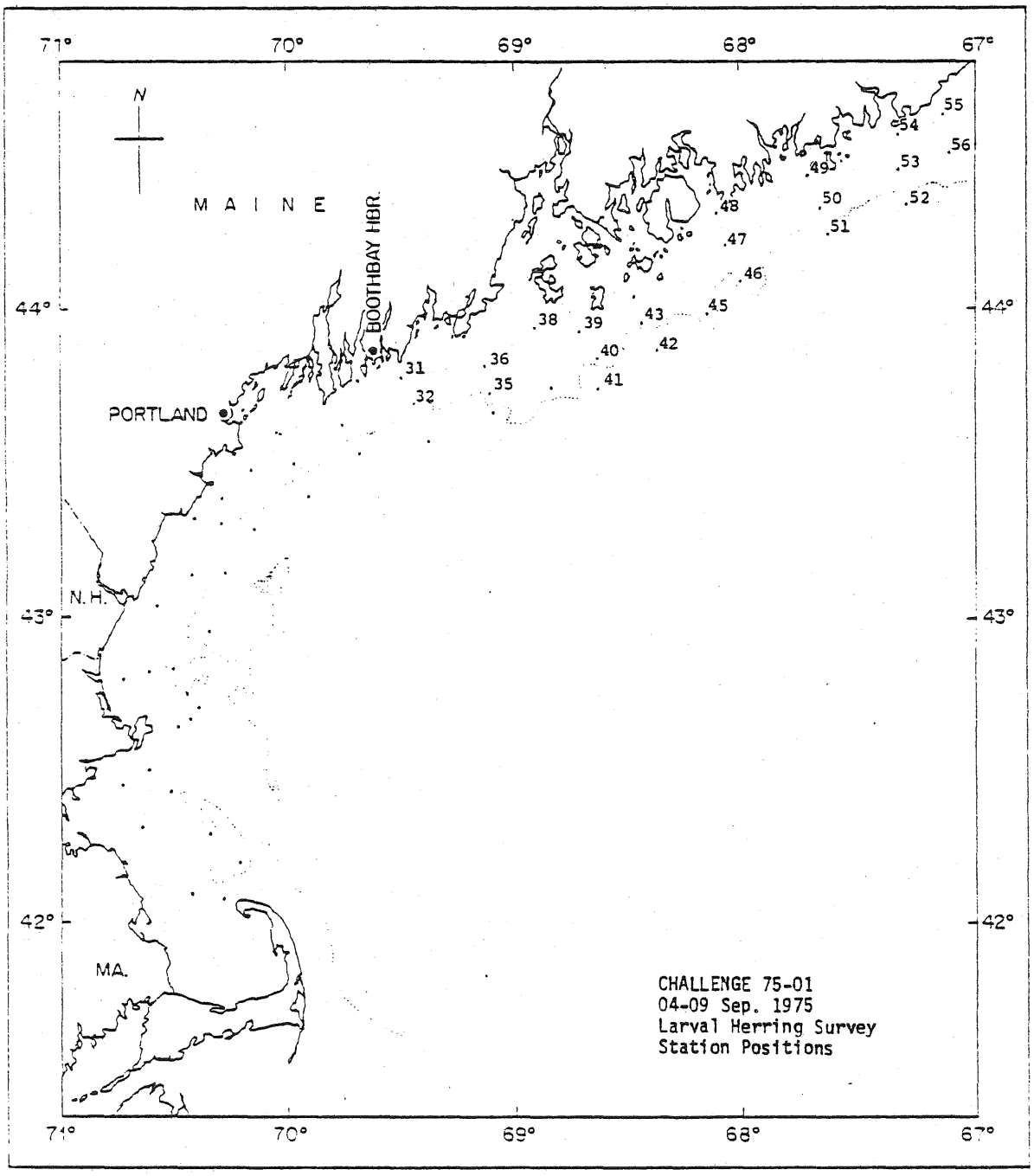

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
31
32
35
36
38
39
40
41
42
43
45
46
47
48
49
50
51
52
53
54
55
56
CHALLENGE 75-01
04-09 Sep. 1975
Larval Herring Survey
Station Positions

Figure 110.

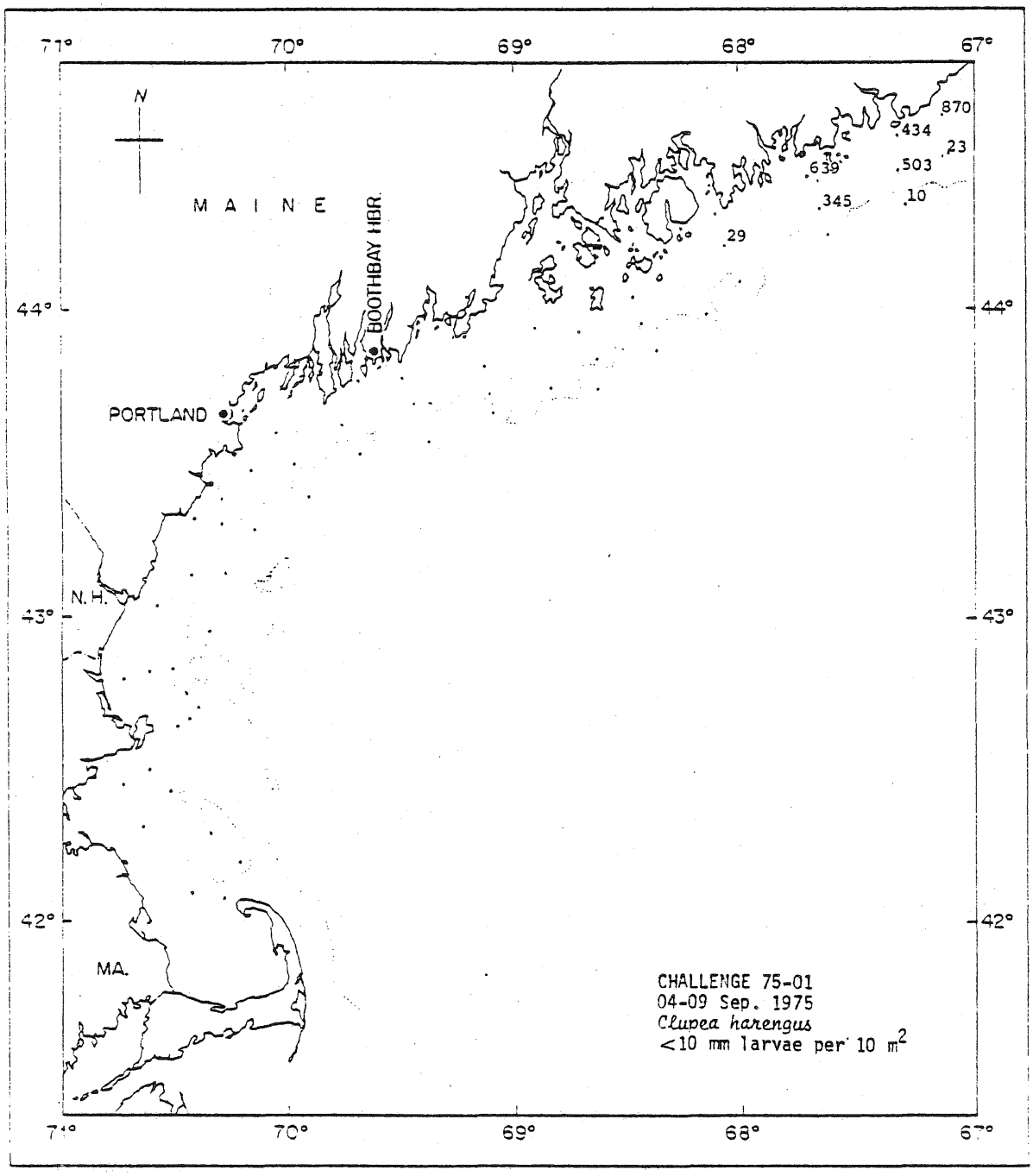

71°
70°
69°
68°
67°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
44°
43°
42°
.870
.434
.23
.639
.503
.345
.10
.29
CHALLENGE 75-01
04-09 Sep. 1975
Clupea harengus
<10 mm larvae per 10 m2

Figure 111.

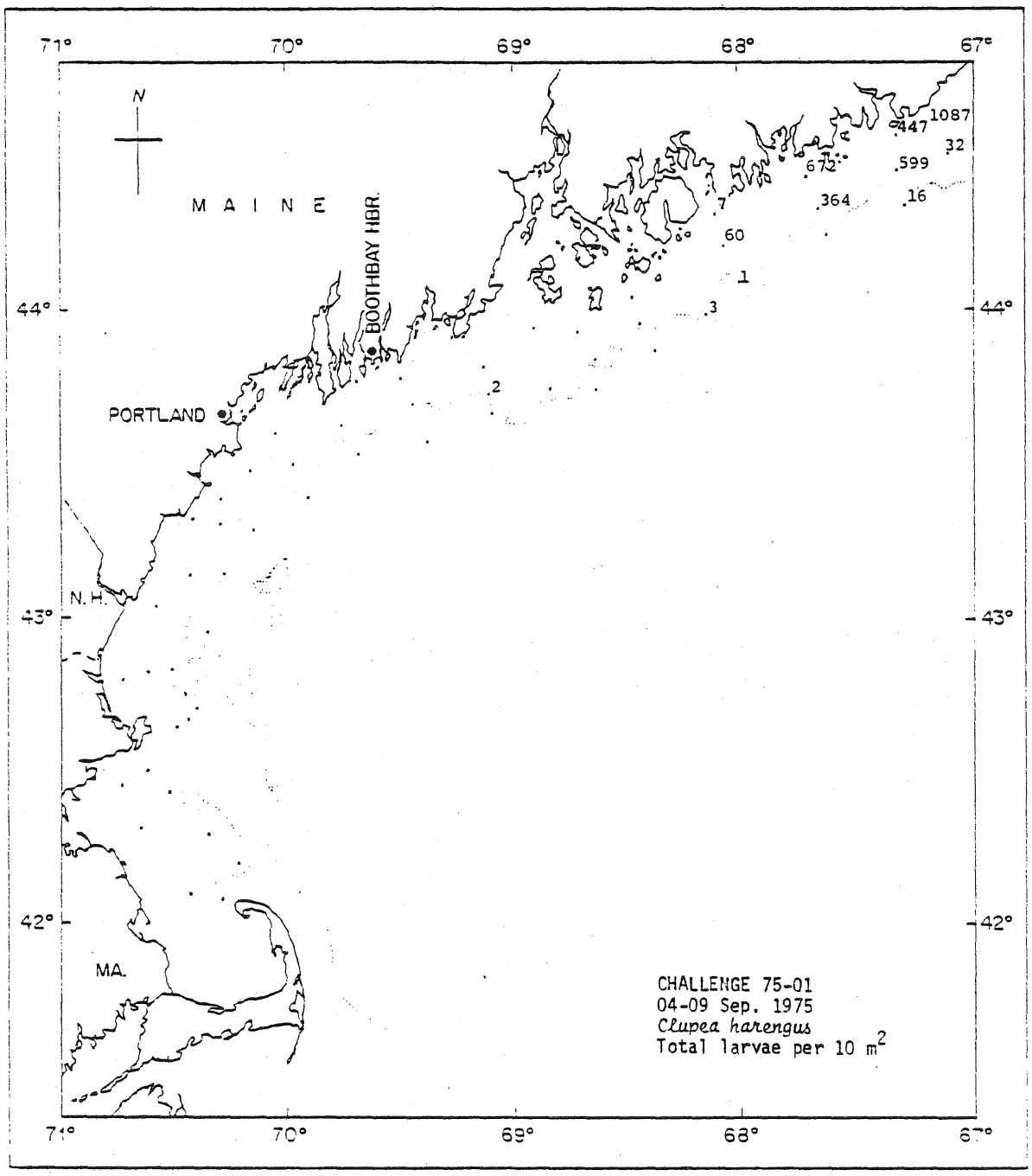

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
1087
447
32
599
672
16
364
7
60
1
3
2
CHALLENGE 75-01
04-09 Sep. 1975
Clupea harengus
Total larvae per 10 m2

Figure 112.

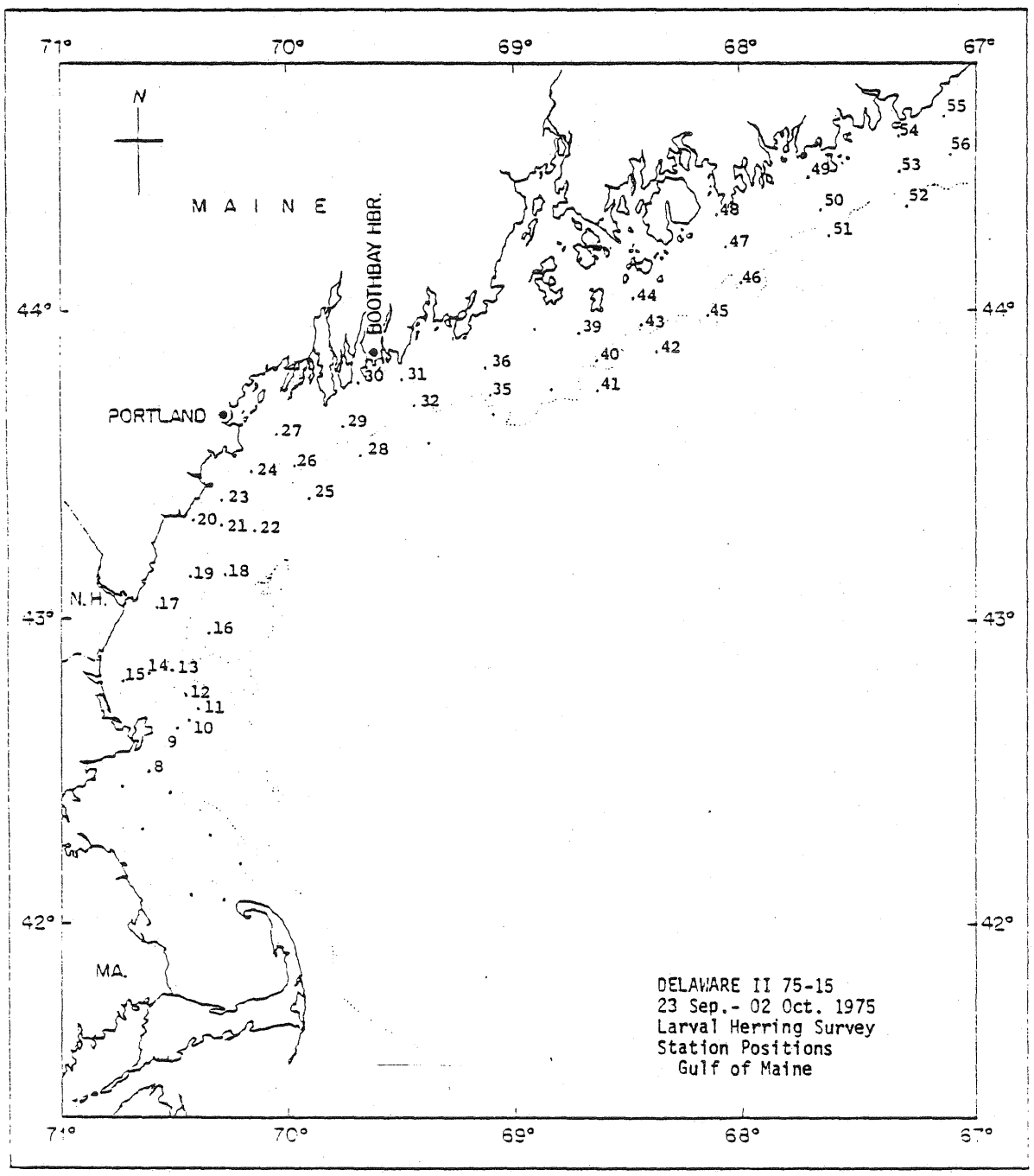

71°
70°
69°
68°
67°
44°
43°
42°
N
MAINE
BOOTHBAY HBR.
PORTLAND
N.H.
MA.
DELAWARE II 75-15
23 Sep.- 02 Oct. 1975
Larval Herring Survey
Station Positions
Gulf of Maine

Figure 113.

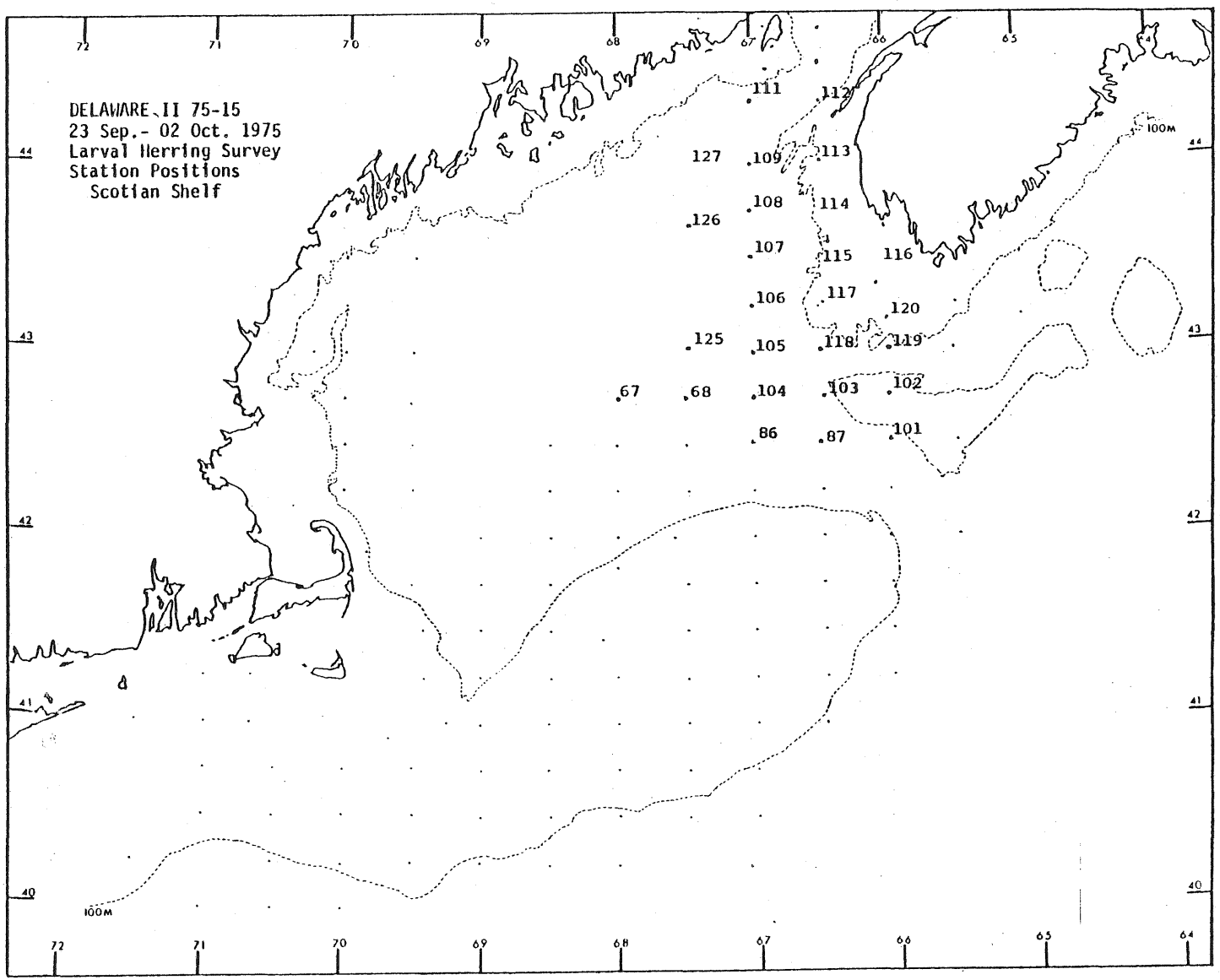

DELAWARE II 75-15
23 Sep.- 02 Oct. 1975
Larval Herring Survey
Station Positions
Scotian Shelf
100M
100M
111
112
127
109
113
108
114
126
107
115
116
117
106
120
125
105
118
119
67
68
104
103
102
86
87
101
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 114.

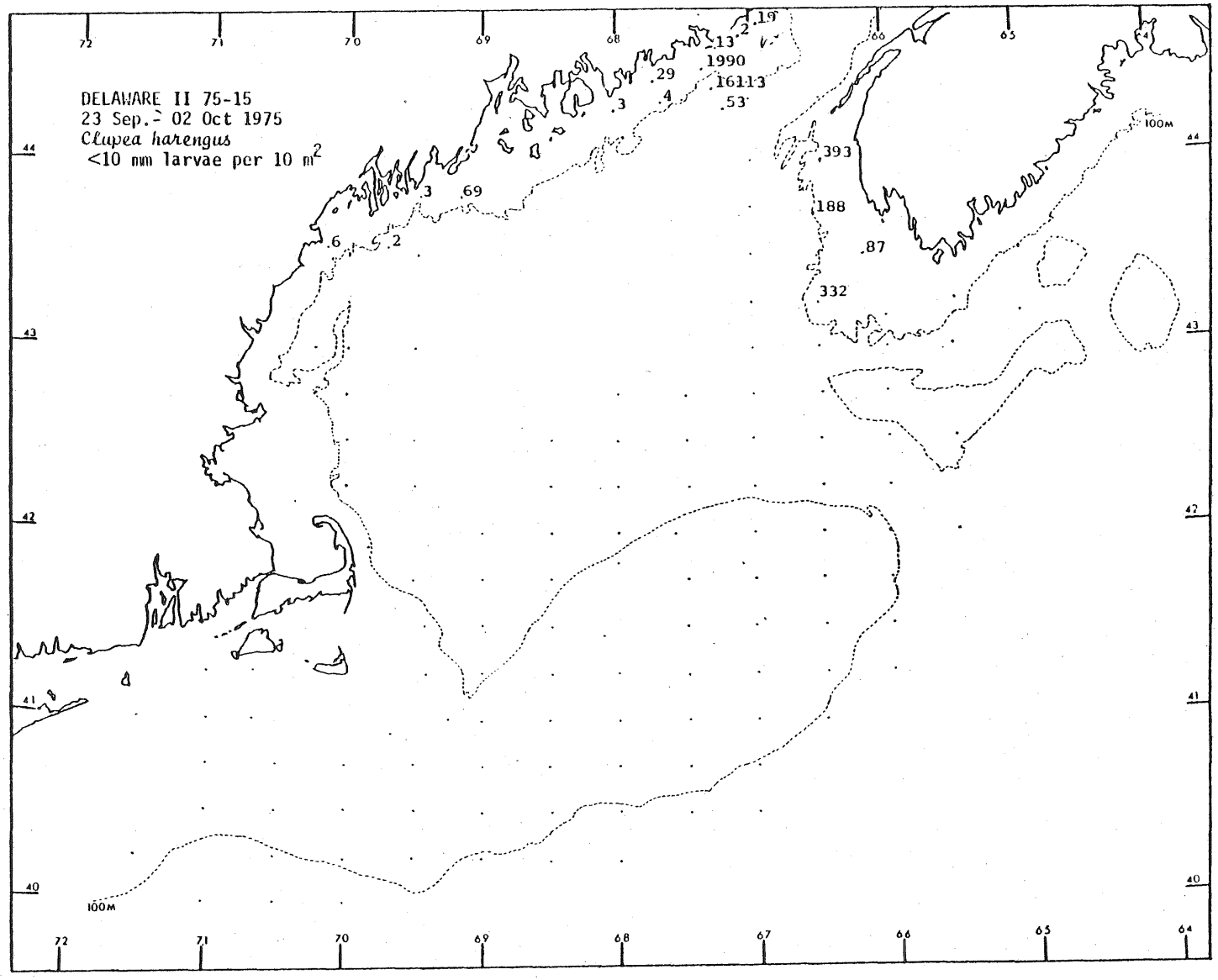

DELAWARE II 75-15
23 Sep. - 02 Oct 1975
Clupea harengus
<10 mm larvae per 10 m2
.19
.2
.13
1990
.29
16113
.3
.4
.53
.3
.69
.6
.2
393
188
.87
332
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 115.

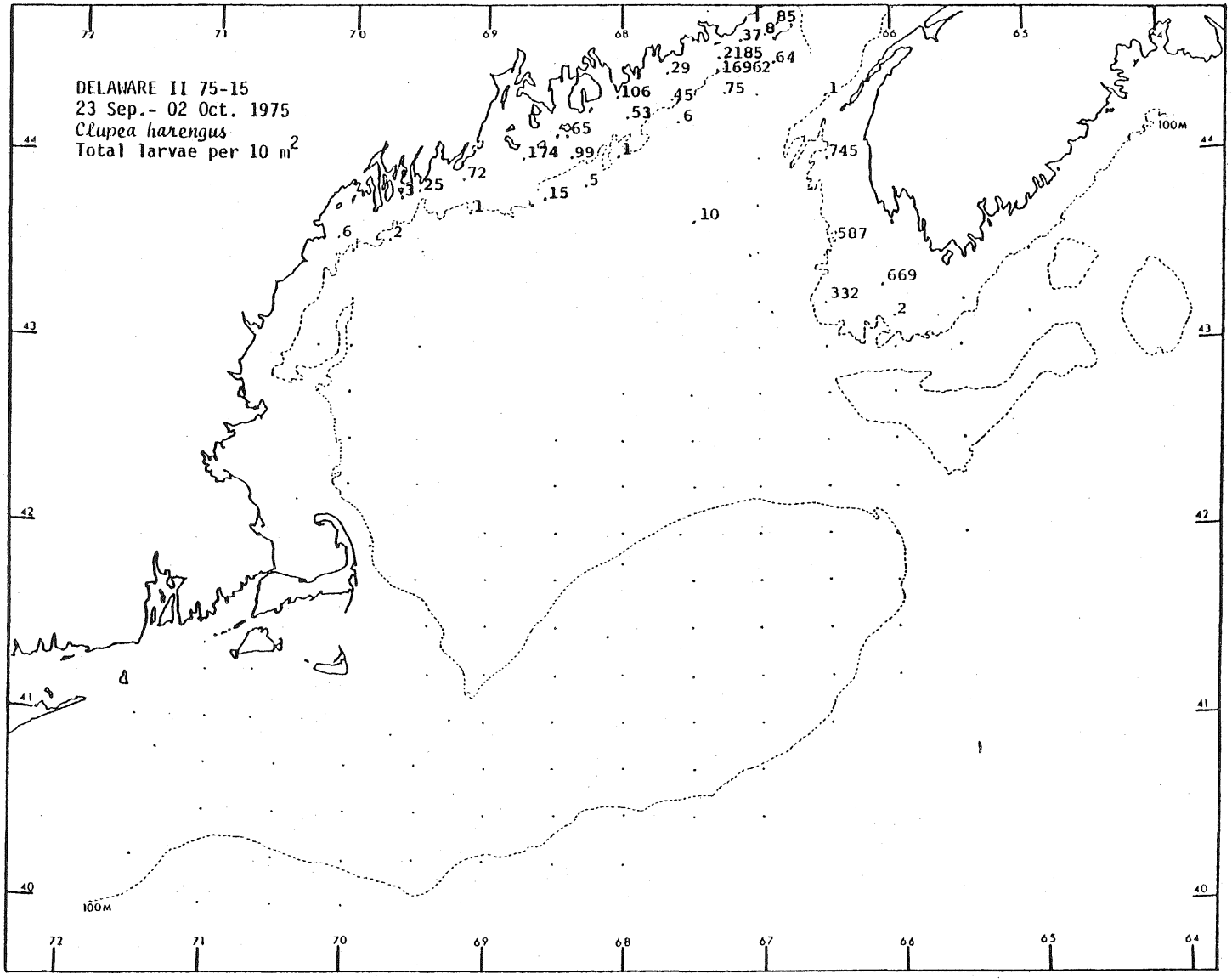

DELAWARE II 75-15
23 Sep.- 02 Oct. 1975
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 116.

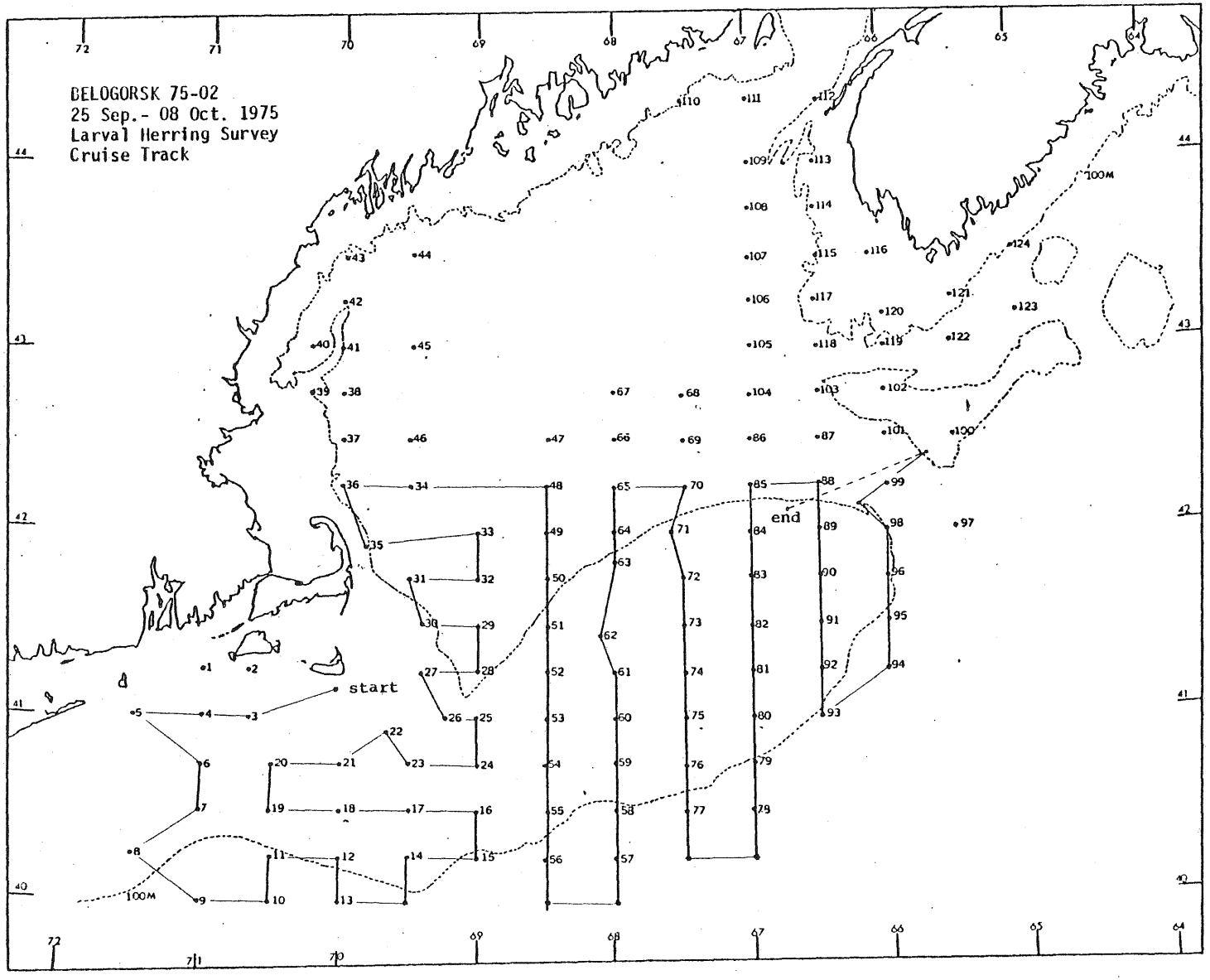

BELOGORSK 75-02
25 Sep.- 08 Oct. 1975
Larval Herring Survey
Cruise Track
start
end
100M

Figure 117.

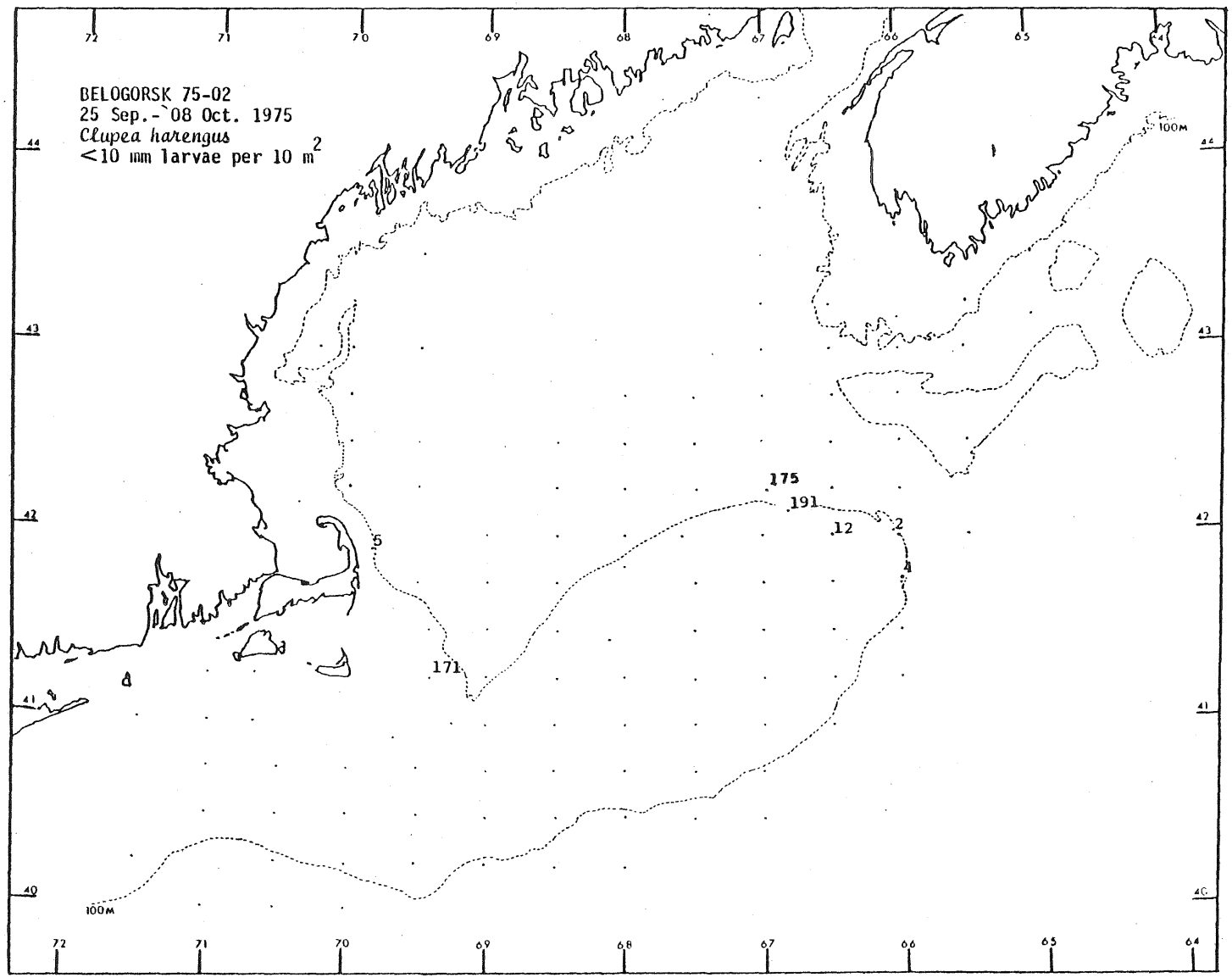

BELOGORSK 75-02
25 Sep.-08 Oct. 1975
Clupea harengus
<10 mm larvae per 10 m2
175
191
12
2
5
171
100M
100M

Figure 118.

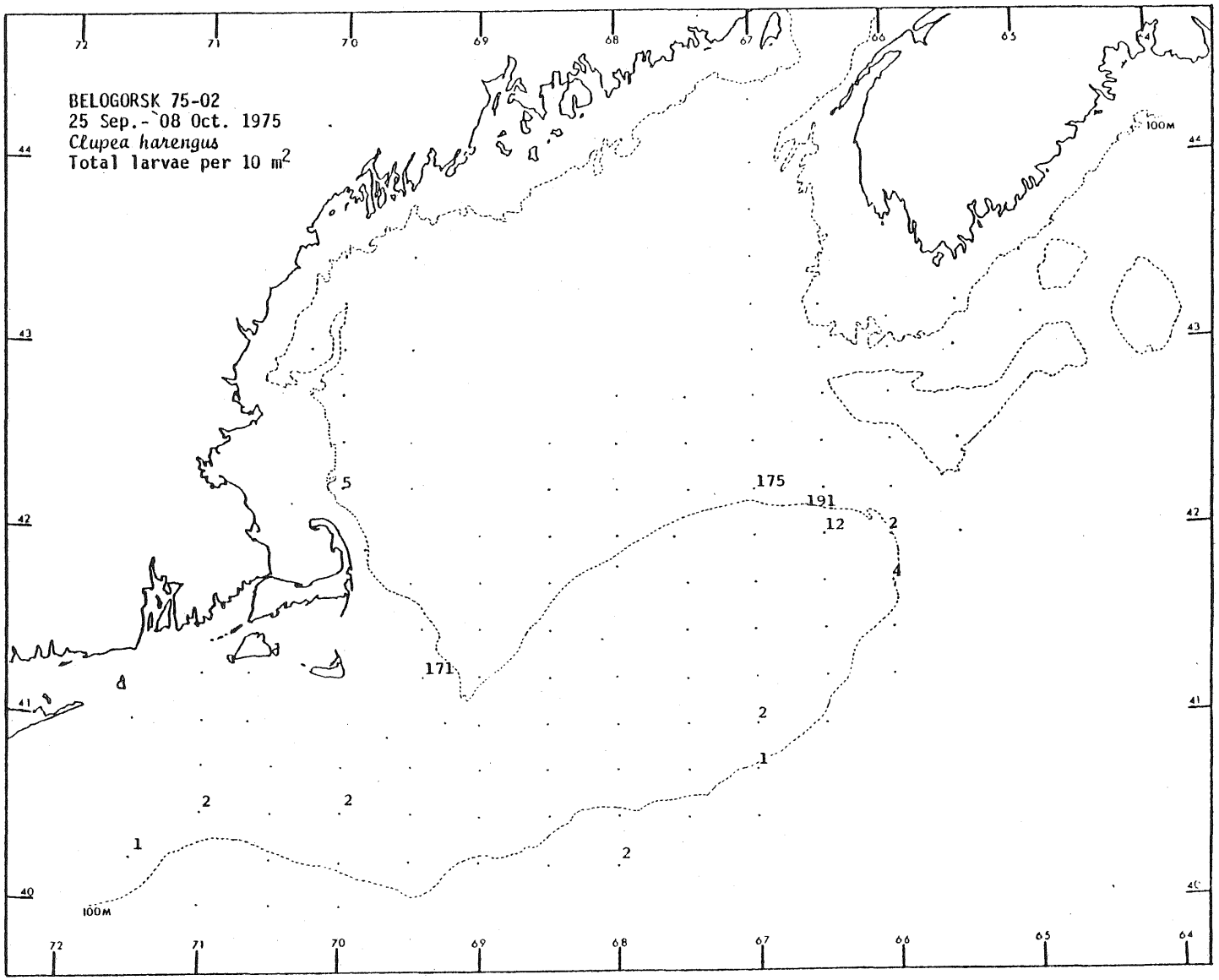

BELOGORSK 75-02
25 Sep.-08 Oct. 1975
Clupea harengus
Total larvae per 10 m2
100M
5
175
191
12
2
4
171
2
1
2
2
1
2
100M

Figure 119.

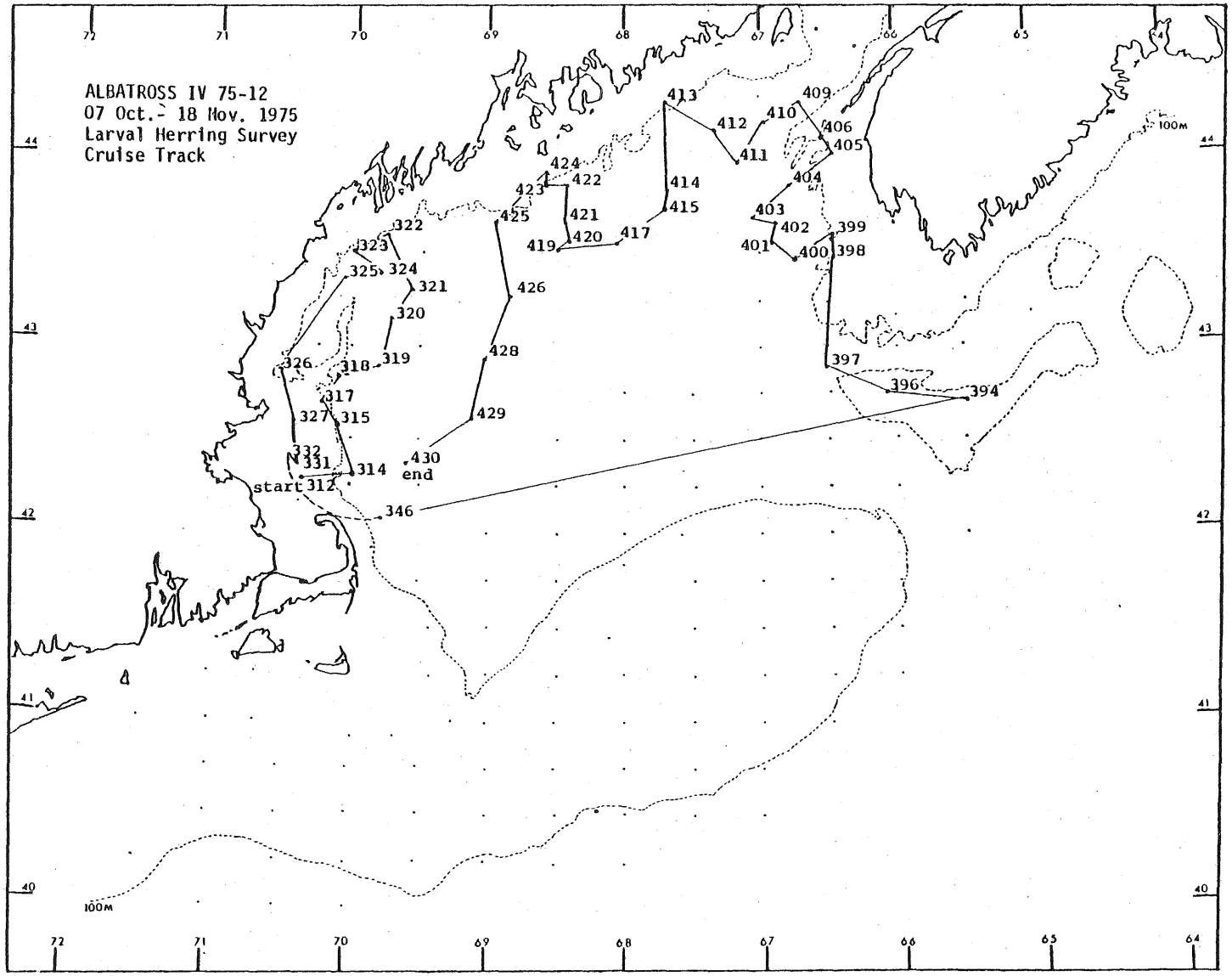

ALBATROSS IV 75-12
07 Oct. - 18 Nov. 1975
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 120.

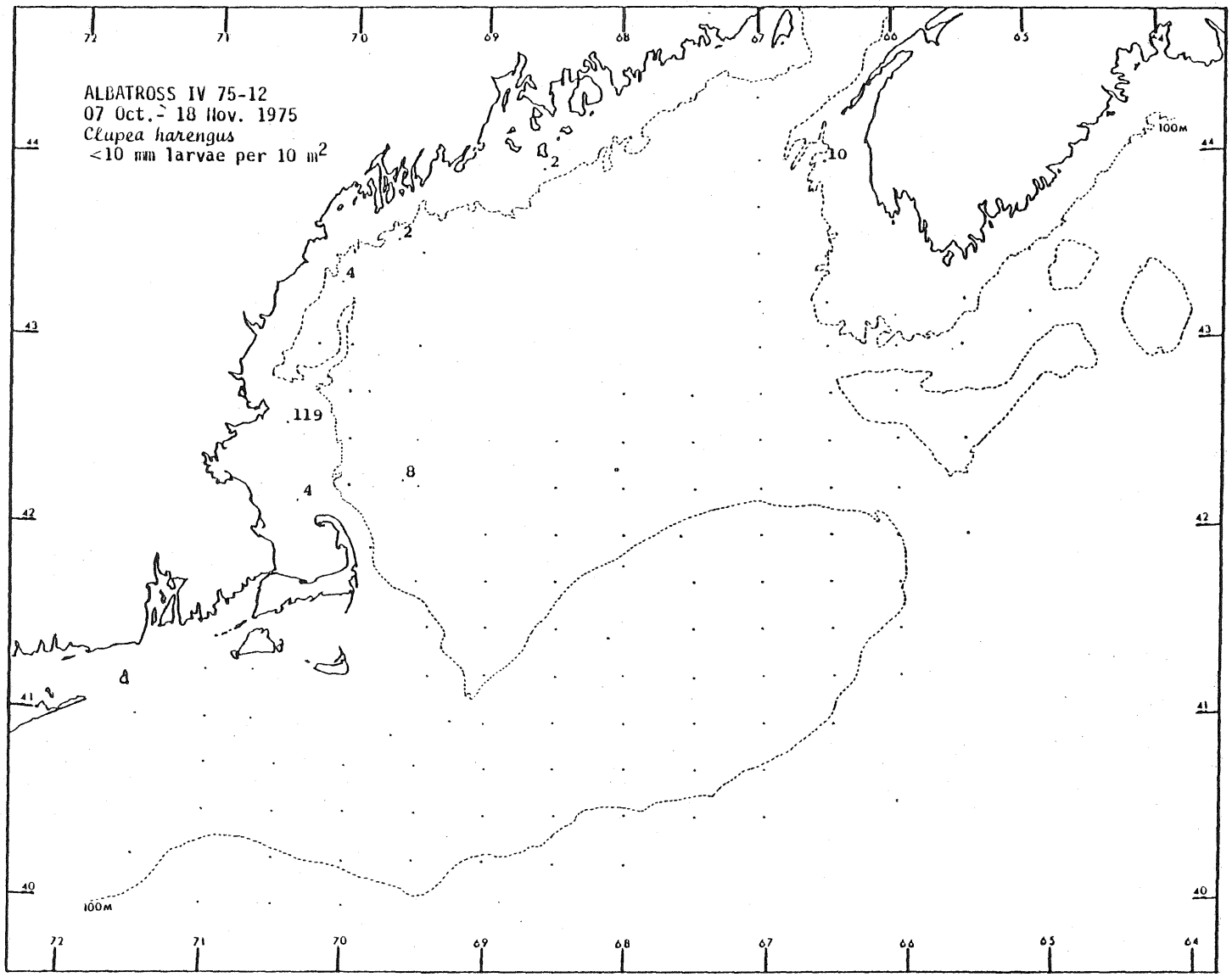

ALBATROSS IV 75-12
07 Oct.- 18 Nov. 1975
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
119
8
4
4
2
2
10
4
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 121.

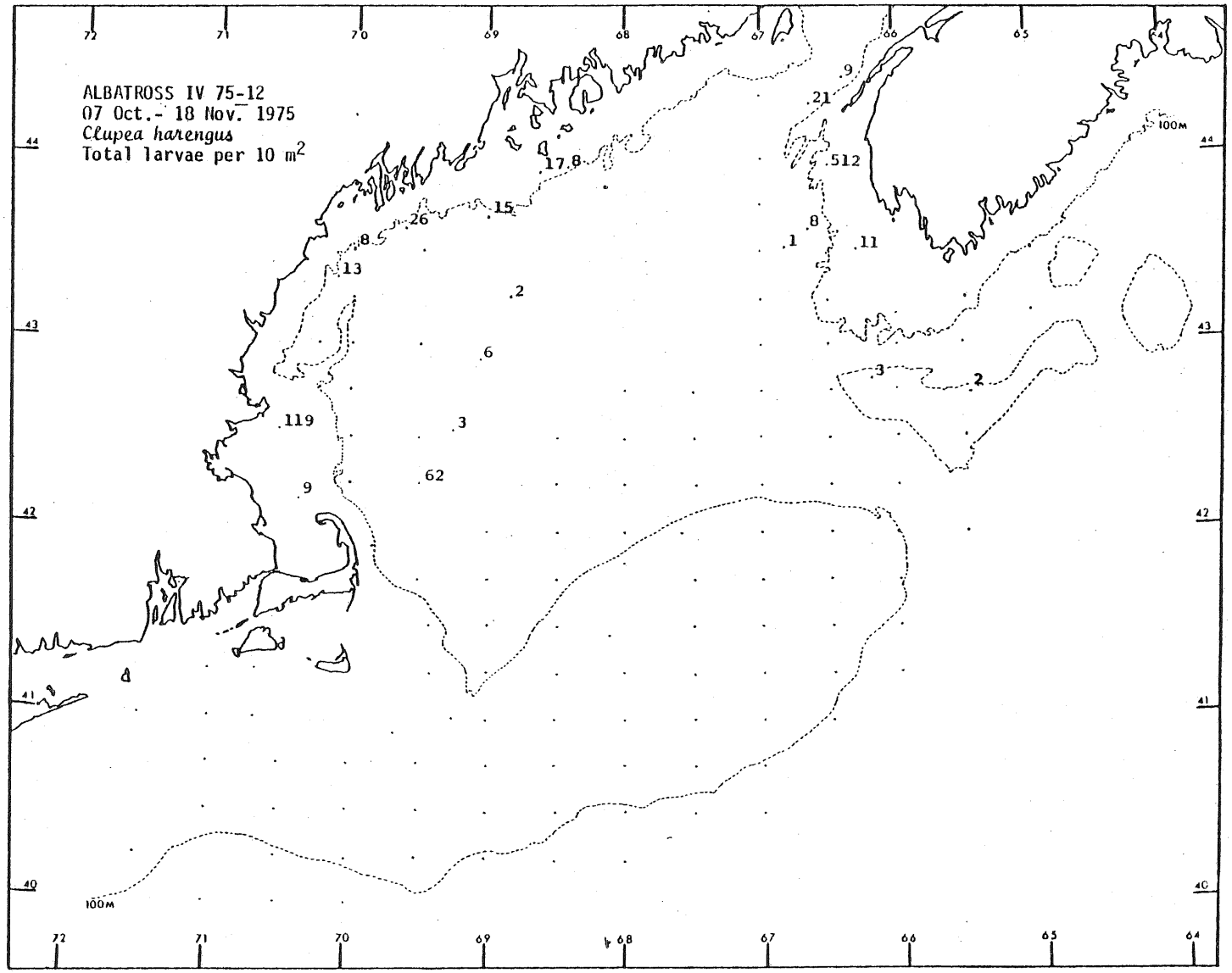

ALBATROSS IV 75-12
07 Oct.- 18 Nov. 1975
Clupea harengus
Total larvae per 10 m2
100M
100M
.9
.21
.512
.8
.1
.11
.17.8
.15
.26
.8.5
.13
.2
.6
.3
.2
.119
.3
.62
.9

Figure 122.

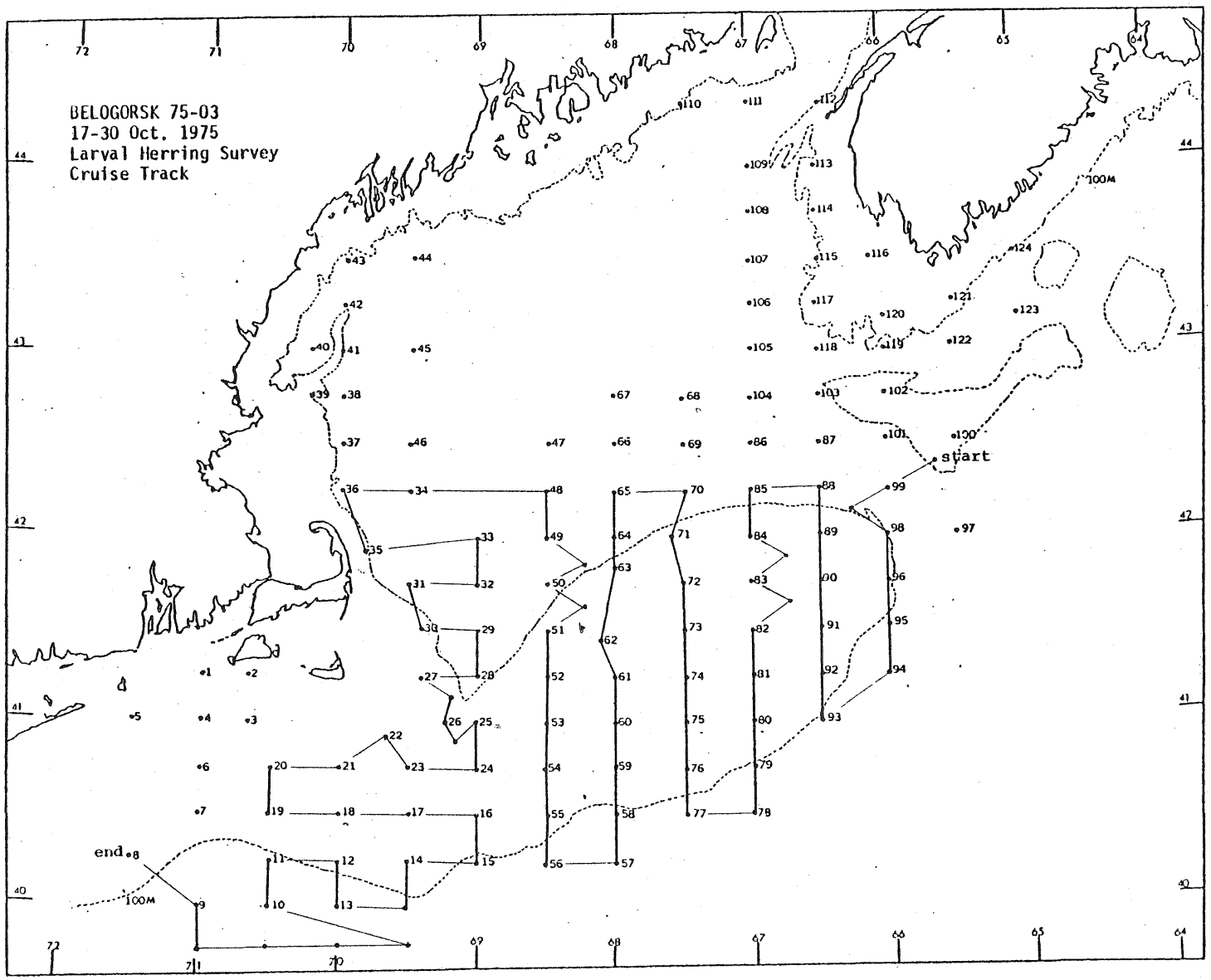

BELOGORSK 75-03
17-30 Oct. 1975
Larval Herring Survey
Cruise Track
start
end
100M

Figure 123.

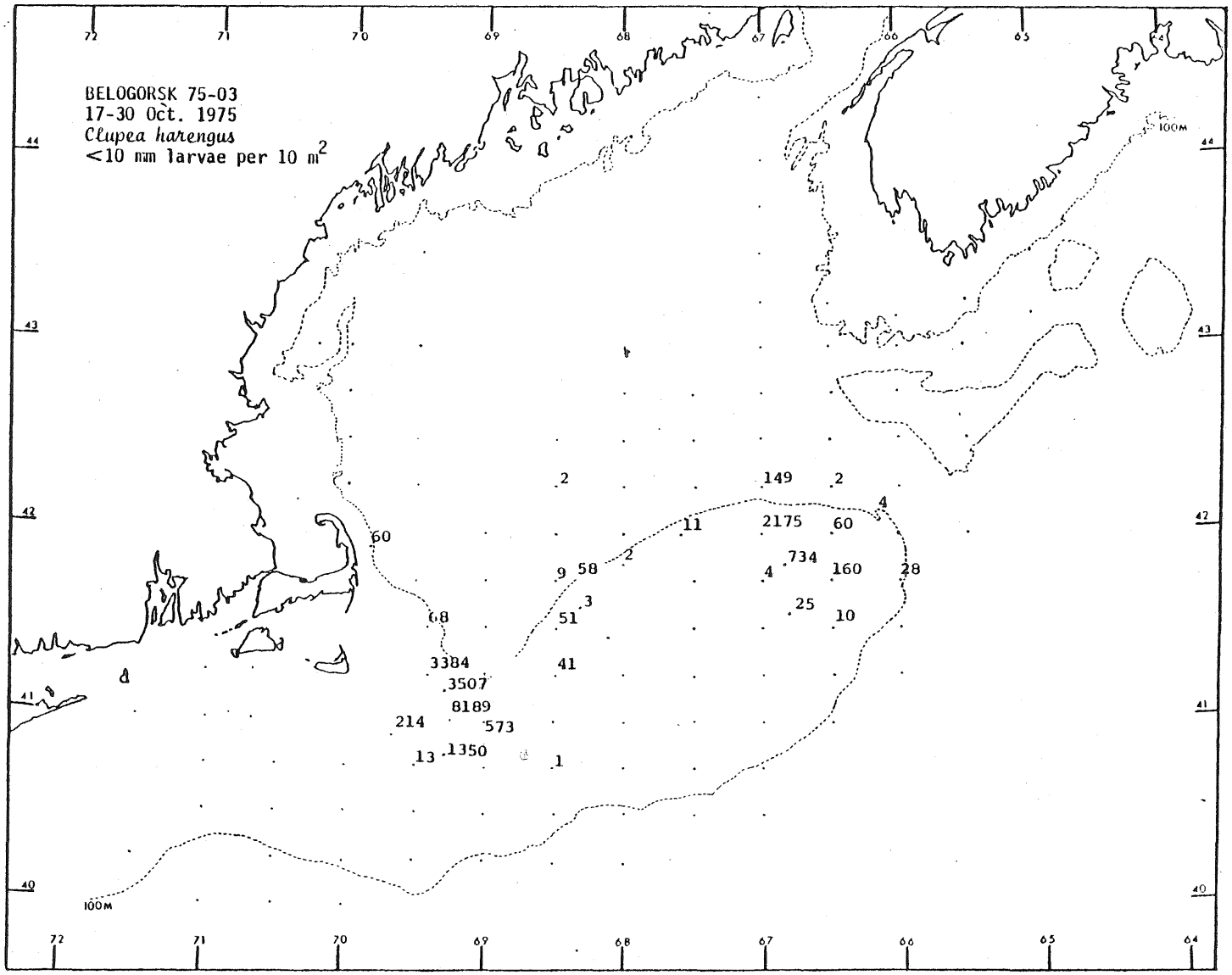

BELOGORSK 75-03
17-30 Oct. 1975
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
2
149
2
4
60
11
2175
60
734
9
58
2
4
160
28
3
25
51
10
68
41
3384
3507
8189
214
573
13
1350
1

Figure 124.

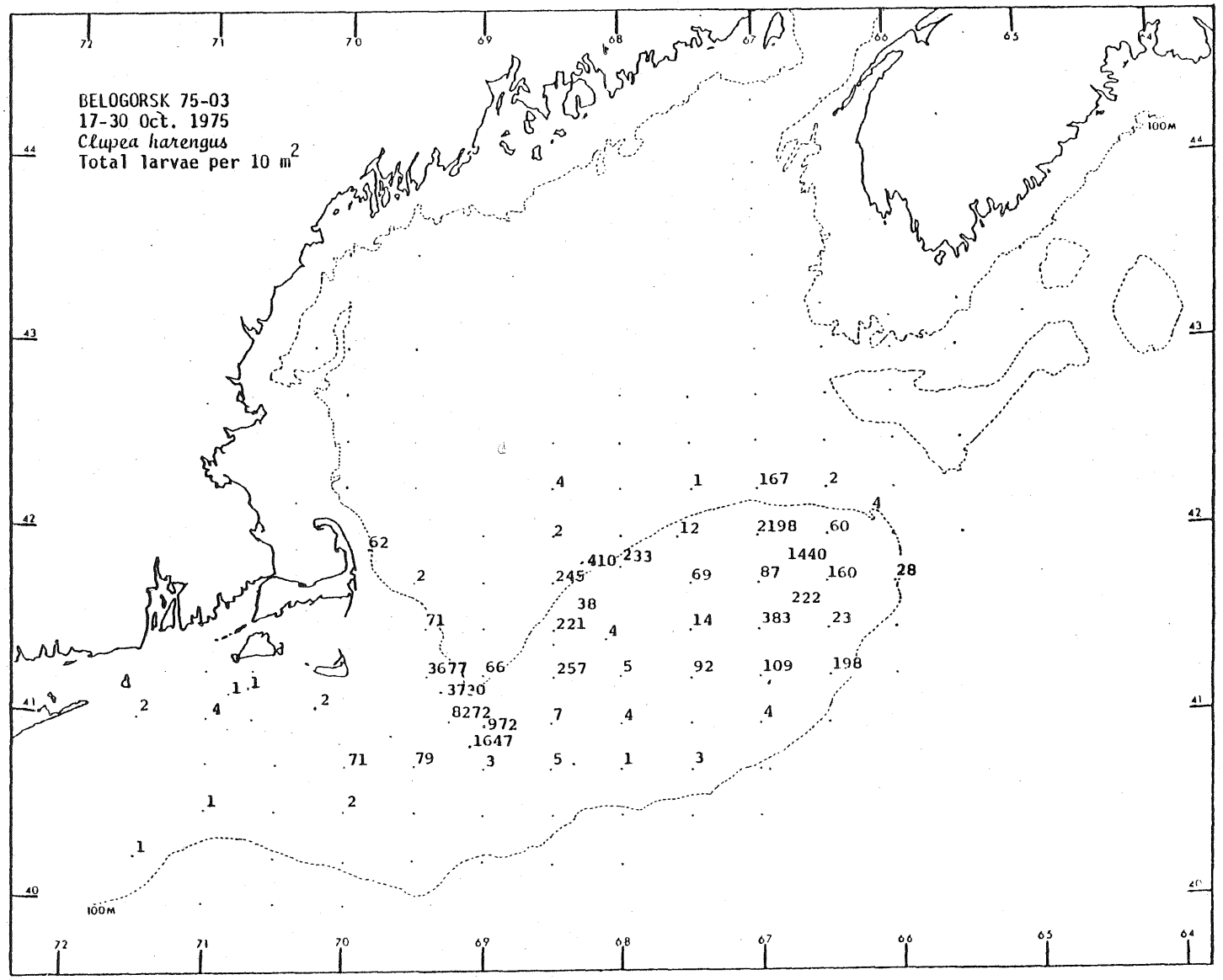

BELOGORSK 75-03
17-30 Oct. 1975
Clupea harengus
Total larvae per 10 m2
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
4
1
167
2
4
2
12
2198
60
62
410
233
1440
2
245
69
87
160
28
38
222
71
221
4
14
383
23
3677
66
257
5
92
109
198
3720
1
1
2
2
4
8272
972
7
4
4
1647
71
79
3
5
1
3
1
2
1

Figure 125.

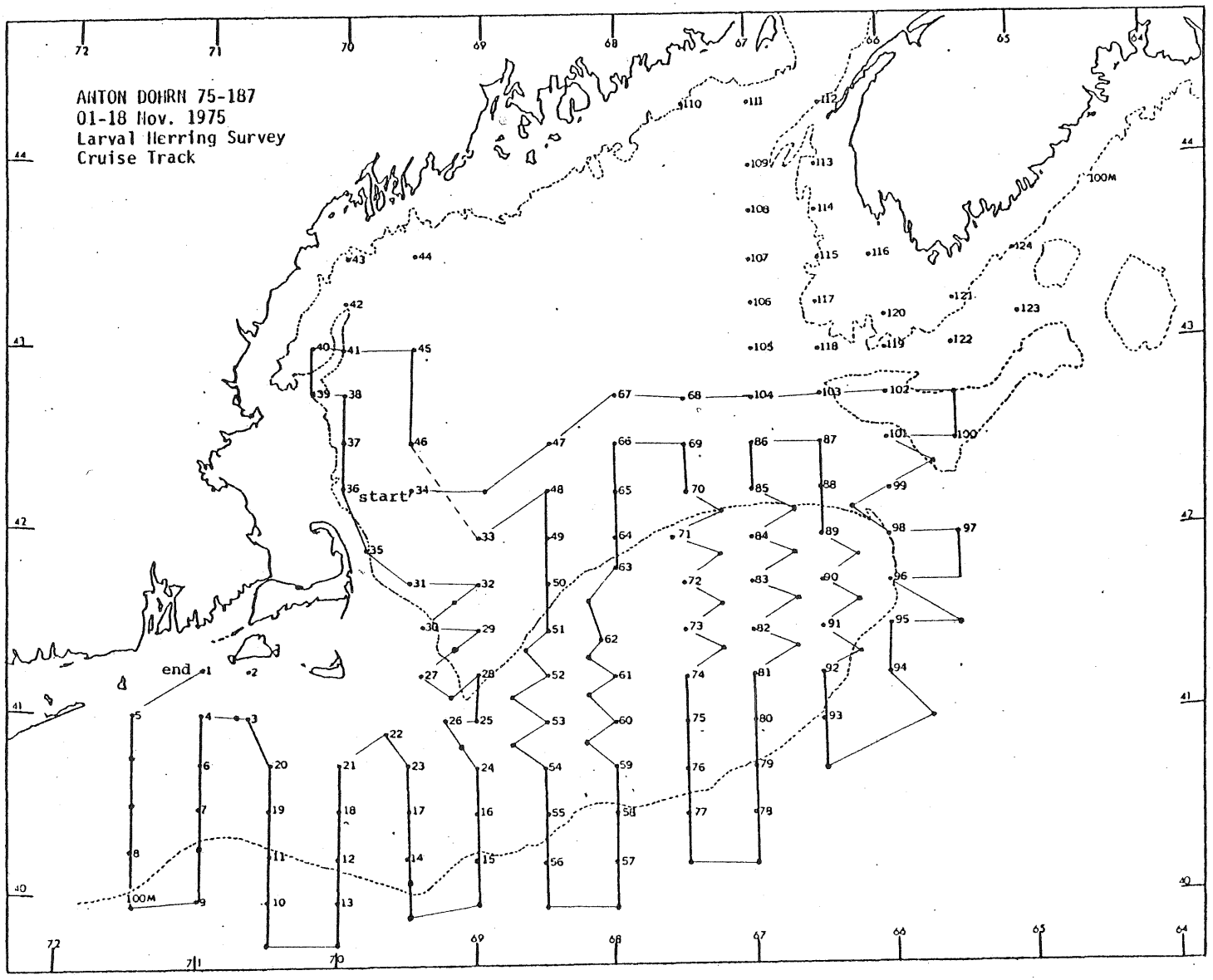

ANTON DOHRN 75-187
01-18 Nov. 1975
Larval Herring Survey
Cruise Track
start
end
100M

Figure 126.

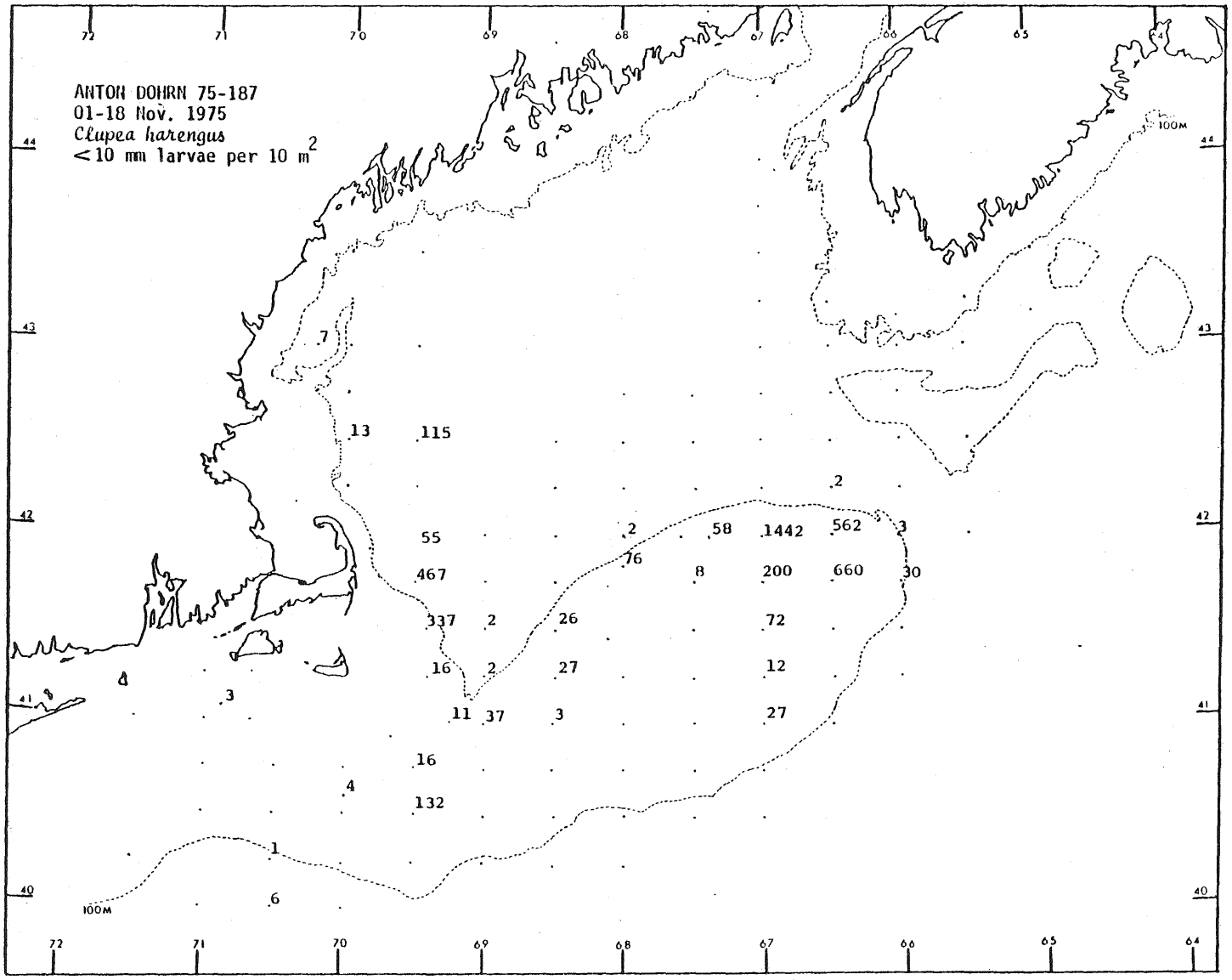

ANTON DOHRN 75-187
01-18 Nov. 1975
Clupea harengus
<10 mm larvae per 10 m2
100M
7
13
115
55
467
337
2
26
16
2
27
11
37
3
16
4
132
1
6
3
2
58
1442
562
3
76
8
200
660
30
72
12
27
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 127.

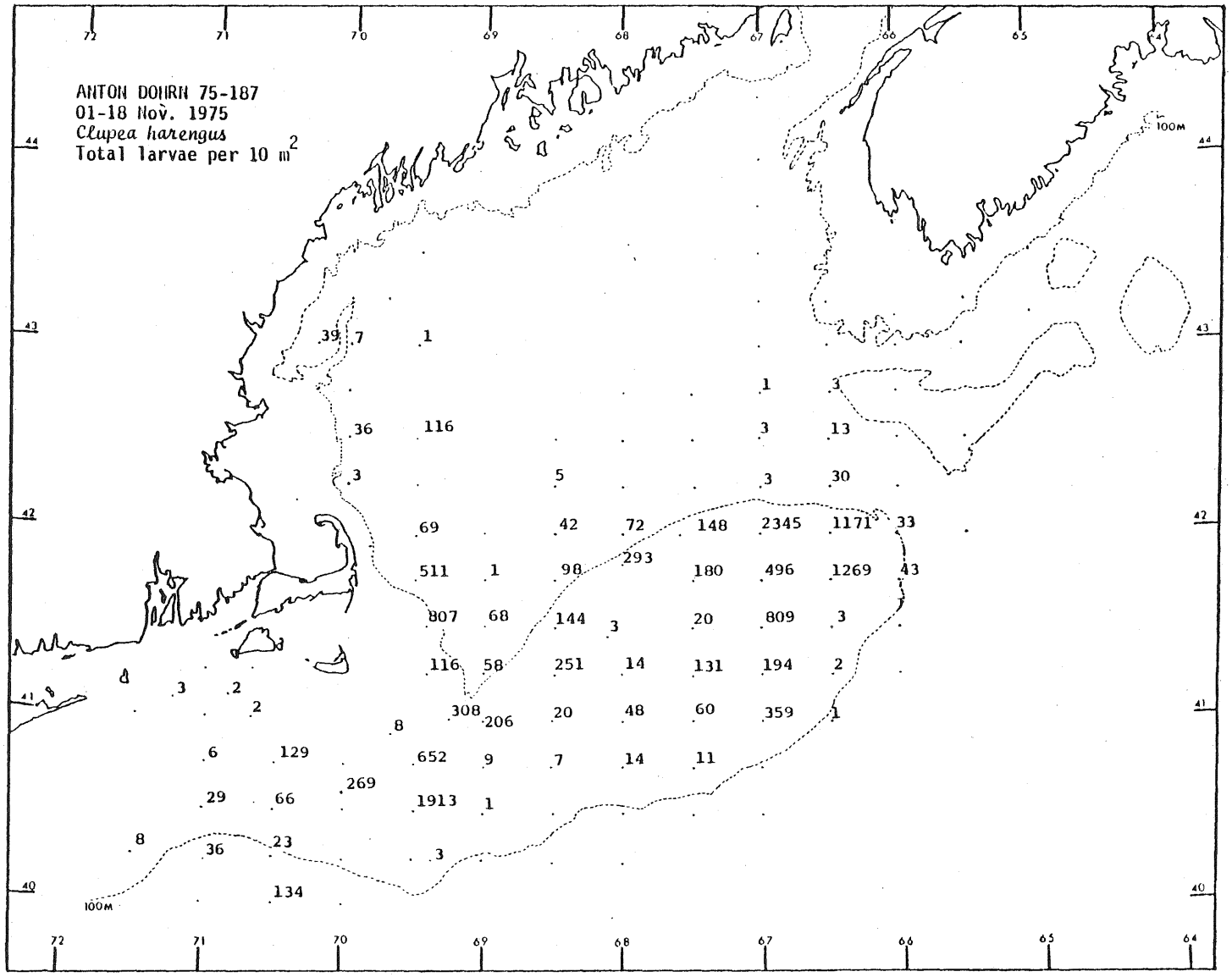

ANTON DOHRN 75-187
01-18 Nov. 1975
Clupea harengus
Total larvae per 10 m2
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
39
7
1
1
3
36
116
3
13
3
5
3
30
69
42
72
148
2345
1171
33
511
1
98
293
180
496
1269
43
807
68
144
3
20
809
3
116
58
251
14
131
194
2
3
2
2
308
206
20
48
60
359
1
8
6
129
652
9
7
14
11
269
29
66
1913
1
8
36
23
3
134

Figure 128.

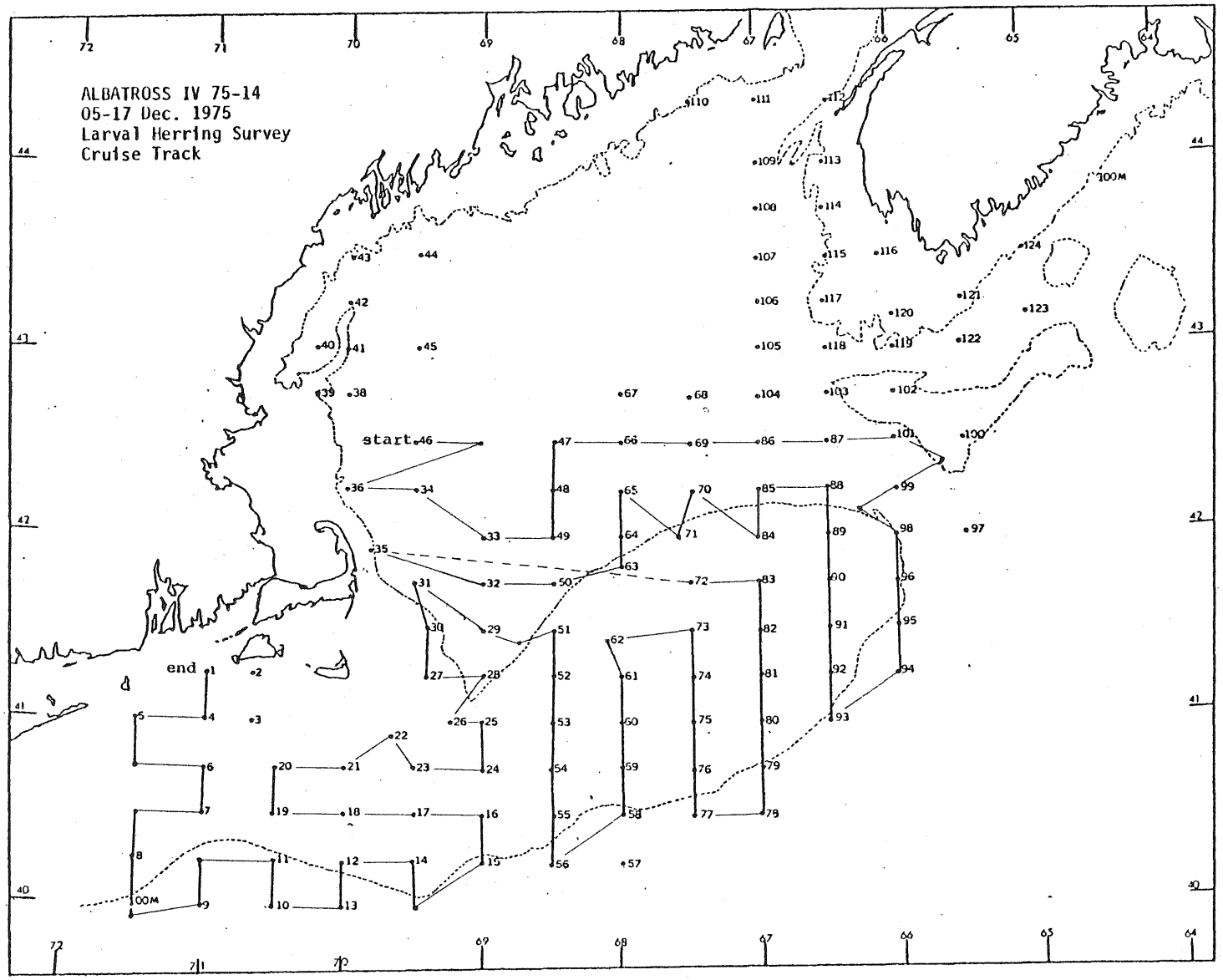

ALBATROSS IV 75-14
05-17 Dec. 1975
Larval Herring Survey
Cruise Track
start
end
100M

Figure 129.

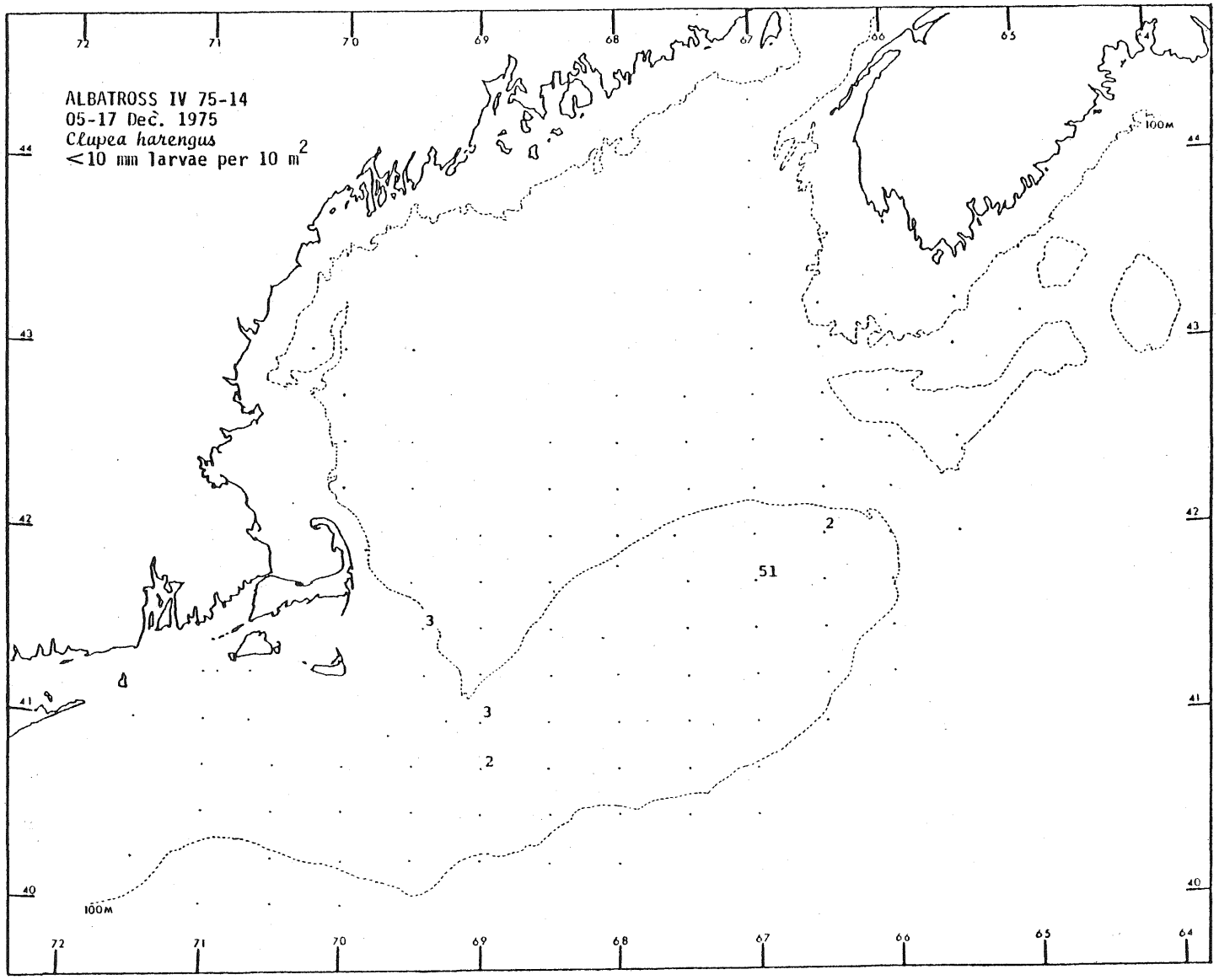

ALBATROSS IV 75-14
05-17 Dec. 1975
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
51
2
3
3
2
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 130.

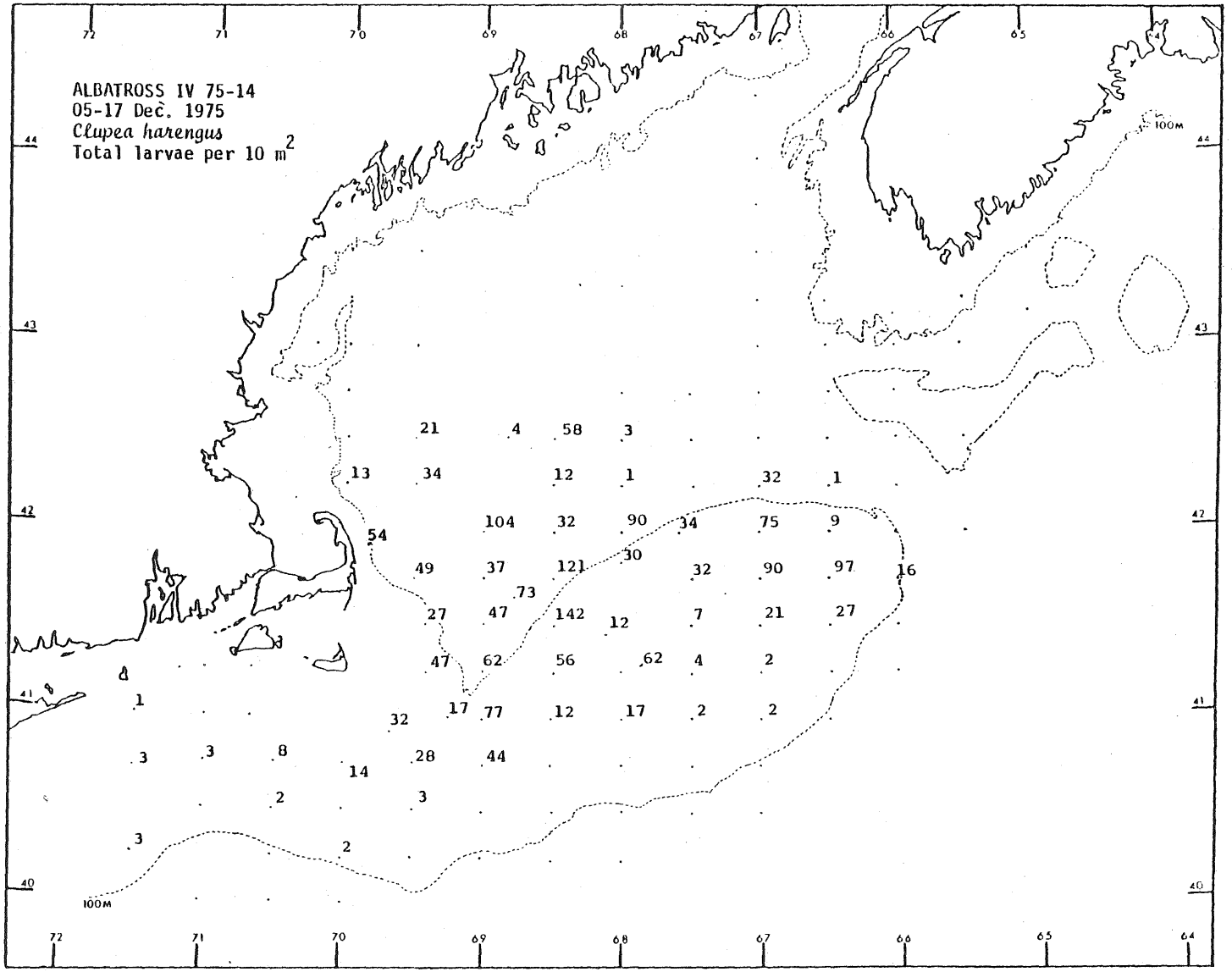

ALBATROSS IV 75-14
05-17 Dec. 1975
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
21
4
58
3
13
34
12
1
32
1
54
104
32
90
34
75
9
49
37
121
30
32
90
97
16
73
27
47
142
12
7
21
27
47
62
56
62
4
2
1
17
77
12
17
2
2
32
3
3
8
28
44
14
2
3
3
2

Figure 131.

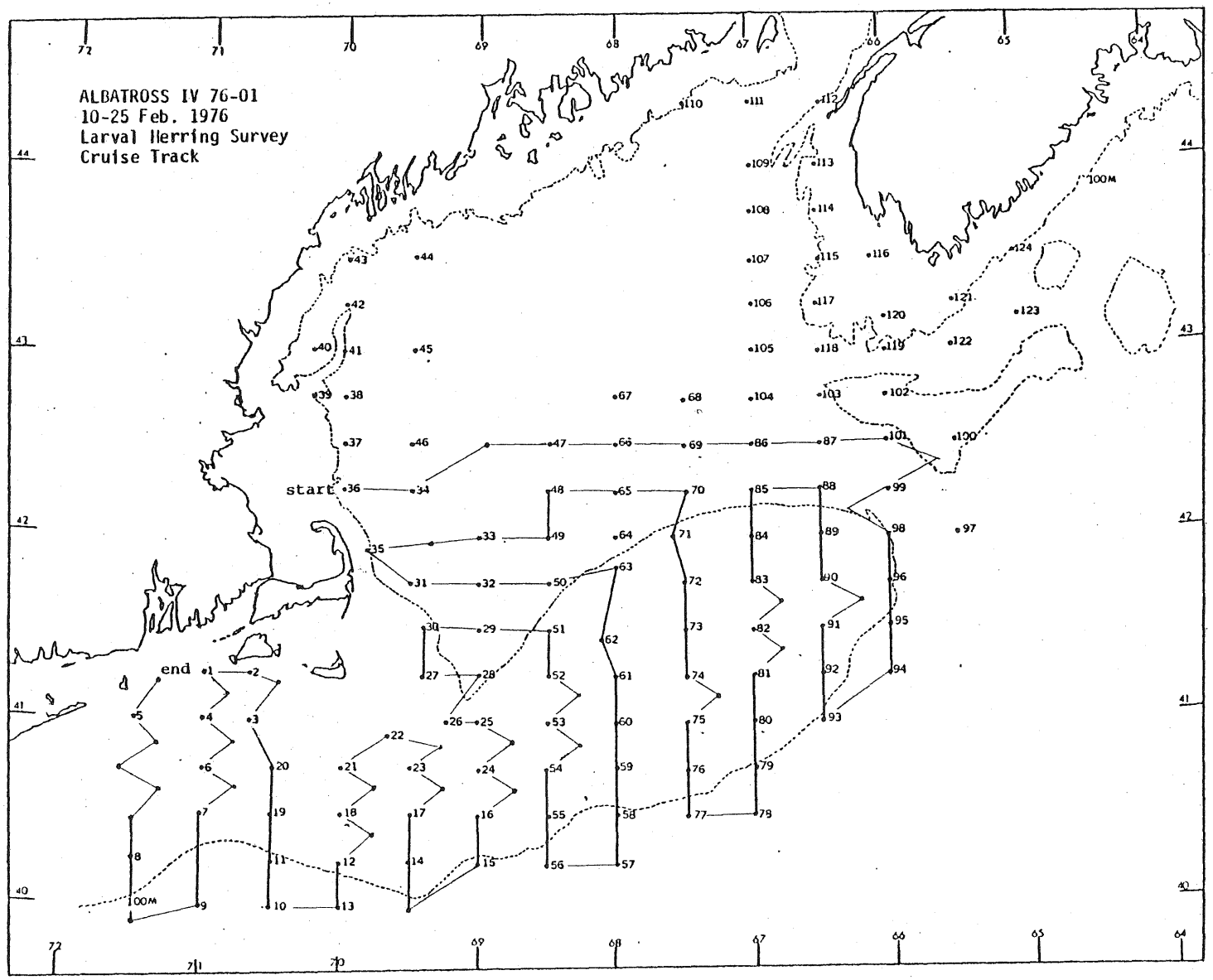

ALBATROSS IV 76-01
10-25 Feb. 1976
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 132.

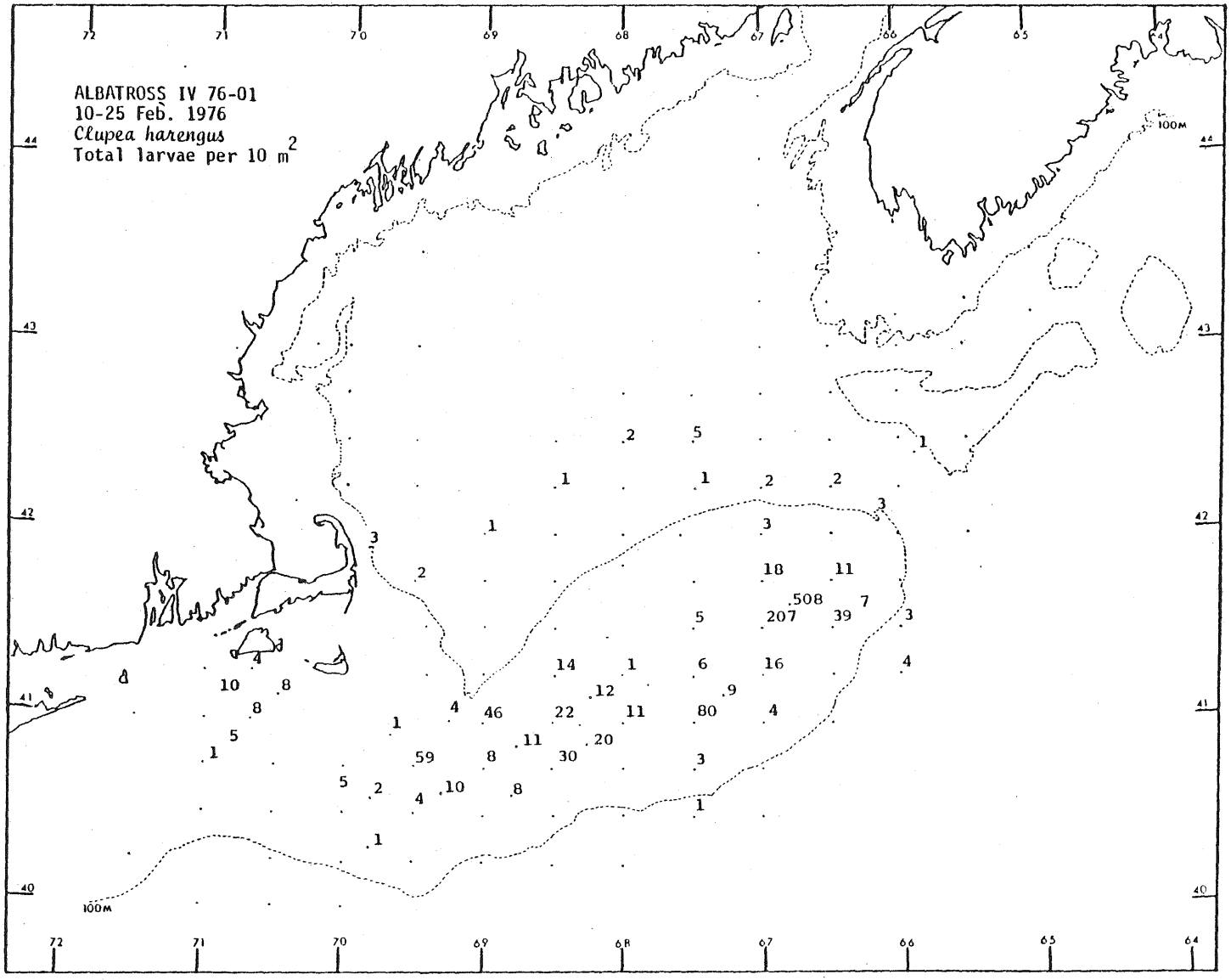

ALBATROSS IV 76-01
10-25 Feb. 1976
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 133.

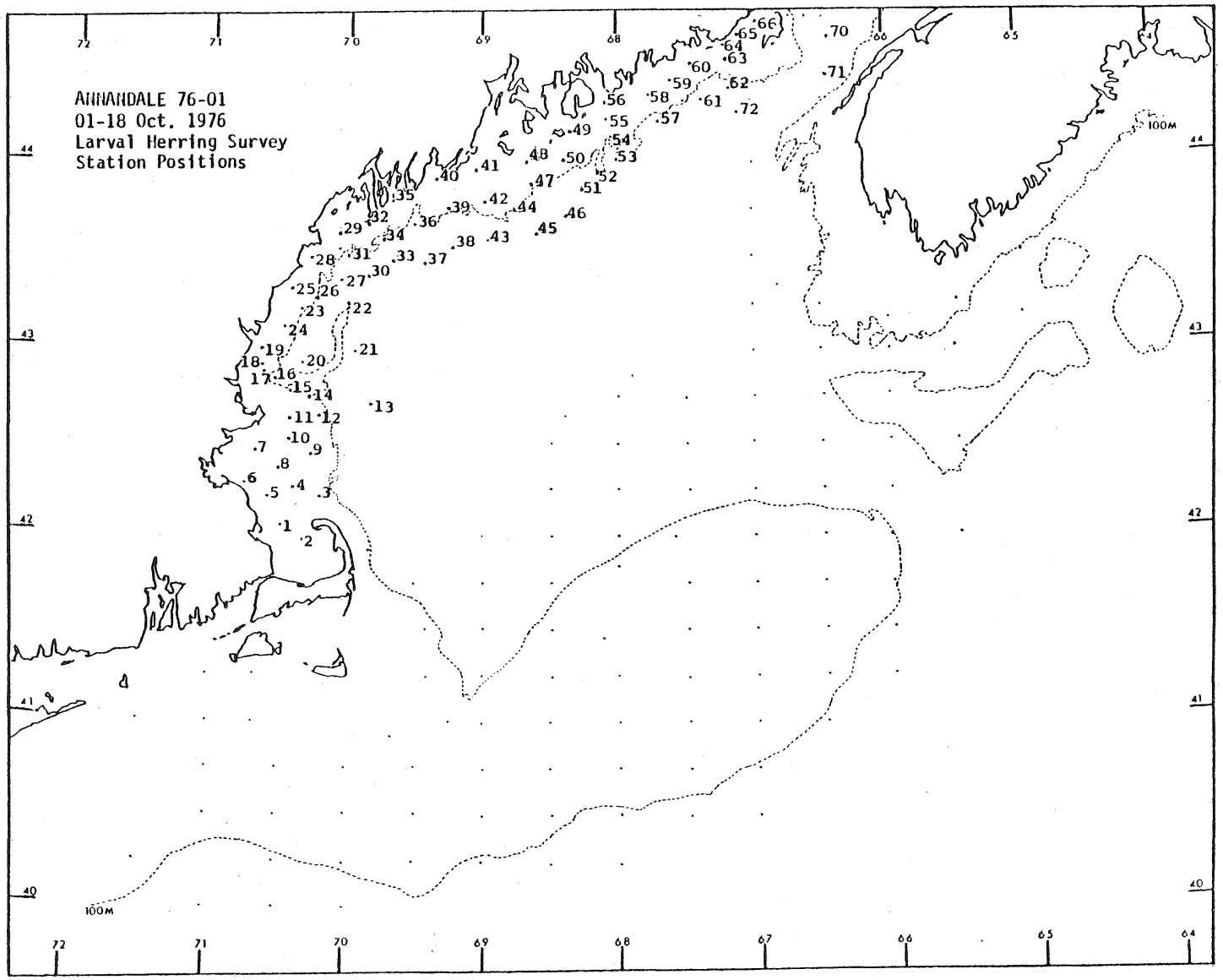

ANNANDALE 76-01
01-18 Oct. 1976
Larval Herring Survey
Station Positions
100M
100M

Figure 134.

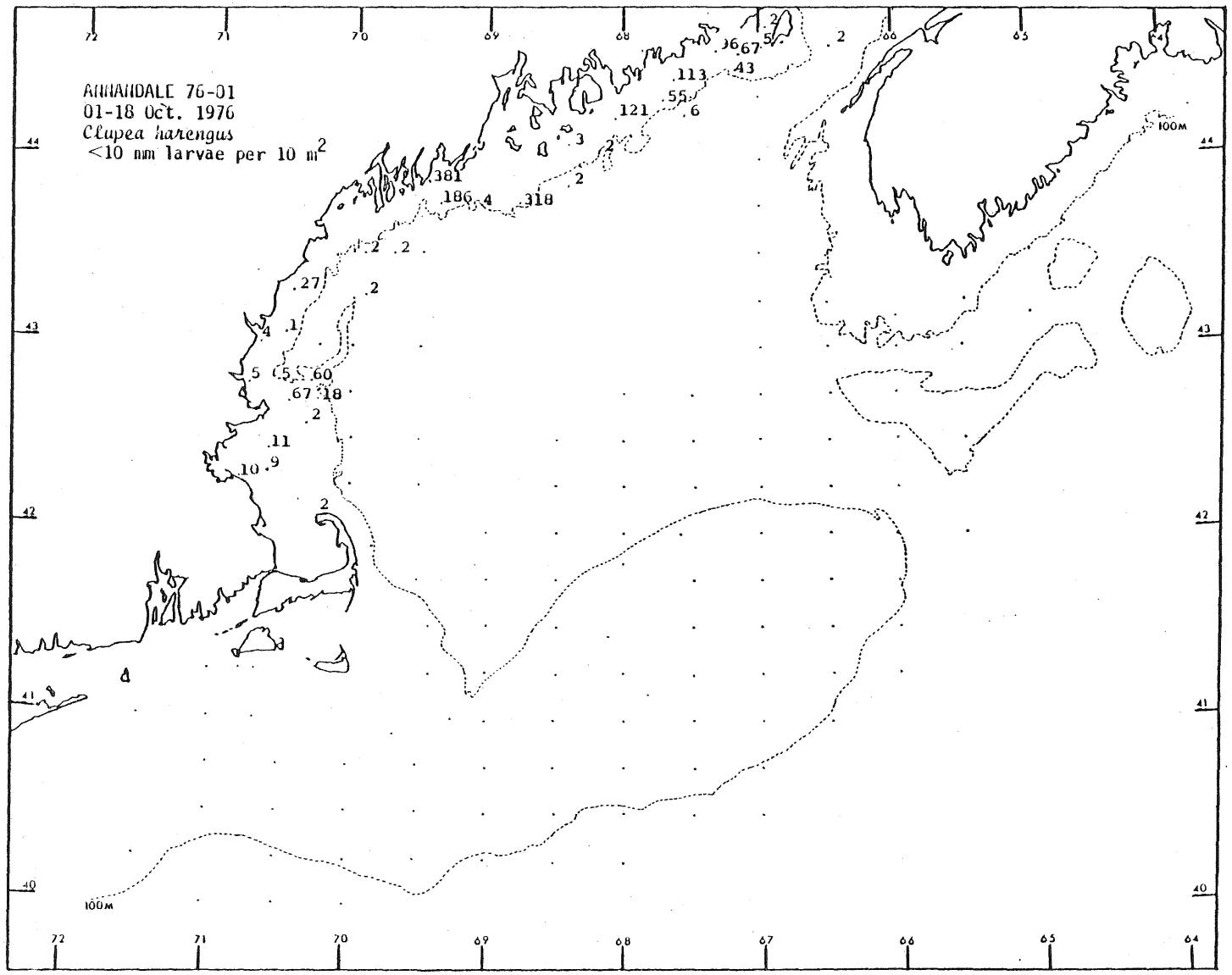

ANNANDALE 76-01
01-18 Oct. 1976
Clupea harengus
<10 mm larvae per 10 m2
100M
100M

Figure 135.

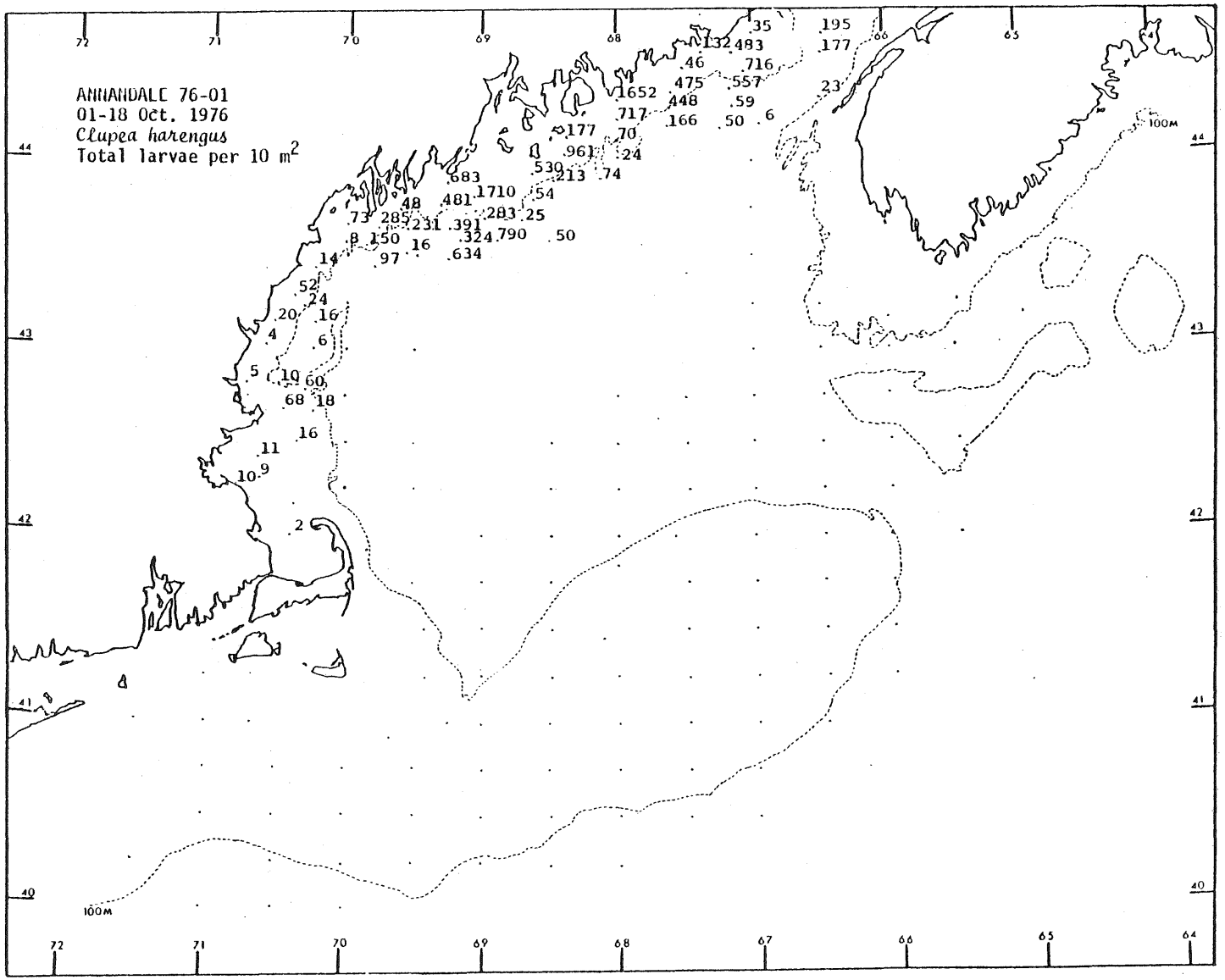

ANNANDALE 76-01
01-18 Oct. 1976
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 136.

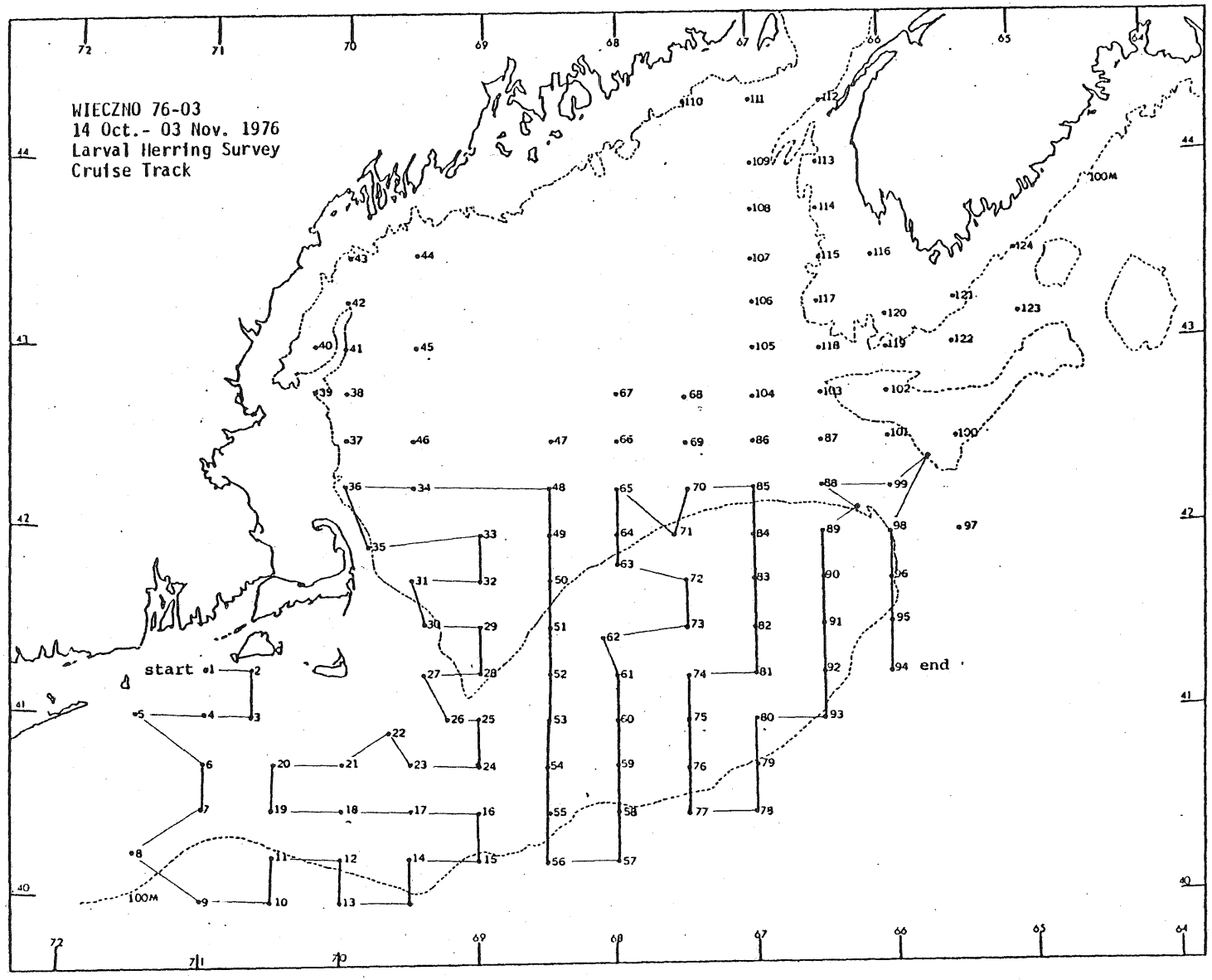

WIECZNO 76-03
14 Oct.- 03 Nov. 1976
Larval Herring Survey
Cruise Track
start
end
100M

Figure 137.

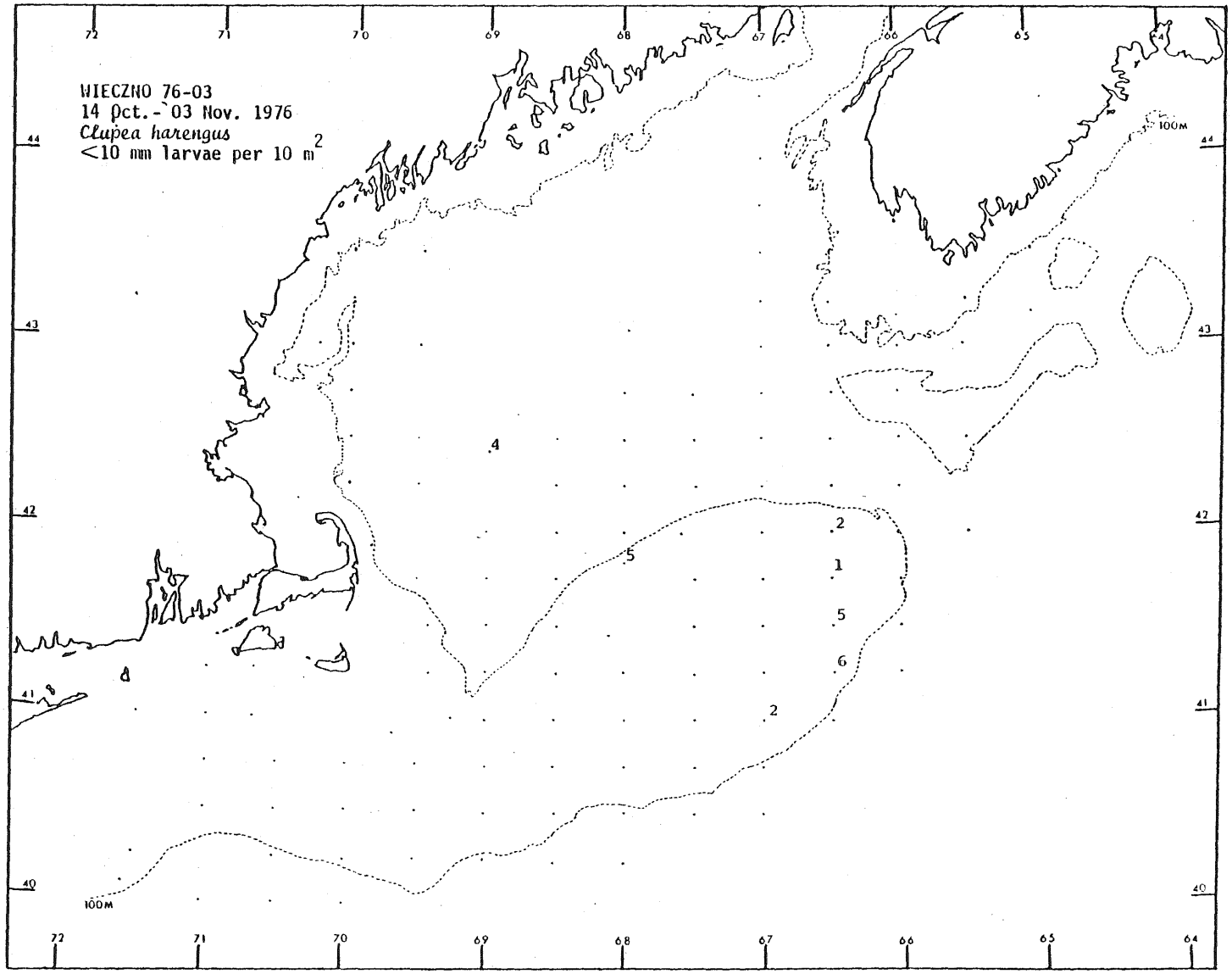

WIECZNO 76-03
14 Oct.-03 Nov. 1976
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
4
5
2
1
5
6
2

Figure 138.

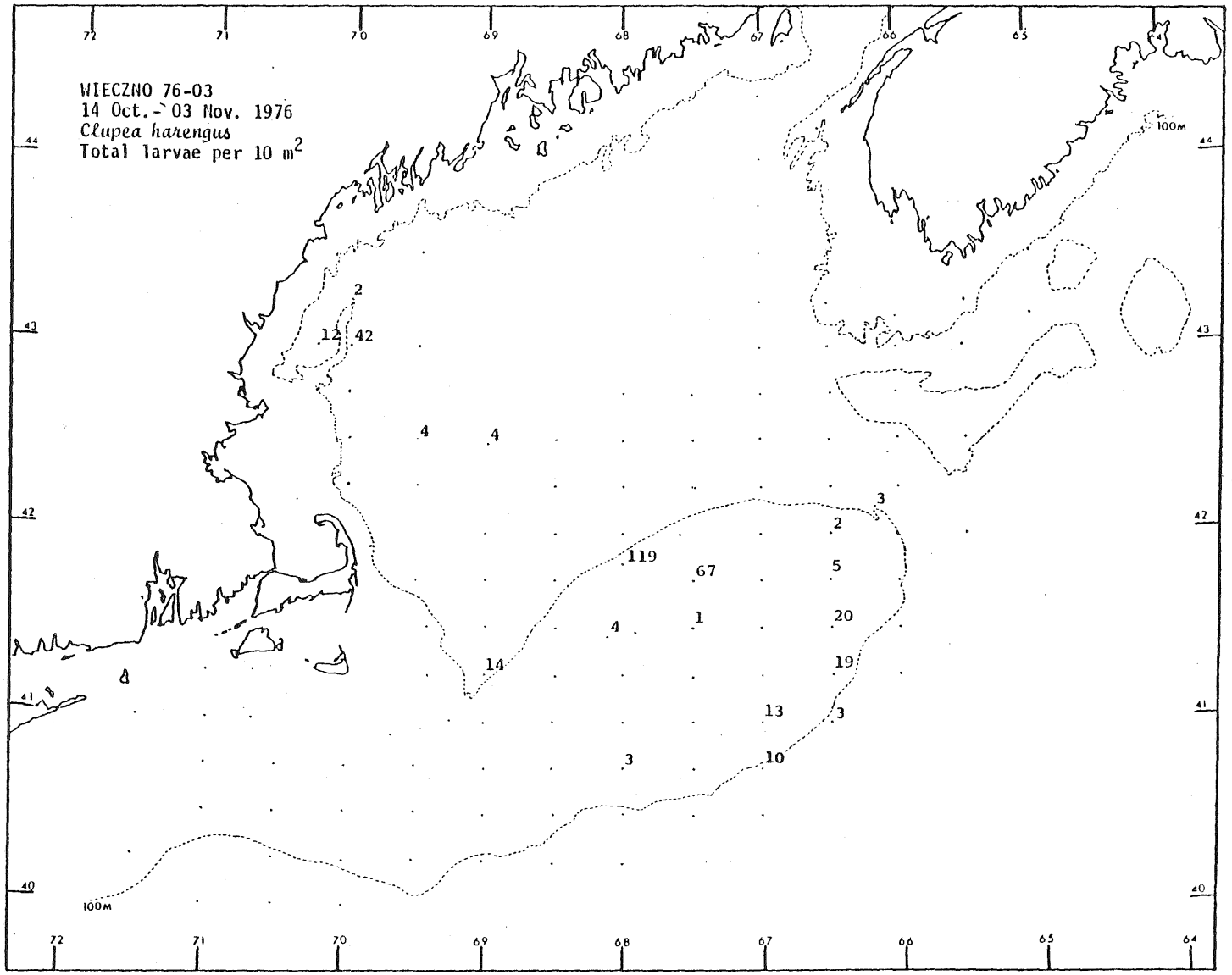

WIECZNO 76-03
14 Oct.-03 Nov. 1976
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
2
12
42
4
4
3
2
119
67
5
4
1
20
14
19
13
3
3
10

Figure 139.

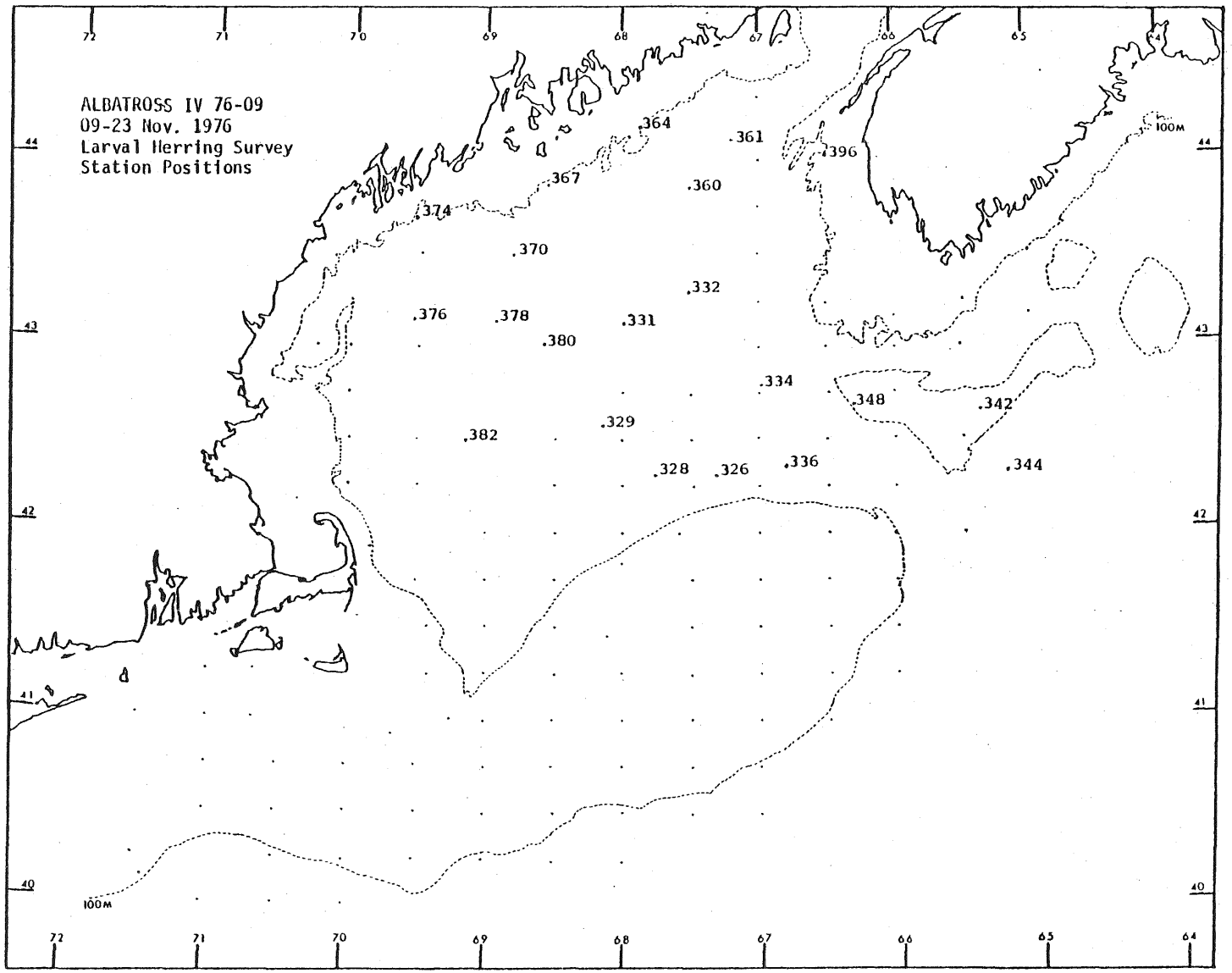

ALBATROSS IV 76-09
09-23 Nov. 1976
Larval Herring Survey
Station Positions
.364
.361
.396
.367
.360
.374
.370
.332
.376
.378
.331
.380
.334
.348
.342
.329
.382
.328
.326
.336
.344
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 140.

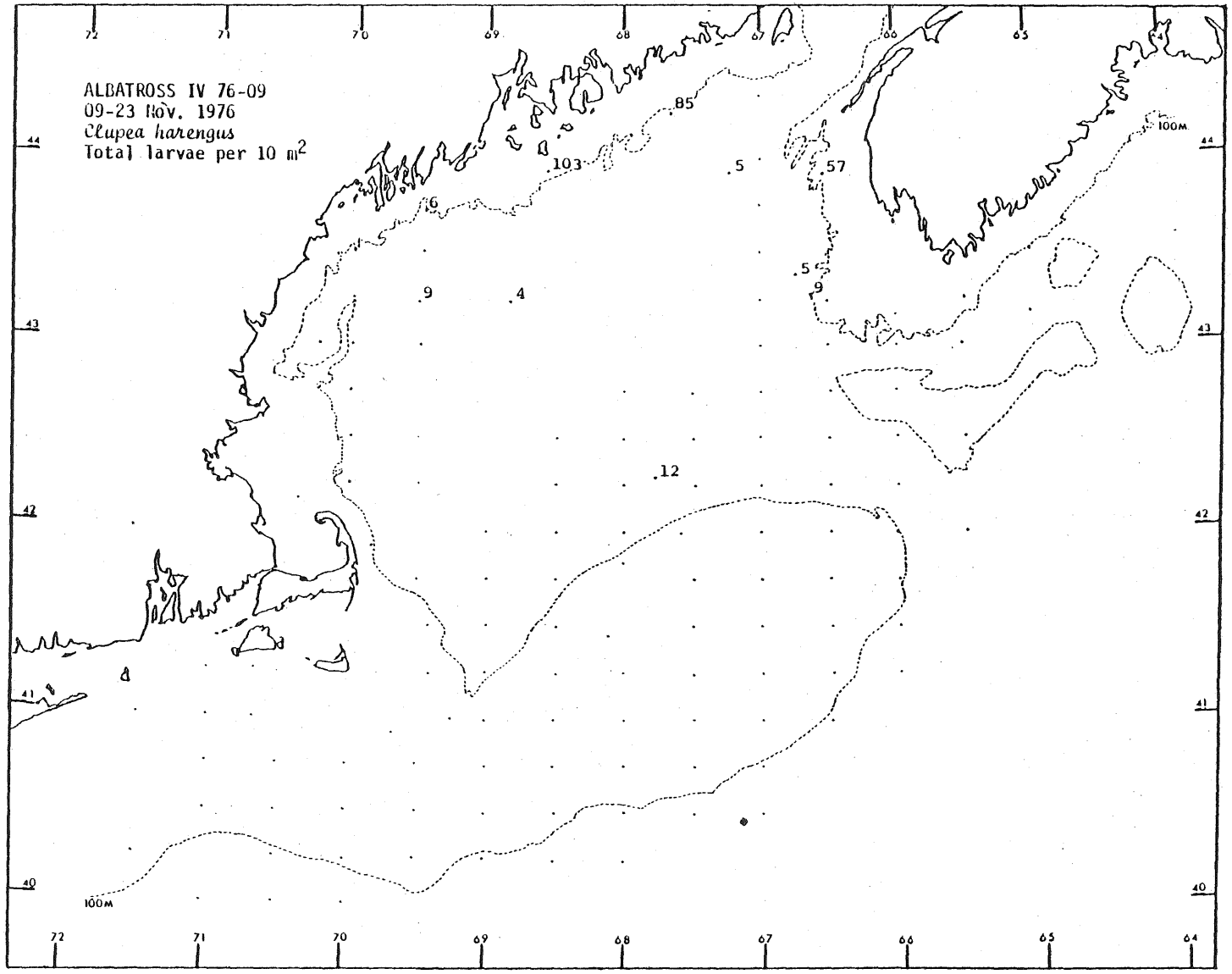

ALBATROSS IV 76-09
09-23 Nov. 1976
Clupea harengus
Total larvae per 10 m2
.85
.103
.5
.57
.6
.5
.9
.9
.4
.12
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 141.

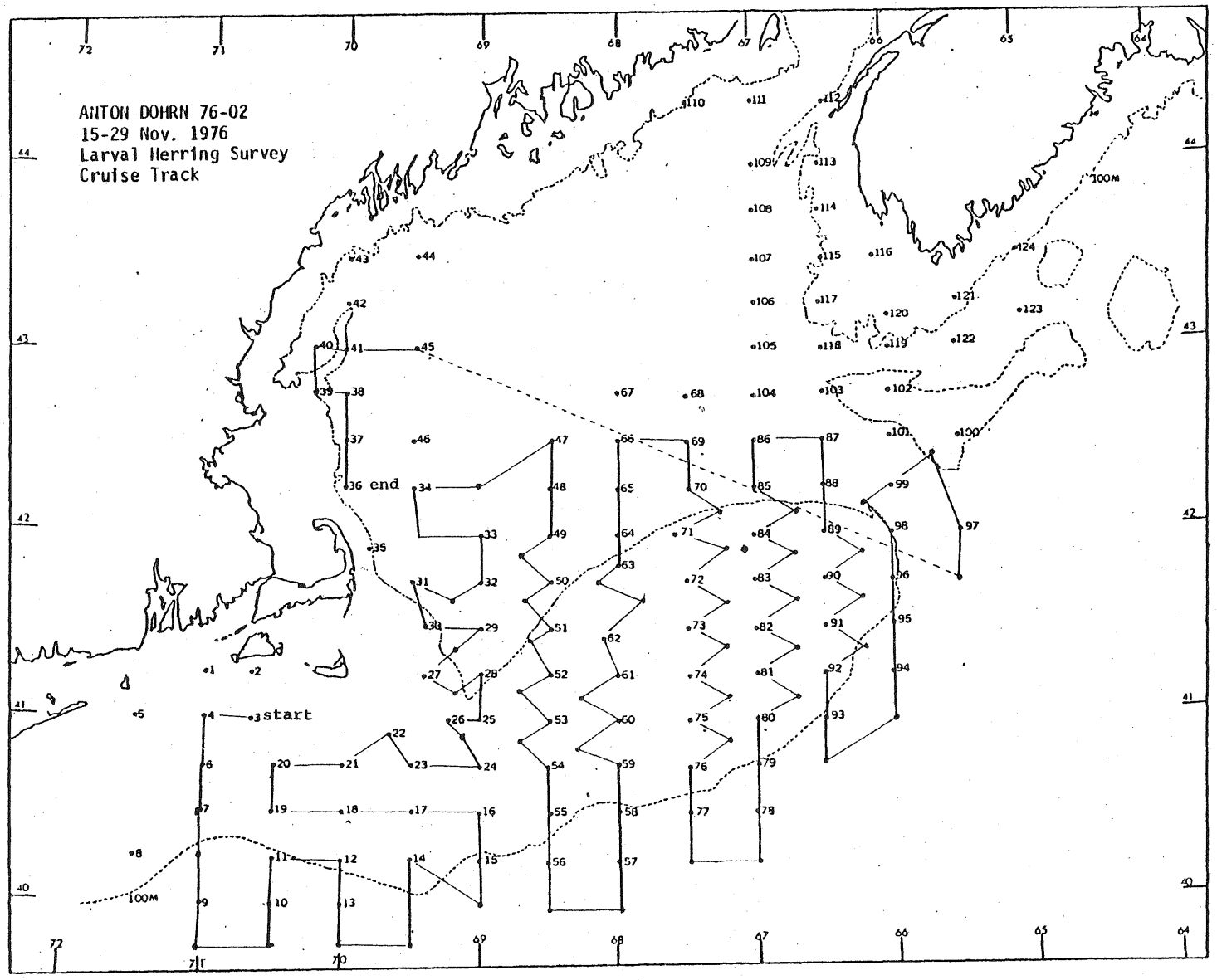

ANTON DOHRN 76-02
15-29 Nov. 1976
Larval Herring Survey
Cruise Track
start
end
100M

Figure 142.

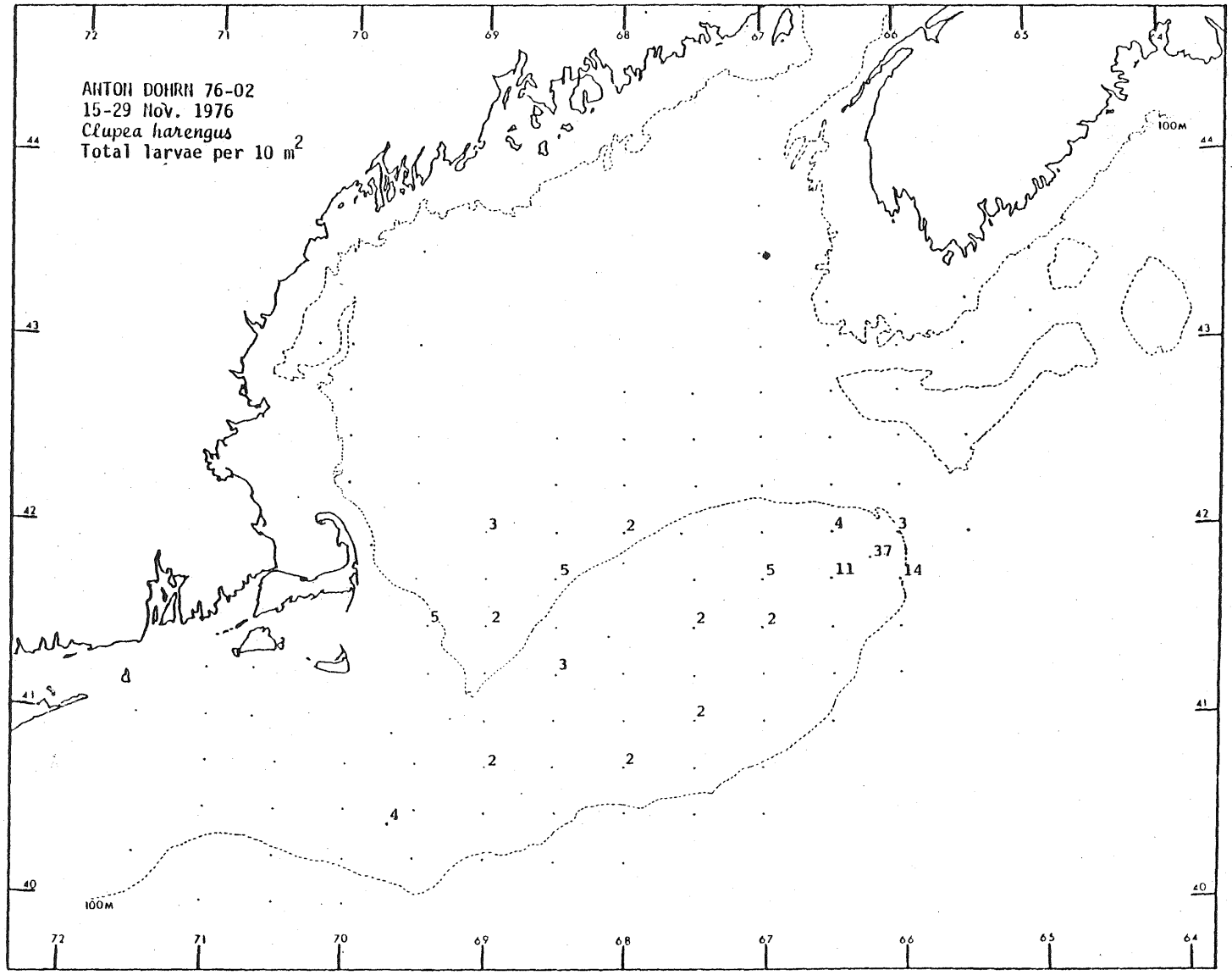

ANTON DOHRN 76-02
15-29 Nov. 1976
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
3
2
4
3
37
5
5
11
14
5
2
2
2
3
2
2
2
4

Figure 143.

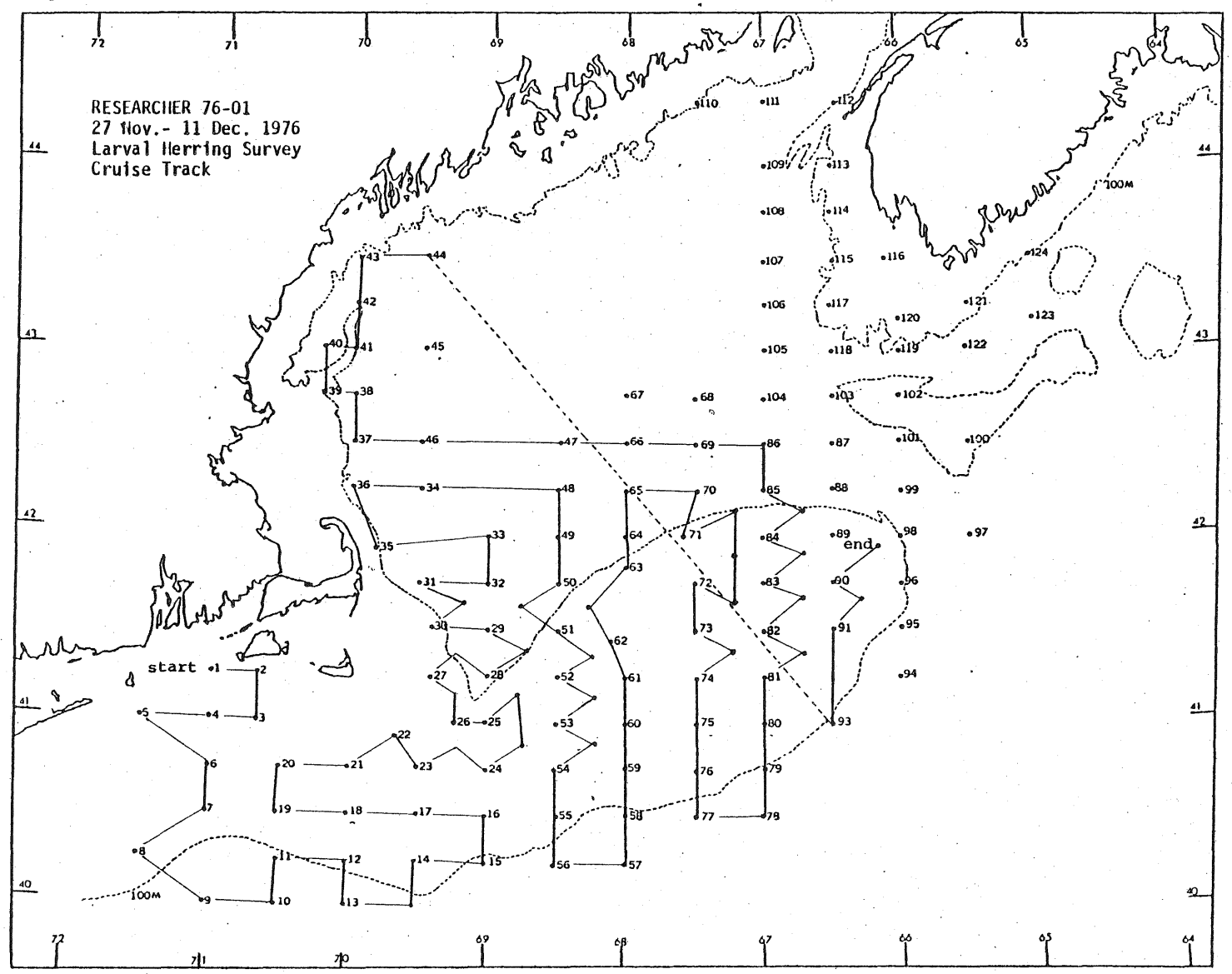

RESEARCHER 76-01
27 Nov.- 11 Dec. 1976
Larval Herring Survey
Cruise Track
start
end
100M

Figure 144.

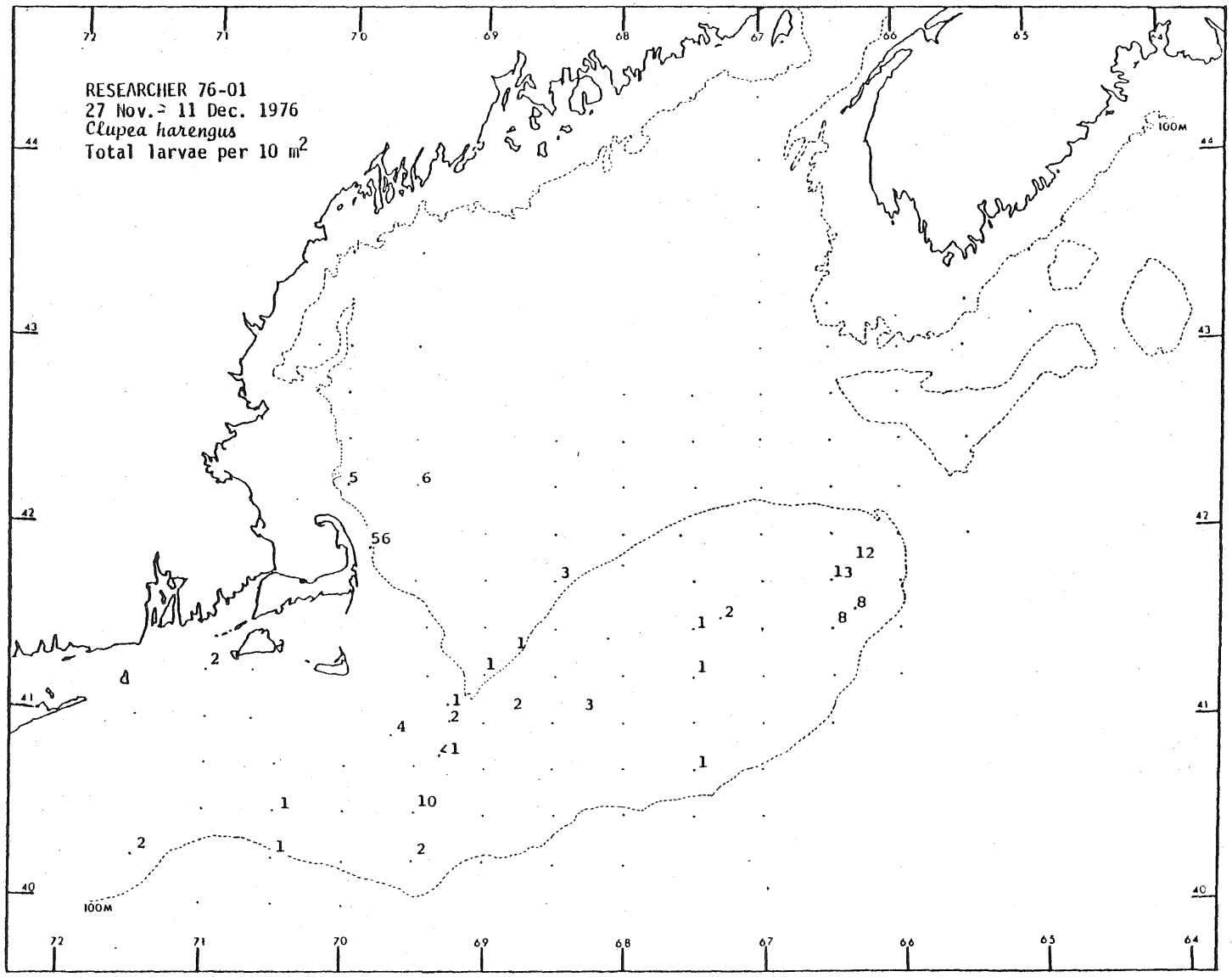

RESEARCHER 76-01
27 Nov.- 11 Dec. 1976
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 145.

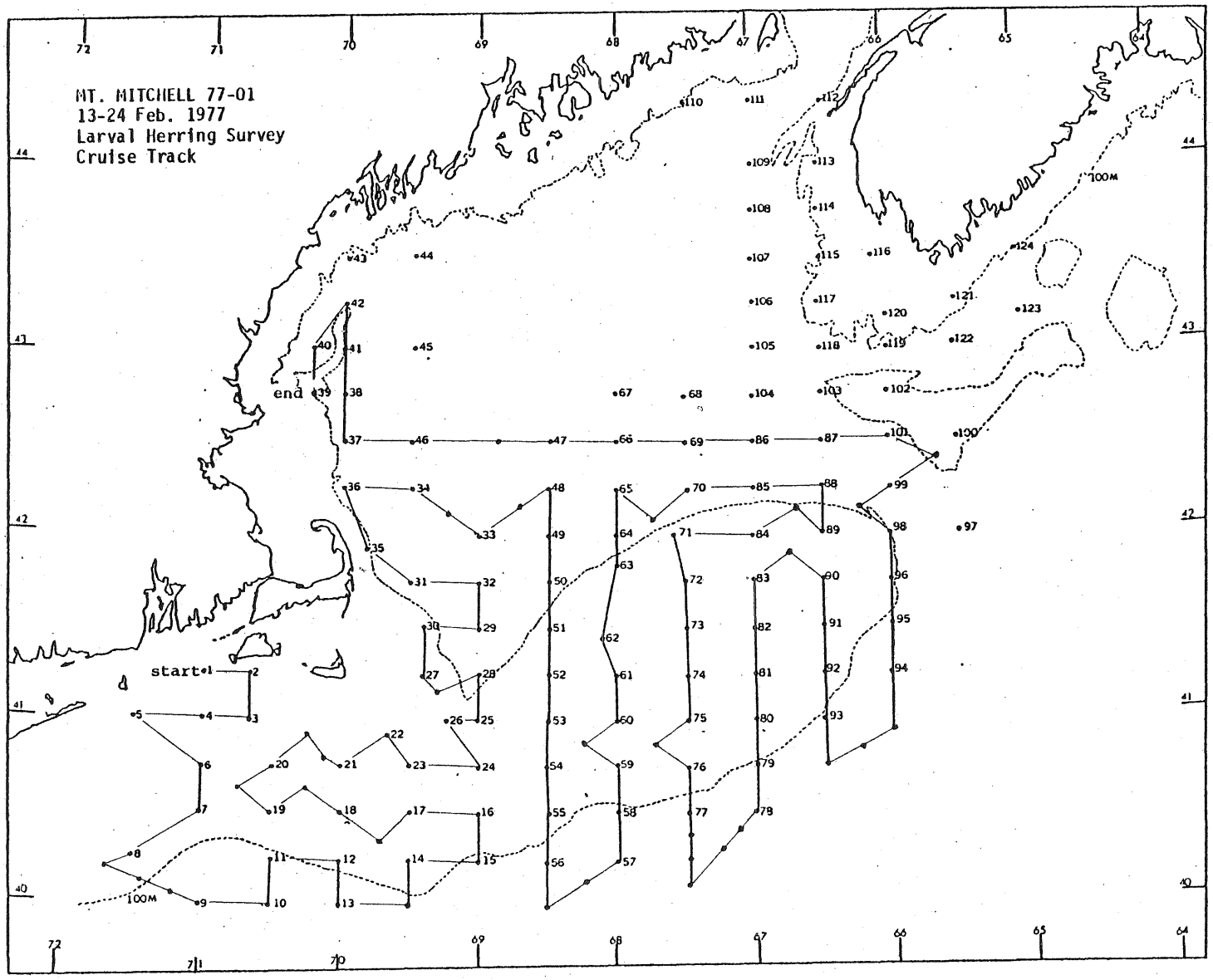

MT. MITCHELL 77-01
13-24 Feb. 1977
Larval Herring Survey
Cruise Track
start
end
100M

Figure 146.

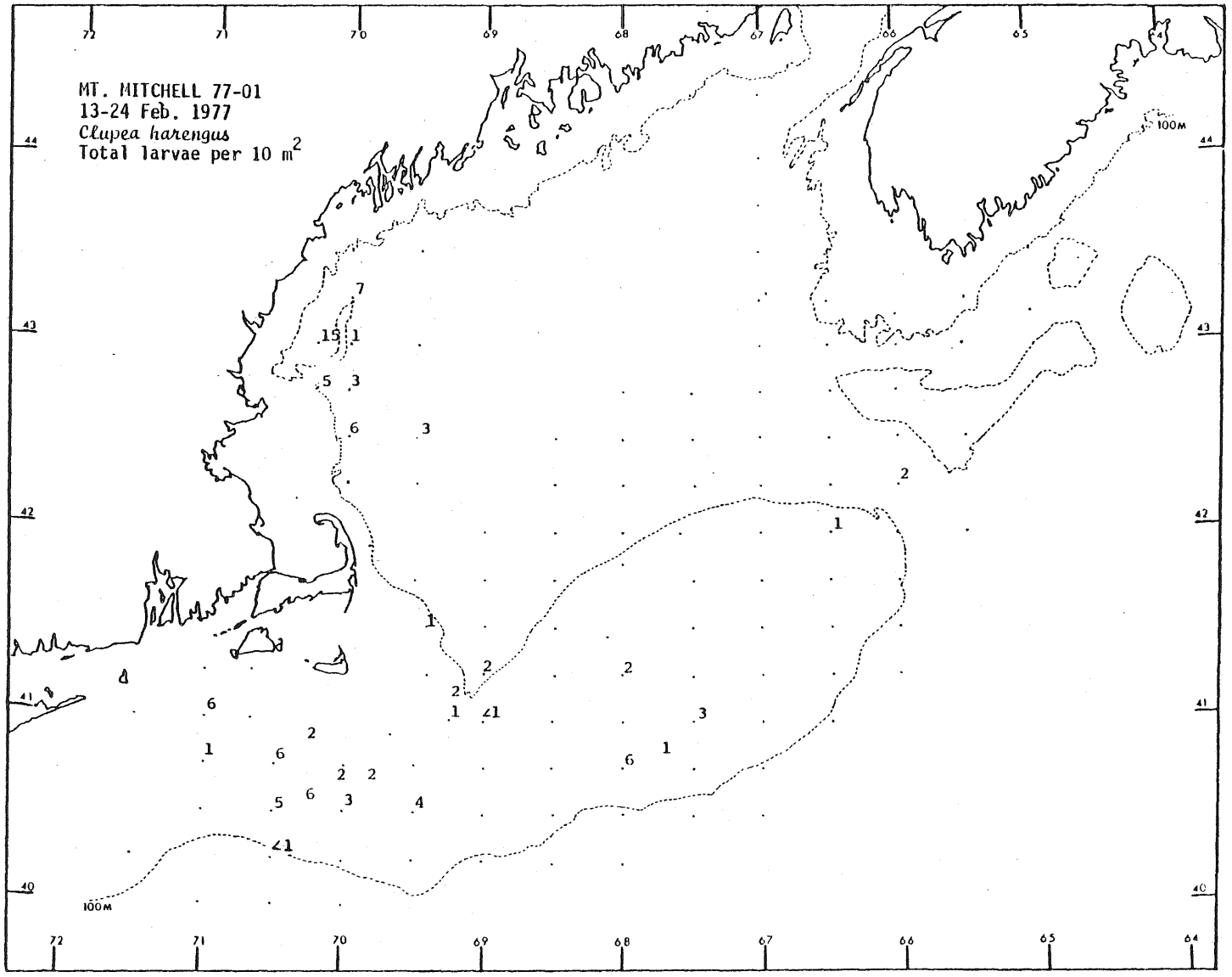

MT. MITCHELL 77-01
13-24 Feb. 1977
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 147.

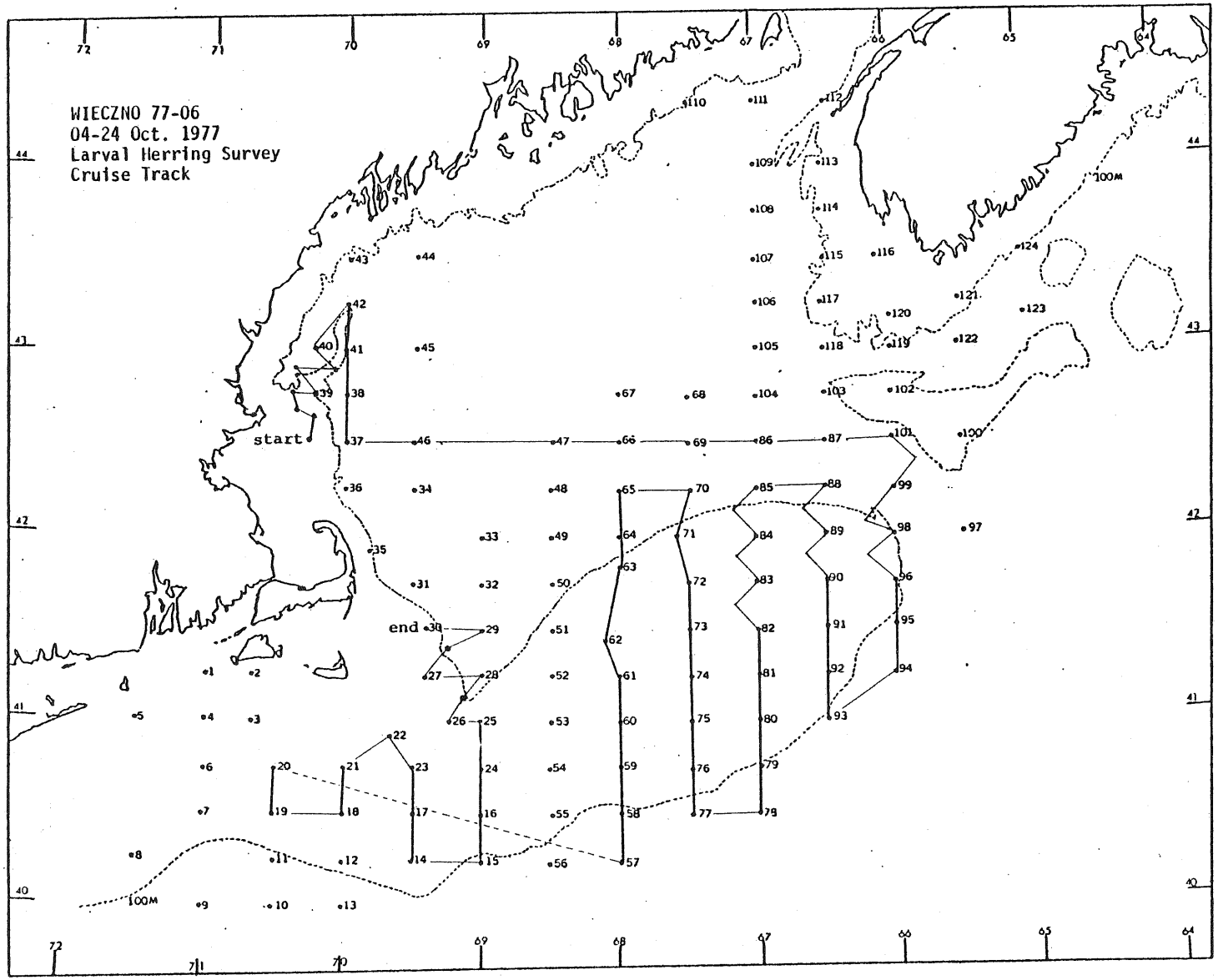

WIECZNO 77-06
04-24 Oct. 1977
Larval Herring Survey
Cruise Track
start
end
100M

Figure 148.

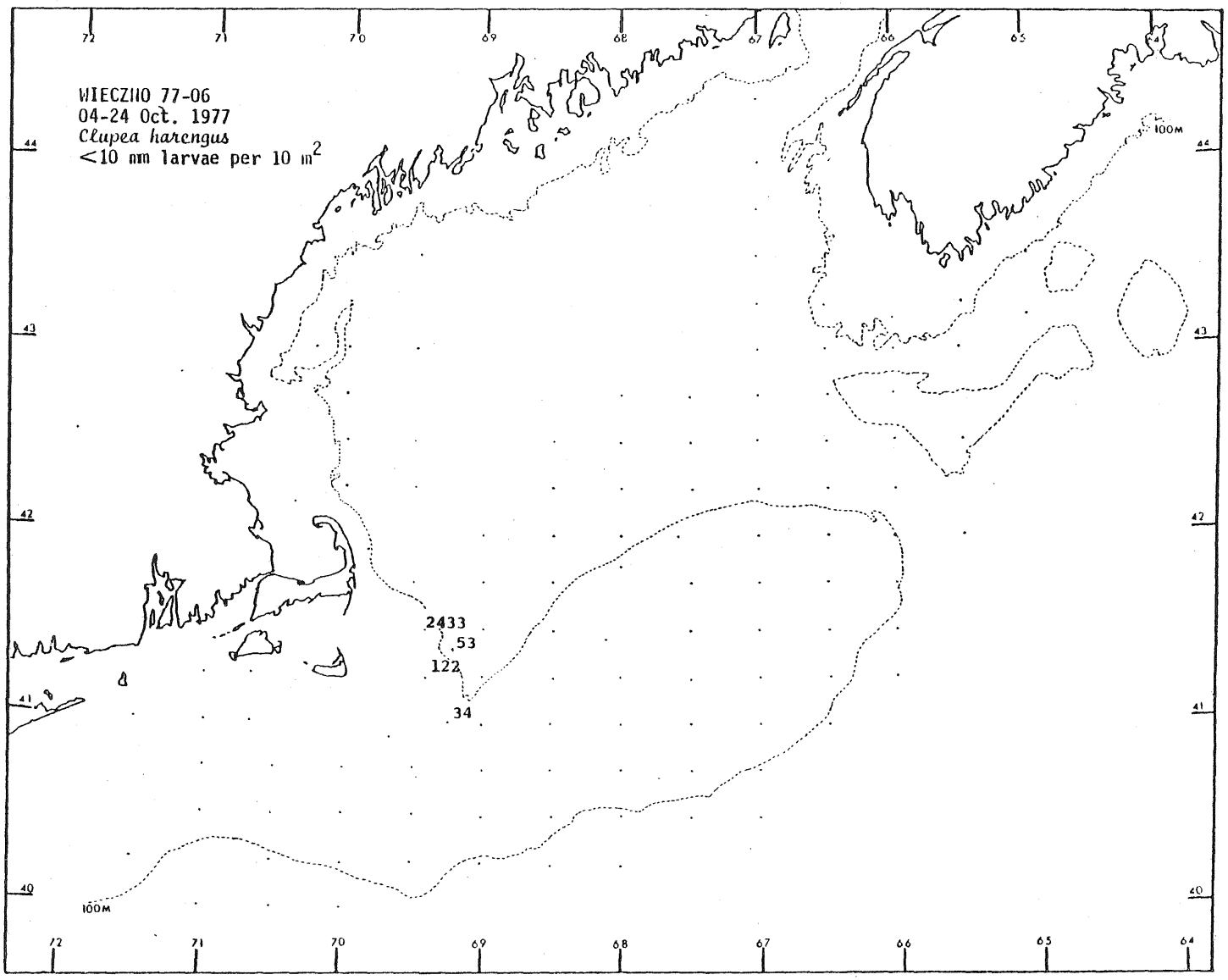

WIECZNO 77-06
04-24 Oct. 1977
Clupea harengus
<10 mm larvae per 10 m^2
2433
53
122
34
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 149.

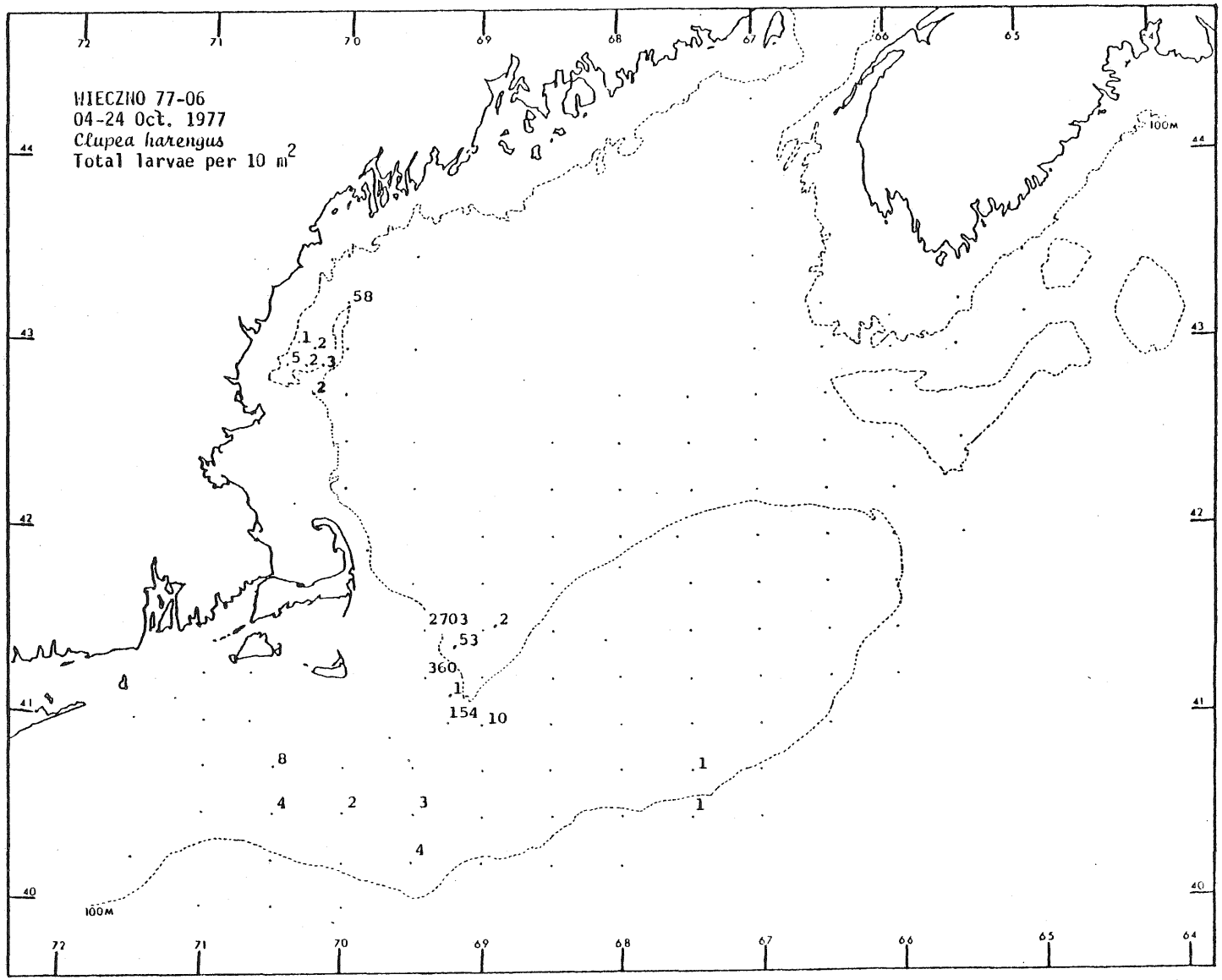

WIECZNO 77-06
04-24 Oct. 1977
Clupea harengus
Total larvae per 10 m2
100M
58
1
2
5
2
3
2
2703
2
53
360
1
154
10
8
4
2
3
4
1
1
100M

Figure 150.

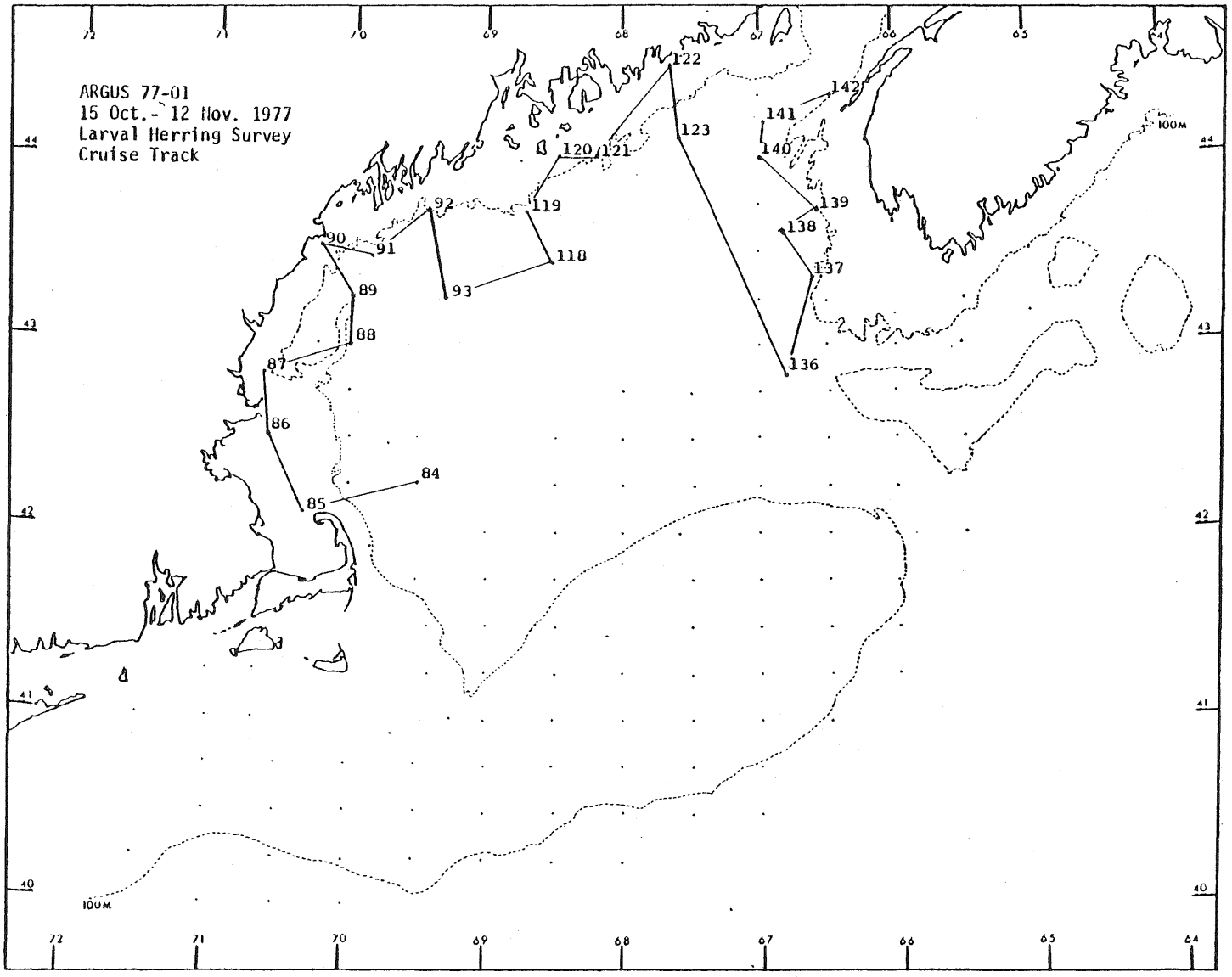

ARGUS 77-01
15 Oct.- 12 Nov. 1977
Larval Herring Survey
Cruise Track
100M
100M
84
85
86
87
88
89
90
91
92
93
118
119
120
121
122
123
136
137
138
139
140
141
142
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 151.

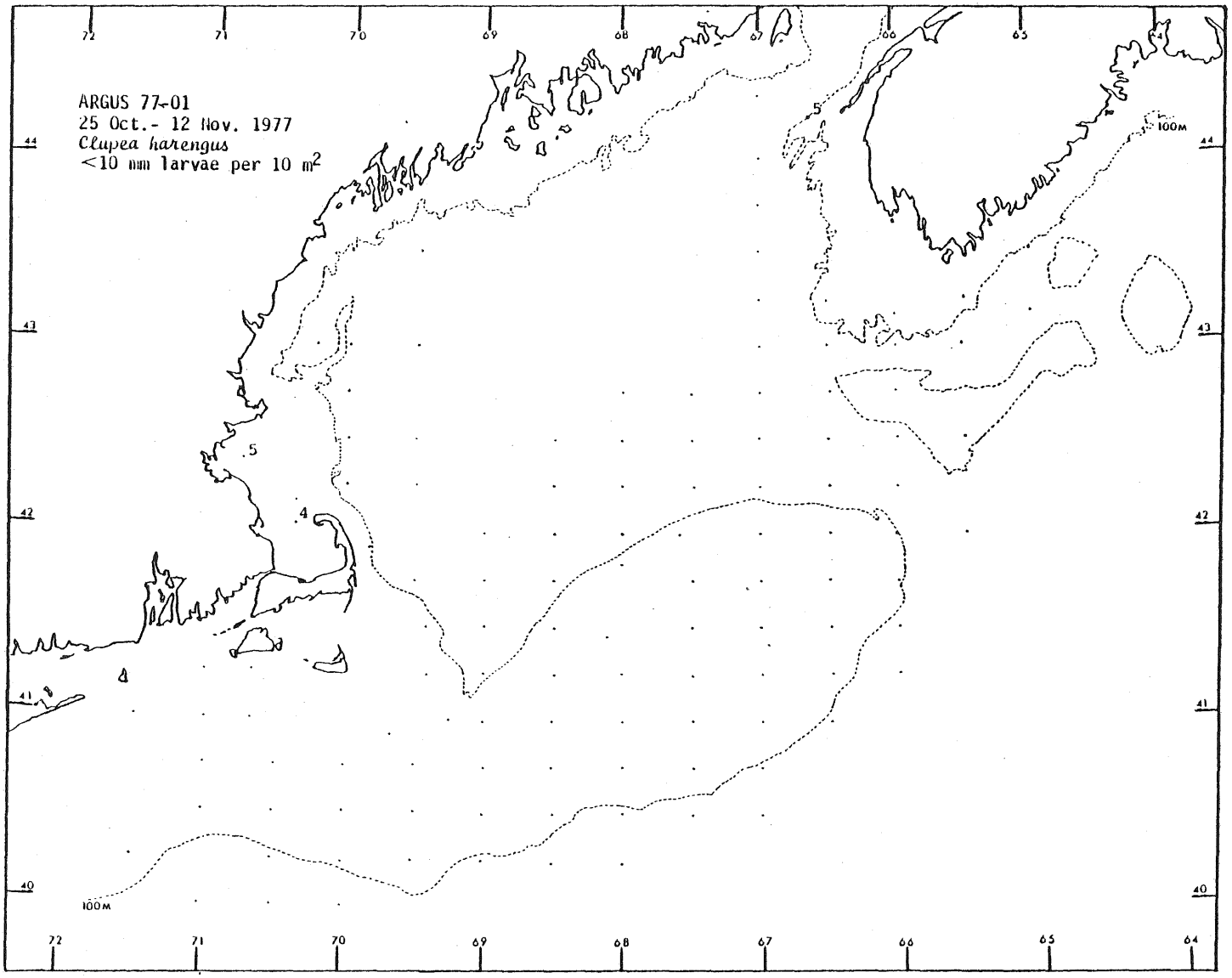

ARGUS 77-01
25 Oct.- 12 Nov. 1977
Clupea harengus
<10 mm larvae per 10 m2
100M
100M
.5
.4
.5
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 152.

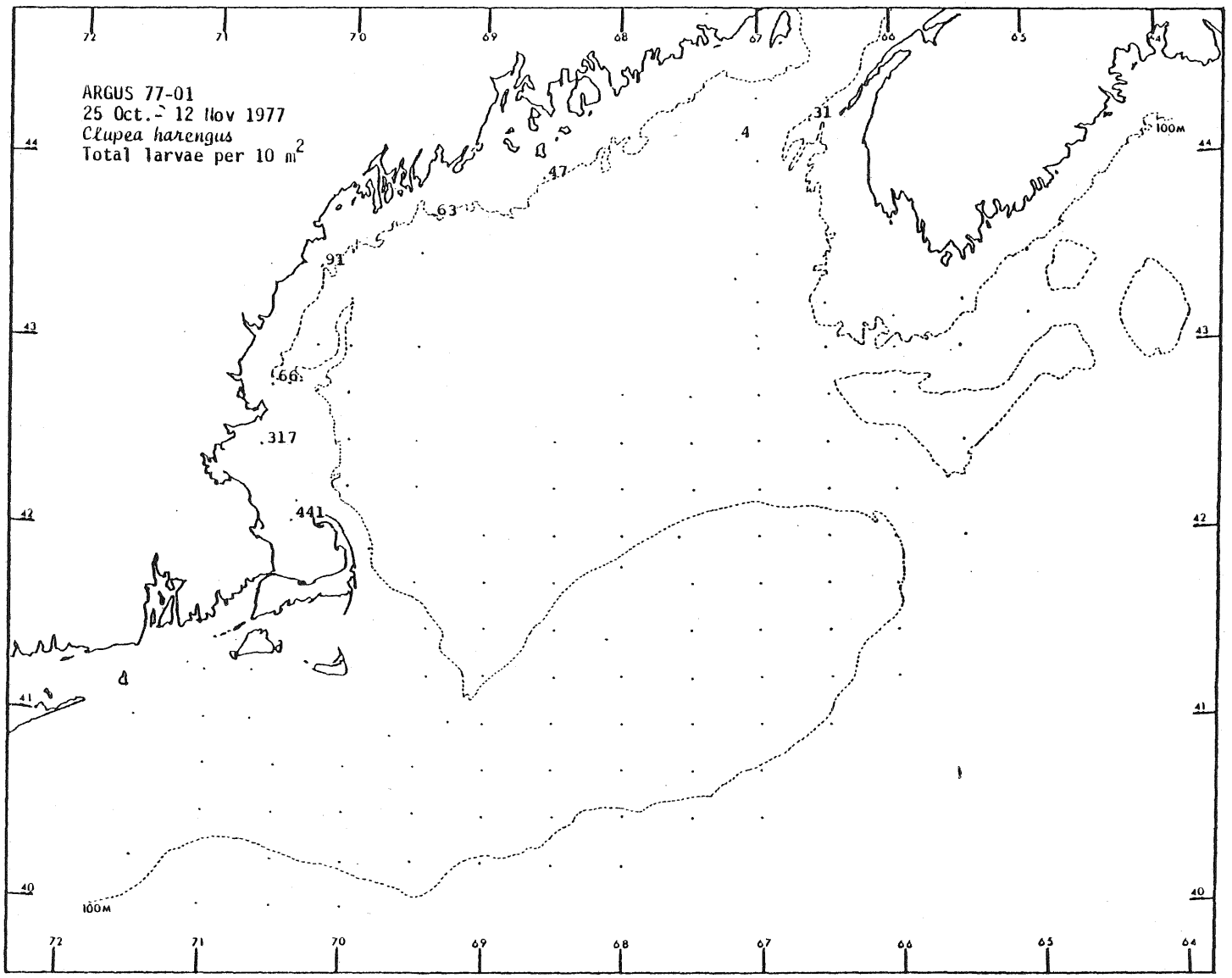

ARGUS 77-01
25 Oct.- 12 Nov 1977
Clupea harengus
Total larvae per 10 m2
72
71
70
69
68
67
66
65
64
44
43
42
41
40
31
4
47
63
91
66
317
441
100M

Figure 153.

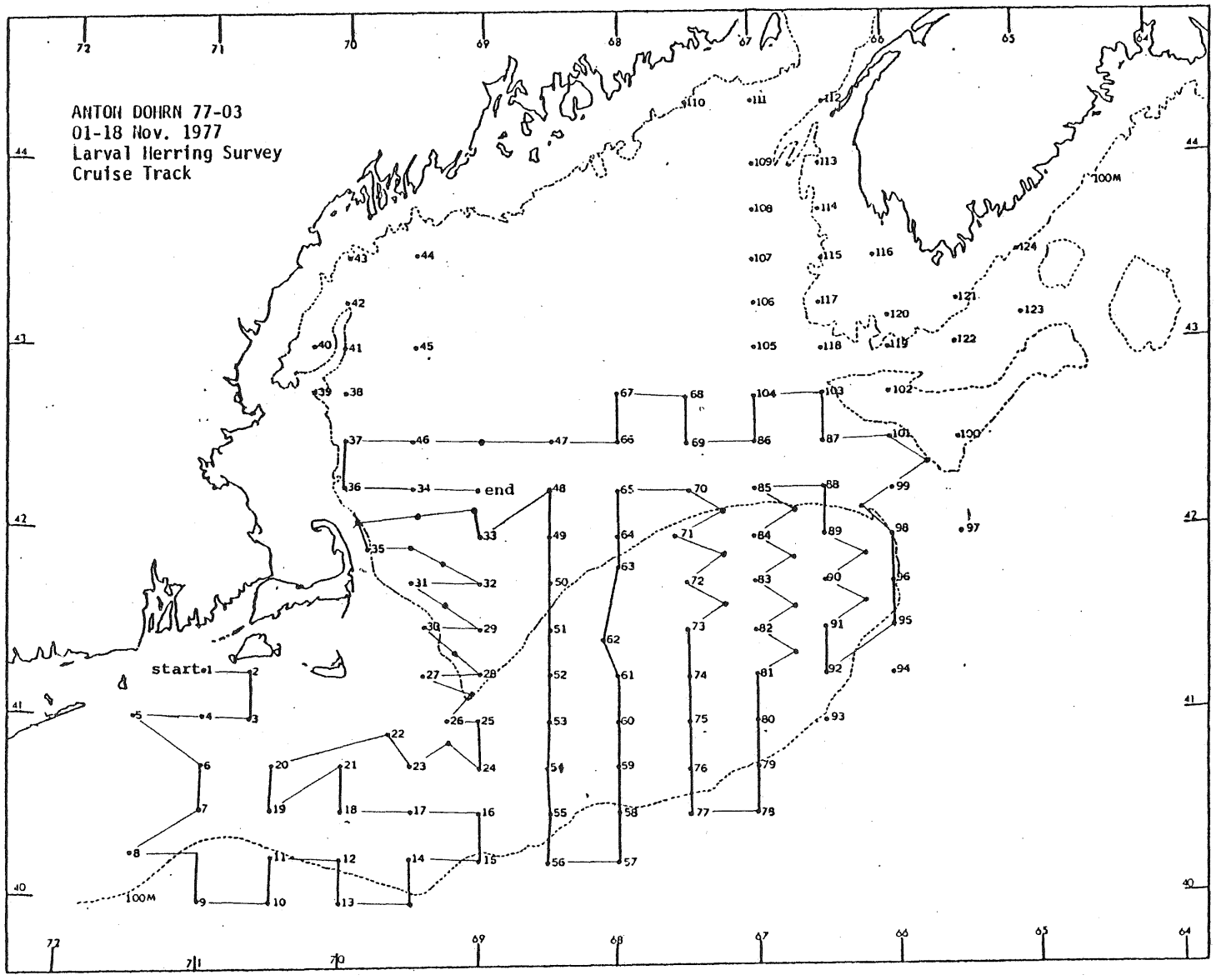

ANTON DOHRN 77-03
01-18 Nov. 1977
Larval Herring Survey
Cruise Track
start
end
100M

Figure 154.

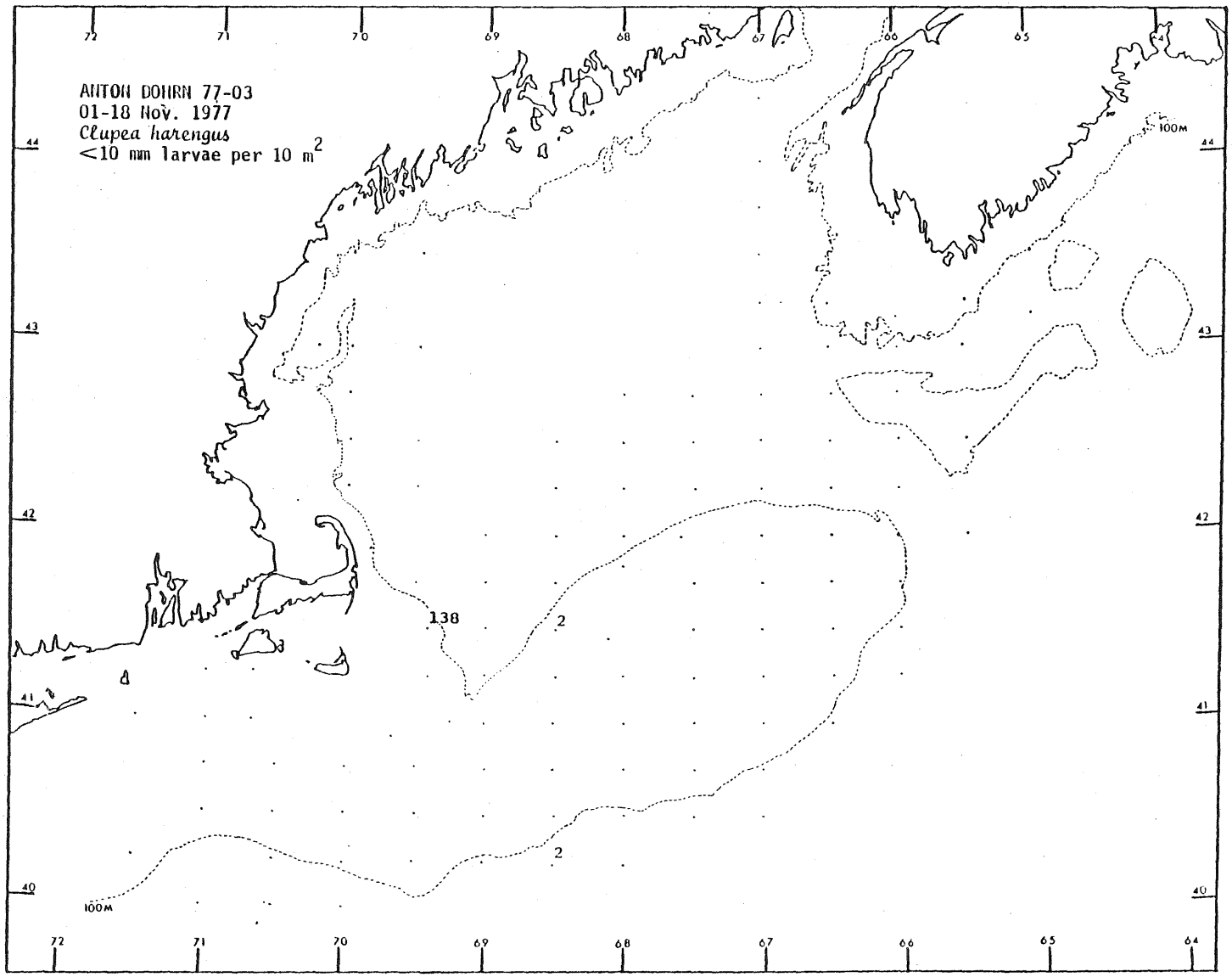

ANTON DOHRN 77-03
01-18 Nov. 1977
Clupea harengus
<10 mm larvae per 10 m2
138
2
2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40

Figure 155.

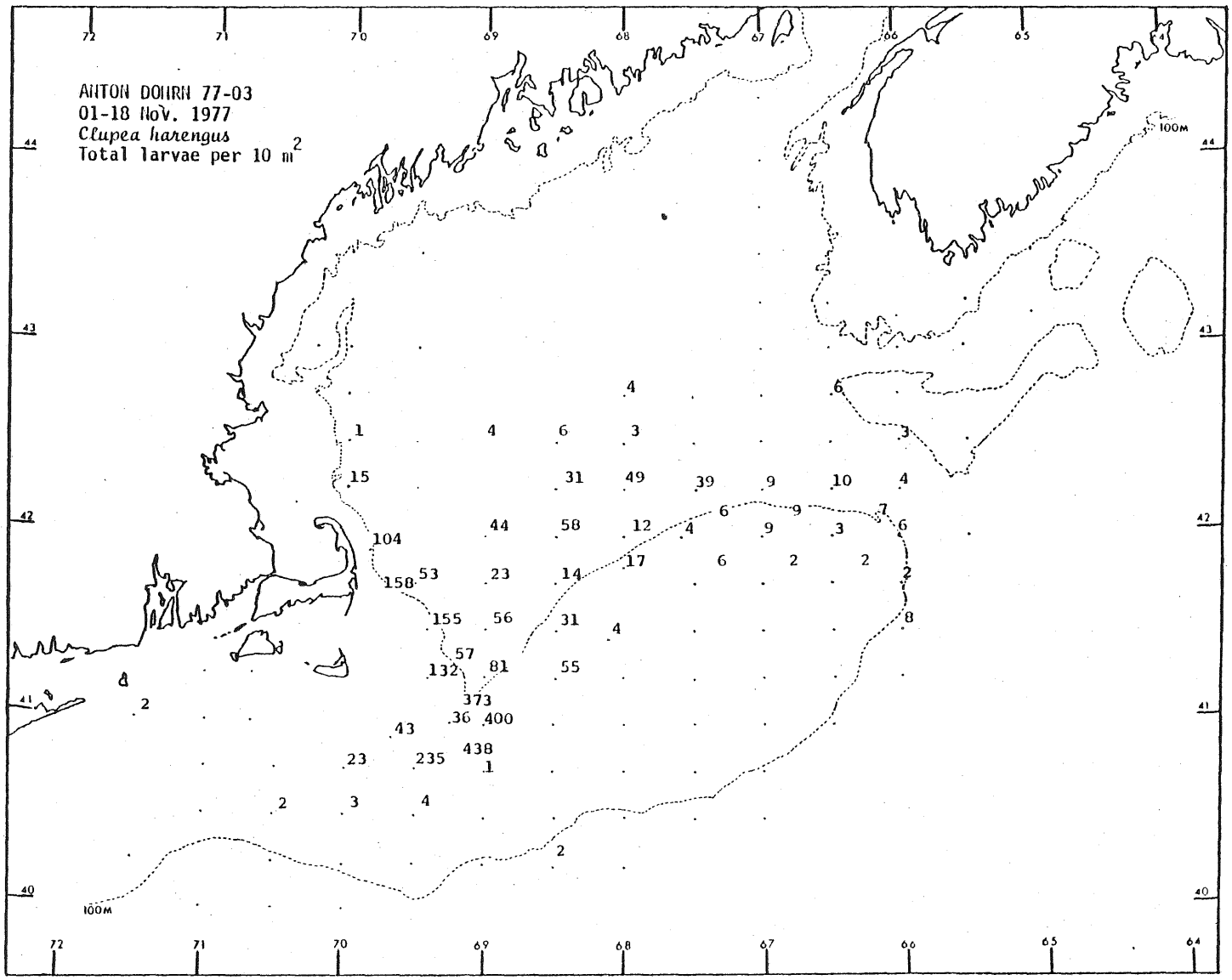

ANTON DOHRN 77-03
01-18 Nov. 1977
Clupea harengus
Total larvae per 10 m2
100M
100M

Figure 156.

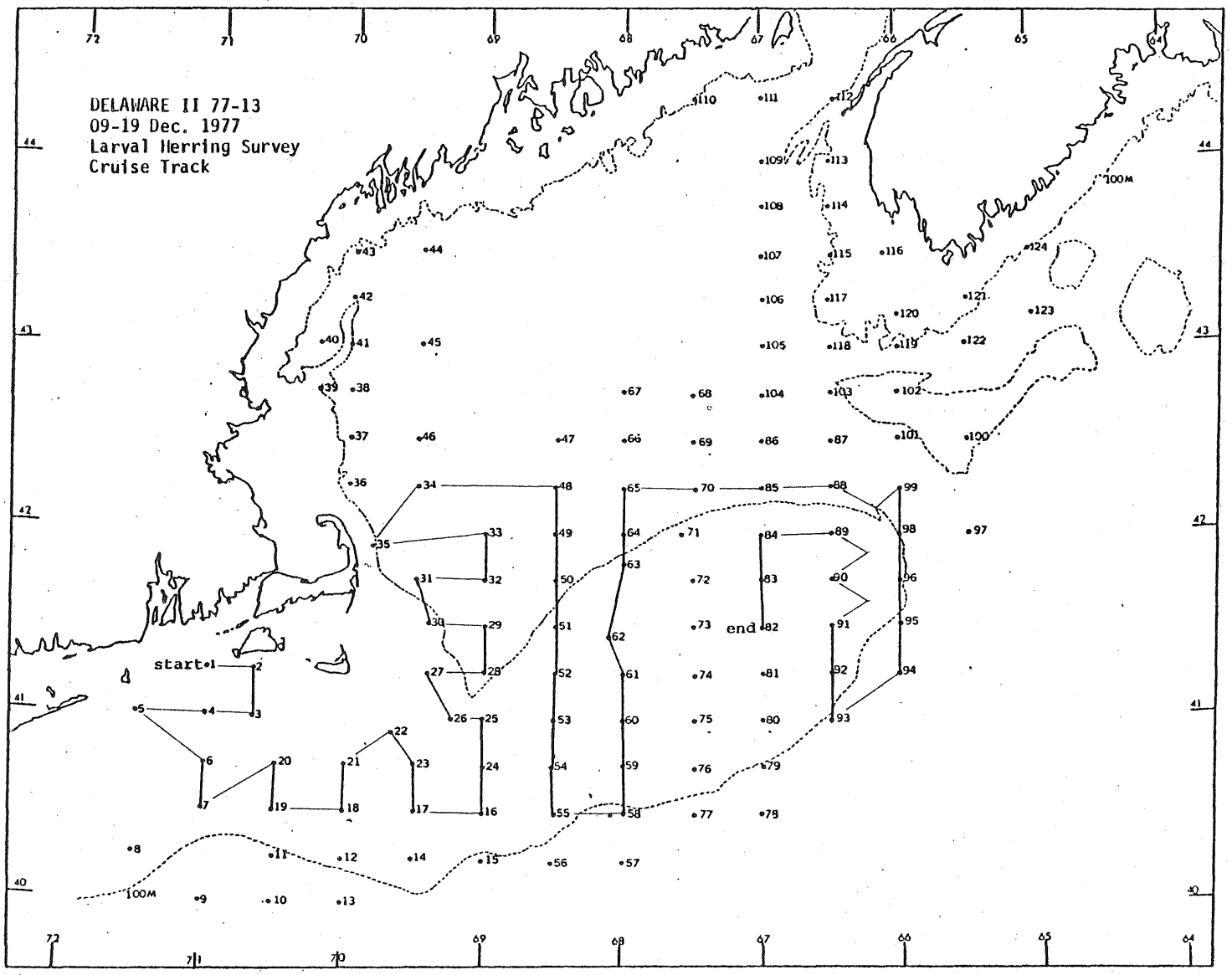

DELAWARE II 77-13
09-19 Dec. 1977
Larval Herring Survey
Cruise Track
start
end
100M

Figure 157.

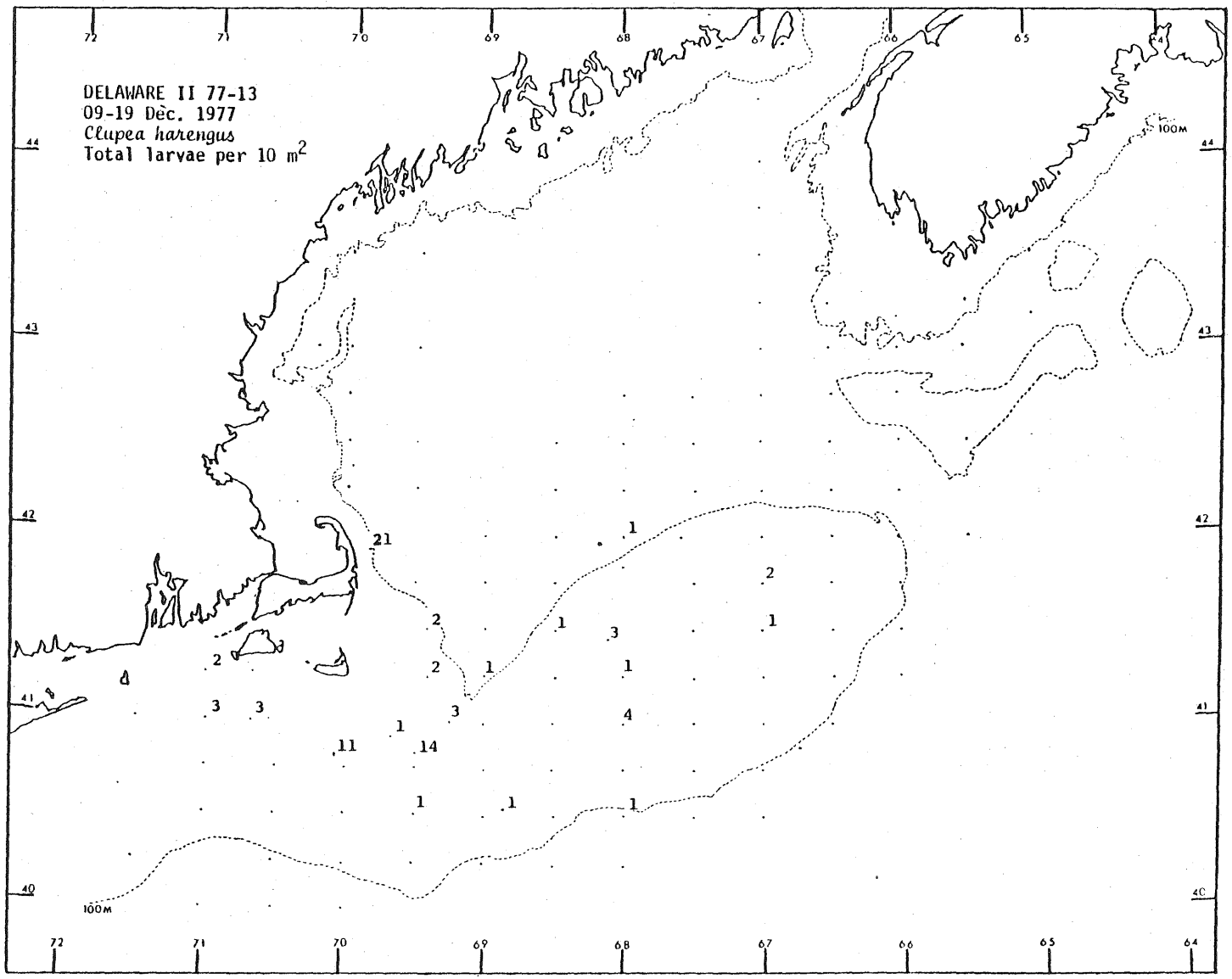

DELAWARE II 77-13
09-19 Dec. 1977
Clupea harengus
Total larvae per 10 m2
100M
100M
72
71
70
69
68
67
66
65
64
44
43
42
41
40
21
1
2
1
2
1
3
1
2
2
1
3
3
3
4
1
11
14
1
1
1

Figure 158.

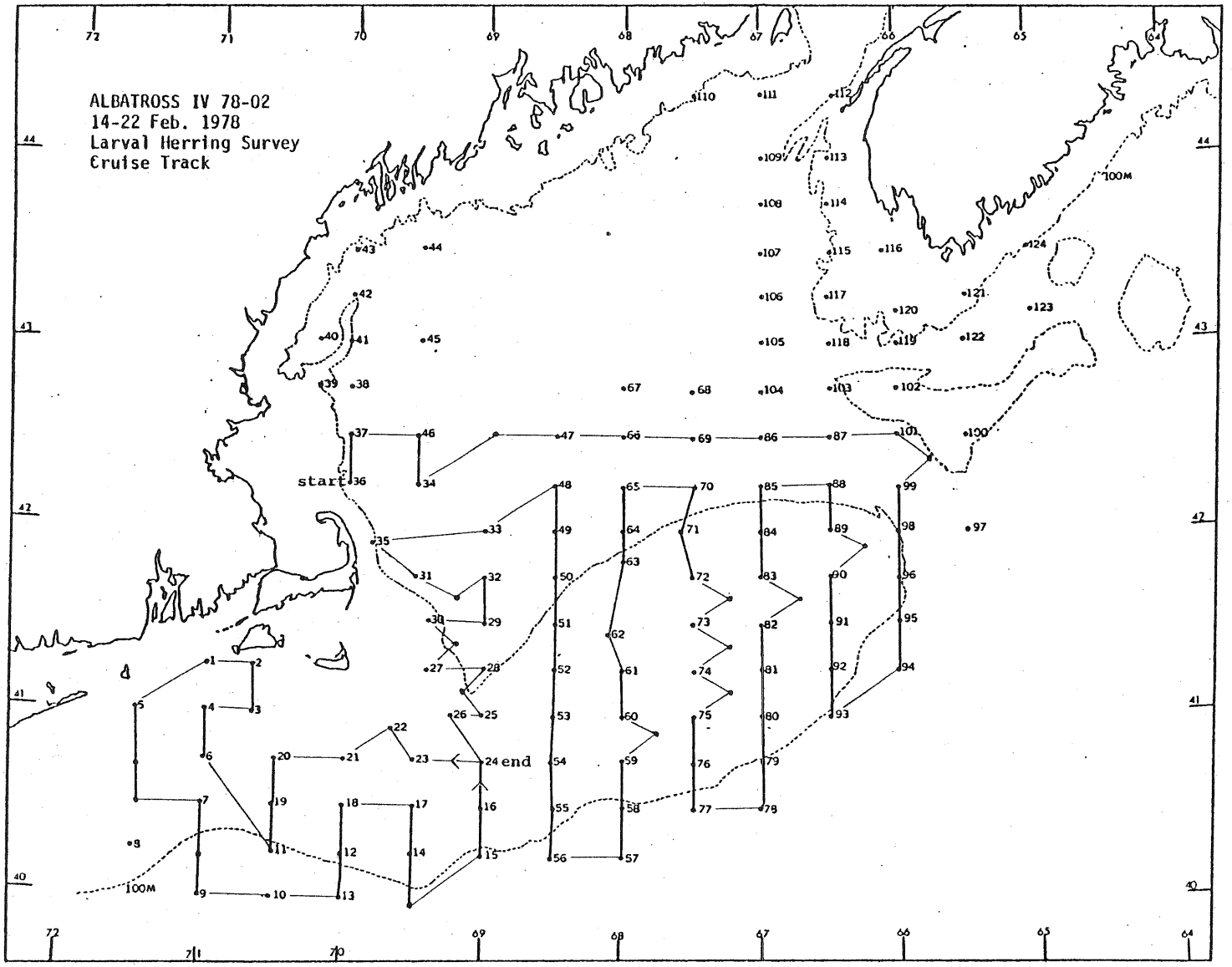
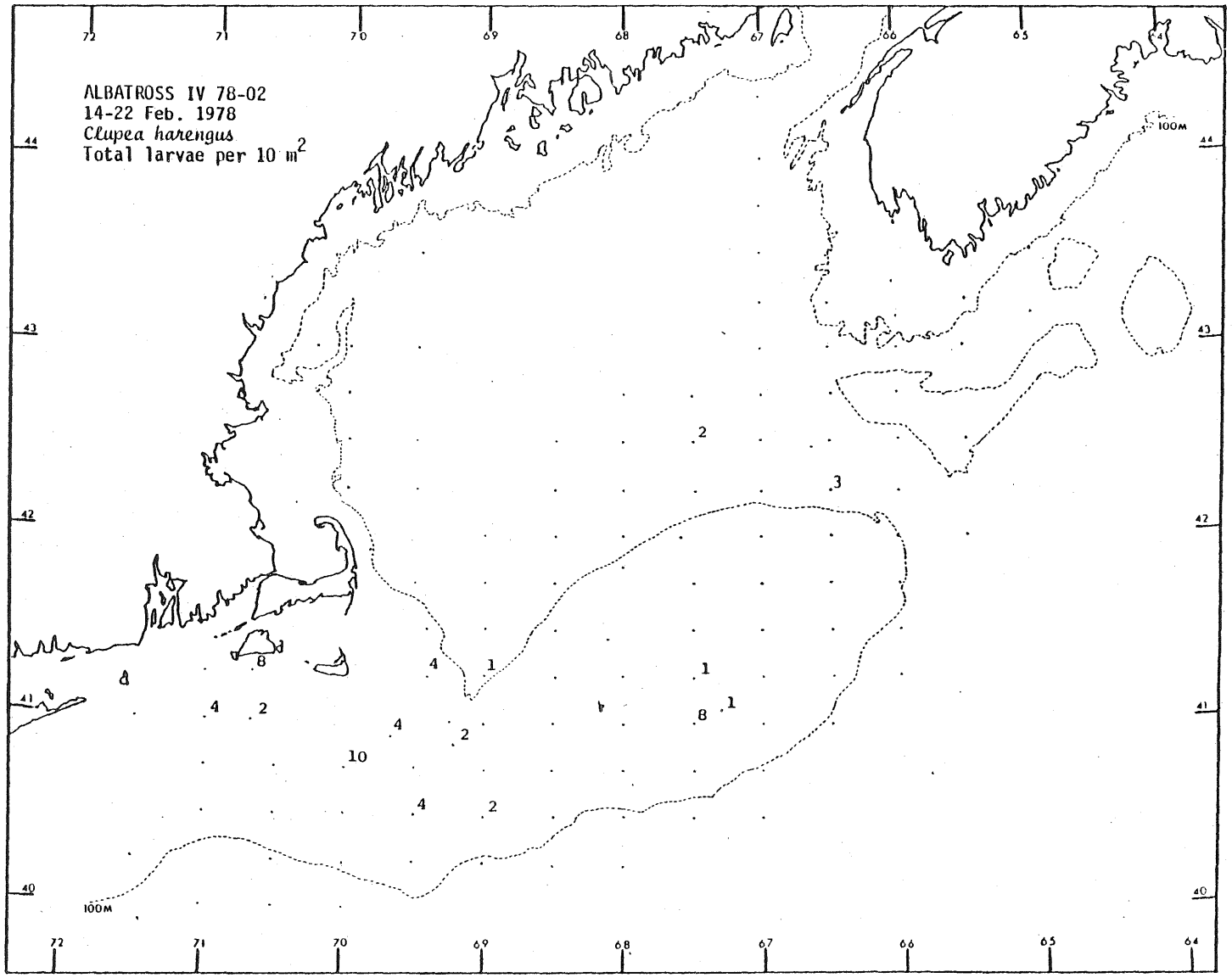

ALBATROSS IV 78-02
14-22 Feb. 1978
Larval Herring Survey
Cruise Track
start
end
100M
100M

Figure 159.


ALBATROSS IV 78-02
14-22 Feb. 1978
Clupea harengus
Total larvae per 10 m2
100M
100M