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Summary of Larval-Juvenile Surveys in November 1980 and January 1981 in Subarea 4

by

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Introduction

In recent years with the increased interest and importance of the squid (Illex illecebrosus) fishery, studies have concentrated on the collection of data to provide information on all stages of the life cycle of Illex. In 1979, a joint Canada/USSR research program resulted in locating a large number of larval and juvenile I. illecebrosus in oceanic water masses outside the Scotian Shelf (Amaratunga et al, 1980).

In September 1980, NAFO Scientific Council identified the need to repeat a similar but more comprehensive project for 1981 squid research (NAFO SCR.Doc. 80/1X/32). A multinational project was developed with the primary objective to elaborate that portion of the life cycle of Illex maturity and spawning, through larval and juvenile stages to recruitment, with emphasis on (a) timing and location of spawning and its possible relationship to physical and biological properties, and (b) larval and juvenile distribution and abundance in relation to these same factors.

With these objectives in mind, a joint Canada/USSR research program was carried out in November 1980 on the USSR research vessel *Argus*. This study investigated late season distribution of I. illecebrosus spawning stock and distributional patterns of larvae and juvenile (if present) in relation to warm and cold core eddies and other oceanographic characteristics from the Scotian

Shelf to the Sargasso Sea.

Another similar survey program was carried out in January and February 1981 on the Canadian RV Cameron, as a part of the multinational project developed by NAFO.

Materials and Methods

RTM *Argus* Cruise, November 1980

Leg 1 (Cruise 8009) consisted of a bottom trawl and Engle Midwater trawl (EMT) survey from Nov. 1-15 conducted along a pre-selected transect ru-ning southward from Halifax (Fig. 1). The bottom trawl stations were on the slope of the Scotian Shelf while EMT stations were chosen along a transect running southward through warm and cold core eddies into the Sargasso Sea. Stations were usually placed 60 nautical miles apart and when an eddy core was found, a station was made at the periphery and at the core of the eddy. The return transect, approximately 100 miles westward, used the same criteria.

On the edge of the Scotian Shelf, three bottom trawl sets were to be completed at 100, 200, and 400 m depths. At the shallowest and deepest bottom trawl station, an oblique bongo at 200 m, a standard hydrographic station for salinity and temperature, and an XBT cast was completed. Outside the shelf at each station, 4 EMT sets were completed at 50, 100, 300 and 500 m depths after the hydrographic stations. The hydrographic station involved taking salinity samples, using Nansen bottles, from the surface, 10, 20, 30, 50, 75, 100, 150, 200, 300, 400 and 500 m depths. Temperatures were recorded using reversing thermometers, and profiles were obtained from XBT casts. An oblique bongo at 200 m was made at each station.

Leg 2 (Cruise 8010) also consisted of a similar bottom trawl and EMT survey from Nov 16-Dec 1 conducted along a cruise track running eastward from Sable Island to the Grand Banks returning westward

to Browns Bank (Fig. 2). Bottom trawls were conducted on the continental slope and EMT stations were carried out through a series of warm and cold core eddies, approximately sixty nautical miles apart. Four EMT's on the return transect were more widely separated due to bad weather and time shortage.

All catches were sorted at sea for cephalopods, which were sampled and fixed for future laboratory analysis.

RV *A.T. Cameron* Cruise, January-February 1981

The first leg (No. 8101) of the cruise (January 24 - February 1, 1981) was scheduled to be an initial exploratory survey (a low resolution transect) extending through the coastal-slope-Gulf Stream-Sargasso Sea water complex to provide preliminary data on water masses in relation to Illex distribution.

EMT, bongo and hydrographic survey was conducted along a transect running southward from Halifax (Fig. 3) through two warm core eddies into the Sargasso Sea. An attempt was made to place stations within and between the various water masses and in the centre and periphery of available eddies.

At each station, standard water sampling using Knudsen bottles at 0, 10, 20, 30, 50, 75, 100, 150, 200, 300, 400, 500, 600, and 750 was frist made for salinity, temperature, dissolved O_2, and nutrients, and an XBT cast was completed. Oblique bongos at 50 and 200 m depths and 5 EMT sets at 50, 100, 300, 500 and 750 m depths were then completed. The second leg (No. 8102) of the cruise (February 13-16, 1981) was scheduled to leave February 4, 1981 but was delayed due to ship repairs and bad weather. Sampling began at the Scotian Shelf edge in a southerly direction into the oceanic water masses (Figure 4).

Results and Discussion

November 1980 *Argus* Cruise

Forty-two (42) sets were completed in leg 1 (40 EMT sets and 2 bottom trawl sets). Two of the 3 proposed bottom trawl sets were completed at the Shelf edge on the southward transect, but on the return transect no bottom trawl sets were done due to bad weather. Seven EMT stations were made on the transect southward and 3 stations on the return transect. Bad weather limited the number of EMT stations on the return transect.

No cephalopods were caught in the bottom trawl sets while 752 specimens were caught in the EMT. They belonged to thirteen families (Table 1) mainly from the Enoploteuthidae and Ommastrephidae families. Of the 102 specimens from the family Ommastrephidae, only 8 were identified as Illex sp. Three of these were caught at 50m and 5 at 100m depths, at temperature and salinities ranging from 19.68-22.27°C and 36.25-36.61ppm respectively.

Ten bottom trawls and 36 EMT sets (9 stations) were completed in leg 2. The first 2 bottom trawls were test runs to adjust the doors on the bottom trawl. Illex caught in these 2 sets (7 Kg) were sampled for observations on maturity only. On the next 2 sets only 2 depth strata were surveyed as suitable bottom could not be found at 400 m. Bottom trawls on Sable Island Bank and the tip of Grand Bank produced little or no Illex (1 or 2) while larger catches were obtained in the LaHave Bank and Basin area (Table 2). Nine Illex were caught in the EMTs, 8 at 500 m (1 at Stn 14 and 7 at Stn 16) and 1 at 300 m depth (Stn 16).

Illex caught in the bottom trawls had a mean length of 206.0mm while those from the EMT's had a mean length of 230.0mm. The percent maturity stages for both the B.T. and EMTs are given in Table 3.

Specimens from 8 cephalopod families (Table 4) were caught in the EMT sets mainly from the family Enoploteuthidae.

Bongo plankton samples are still to be analyzed. Temperature and salinity profiles were plotted (Figures 5 and 6).

January-February 1981 *A.T. Cameron* Cruise

Five (5) stations were completed during Leg 1. Only a hydrographic station (excluding XBT) was not made on station 5 due to bad weather. Four of these stations were completed on the southward transect and only one on the return transect. Bad weather limited the number of EMT stations completed during the cruise.

Twenty cephalopod specimens from 6 families were caught in leg 1 and 2 (Table 5). Only 1 Illex illecebrosus was caught at 100 m depth at Stn 5 which was located in the shelf waters. The station recorded 7.2°C at 100 m.

Five stations were completed during Leg 2 but only 3 hydrographic station were completed. Cephalopod specimens from leg 2 are included in Table 5.

Table 1. List of cephalopods caught during Cruise 8009 on *RV Argus* during 1-16 November 1980

Order	Family	Species	Number Specimens
Cephalopoda (class)			1
Decapoda			1
Teuthoidea			14
Oegopsida			6
	Chiroteuthidae	Chiroteuthis sp.	2
	Cranchiidae		5
		Cranchia scabra	4
		Leachia sp.	9
	Taoniinae (sub family)		3
		Helicocranchia sp.	2
		Megalocranchia sp.	4
		Taonius sp.	2
	Enoploteuthidae		21

Table 1 Continued

Order	Family	Species	Number Specimens
	Enoploteuthinae (sub family)		107
		Abraliopsis sp.	110
		Abraliopsis pfefferi	70
		Abralia sp.	38
		Abralia veranyi	1
		Abralia redfieldi	63
		Enoploteuthis onapsis	7
		Enoploteuthis sp.	6
		Enoploteuthis leptura	2
	Pyroteuthinae (sub family)		6
		Pterygioteuthis sp.	2
		Pterygioteuthis giardi	5
		Pterygioteuthis gemmata	21
		Pyroteuthis sp.	10
		Pyroteuthis magaritifera	48
	Gonatidae		1
		Gonatus sp.	1
		Gonatus fabriici	1
	Gonatidae		1
		Gonatus sp.	1
		Gonatus fabriici	1
	Histioteuthidae	Histioteuthis corona corona	1
		Histioteuthis reversa	3
		Histioteuthis sp.	1
	Lycoteuthidae		2
		Selenoteuthis scintillans	34
	Mastigoteuthidae	Mastigoteuthis sp.	1
	Octopoteuthidae	Octopoteuthis sp.	5
	Ommastrephidae		43
	Illiciinae (sub family)	Illex sp.	5
	Ommastrephinae (sub family)		6
		Ornithoteathis antillarium	43
		Hyaloteuthis pelagica	2
	Onychoteuthidae		4
		Onychoteuthis banksi	9
		Onykia carribea	9
Octopoda			3
	Octopodidae		2
		Octopus sp.	1
	Bolitaenidae		1
	Allopsidae		1

Table 2. Numbers of *Illex* caught in the bottom trawl survey in leg 2 of *Argus* cruise; Nov. 16 - Dec. 1, 1980.

Area	Station	Depth	Total Catch(kg)	*Illex* Catch(kg)	# *Illex*
Sable Island Bank	3	165	372.8	0.5	2
	4	240	45.8	0.5	2
Grand Bank	10	335	521.0	1.0	4
	11	205	275.2	-	-
	12	103	265.0	-	-
LaHave Bank	17	210	17.0	-	-
	18	160	321.2	17.2	85
LaHave Basin	19	225	242.2	12.2	59

Table 3. Percentage maturity stages of male and female *Illex* caught during Argus cruise (leg 2), Nov. 16 - Dec. 1, 1980.

	Stage *	Percentage in Bottom Trawl	Percentage in EMT
Males			
	1	7.6	-
	2	49.0	-
	3	43.4	100.0
Females			
	1	11.1	-
	2	46.3	25.0
	3	40.7	75.0
	4	1.9	-

* Maturity stages as defined in Amaratunga and Durward, 1979.

Table 4. List of cephalopods caught during Cruise 8010 on *RTM Argus* during 17 November-1 December 1980.

Order	Family	Species	Number Specimens
Teuthoidea			2
Oegopsida	Chiroteuthidae	Chiroteuthis lacertosa	2
	Cranchiidae	Teuthowenia megalops	1
	Enoploteuthinae (sub family)		2
		Abraliopsis pfefferi	20
		Abraliopsis sp.	60
		Abralia sp.	1
	Pyroteuthinae (sub family)	Pterygioteuthis sp.	1
		Pyroteuthis margaritifera	3
	Histioteuthidae		2
	Octopoteuthidae		2
		Octopoteuthis sp.	3
	Onychoteuthidae	Onychoteuthis banksi	1
	Ctenopterygidae	Ctenopteryx sicula	1
	Lepidoteuthidae		2
	Brachioteuthidae	Brachioteuthis sp.	6

Table 5. List of cephalopods caught during Cruise 8101 on *A.T. Cameron* during 24 January-1 February 1981.

Order	Family	Species	Number Specimens
Teuthoidea	Chiroteuthidae	Chiroteuthis lacertosa	3
		Chiroteuthis sp.	1
	Pyroteuthinae (sub family)	Pyroteuthis margarifera	5
		Brachioteuthis sp.	1
	Histioteuthidae	Histioteuthis reversa	1
		Histioteuthis bonnellii	1
	Gonatidae	Gonatus sp.	1
		Gonatus fabricii	2
	Ommastrephidae Illicinae (sub family)	Illex sp.	1
	Enoploteuthinae (sub family)	Enoploteuthis anopsis	1
	Lycotenthidae	Selenoteuthis scintillans	1
	Octopoteuthidae	Octopoteuthis sp.	1
Octopoda	Allopudae	Allopus mallis	1

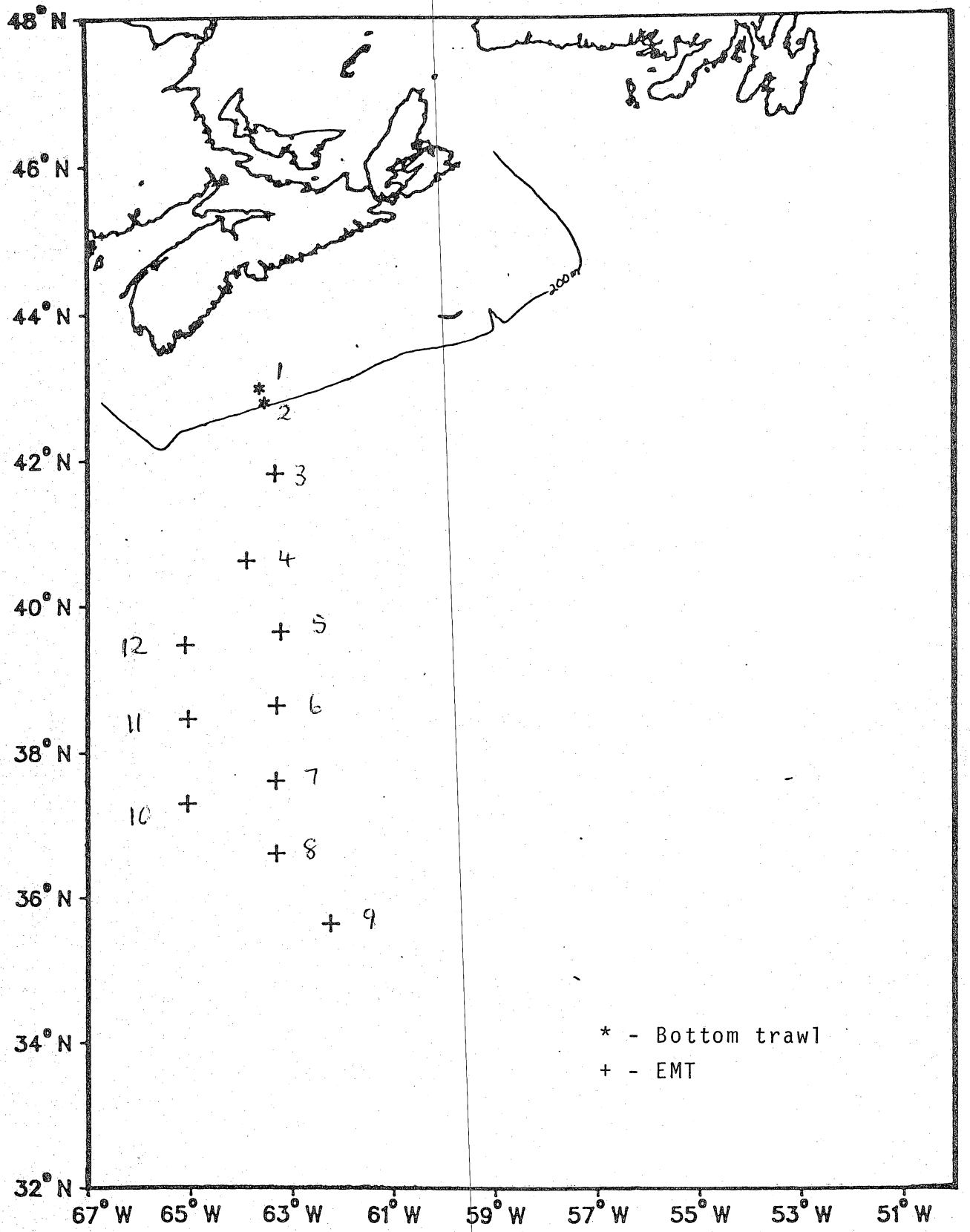


Figure 1. Cruise track of stations surveyed during *Argus* Cruise (8009), 1-15 November 1980.

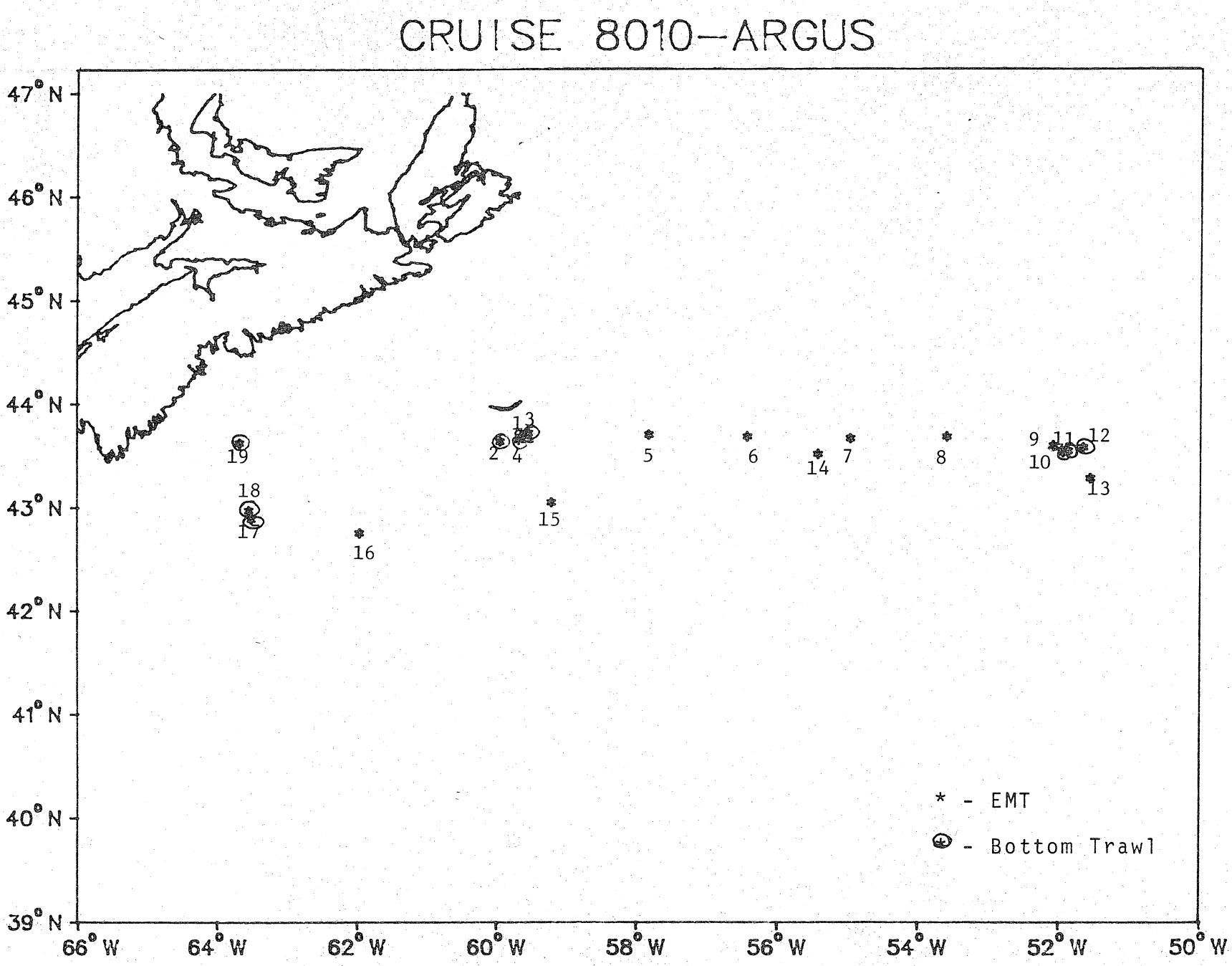


Figure 2. Cruise track of station surveyed during Cruise 8010 on *RTM Argus*, 16 November-1 December 1980.

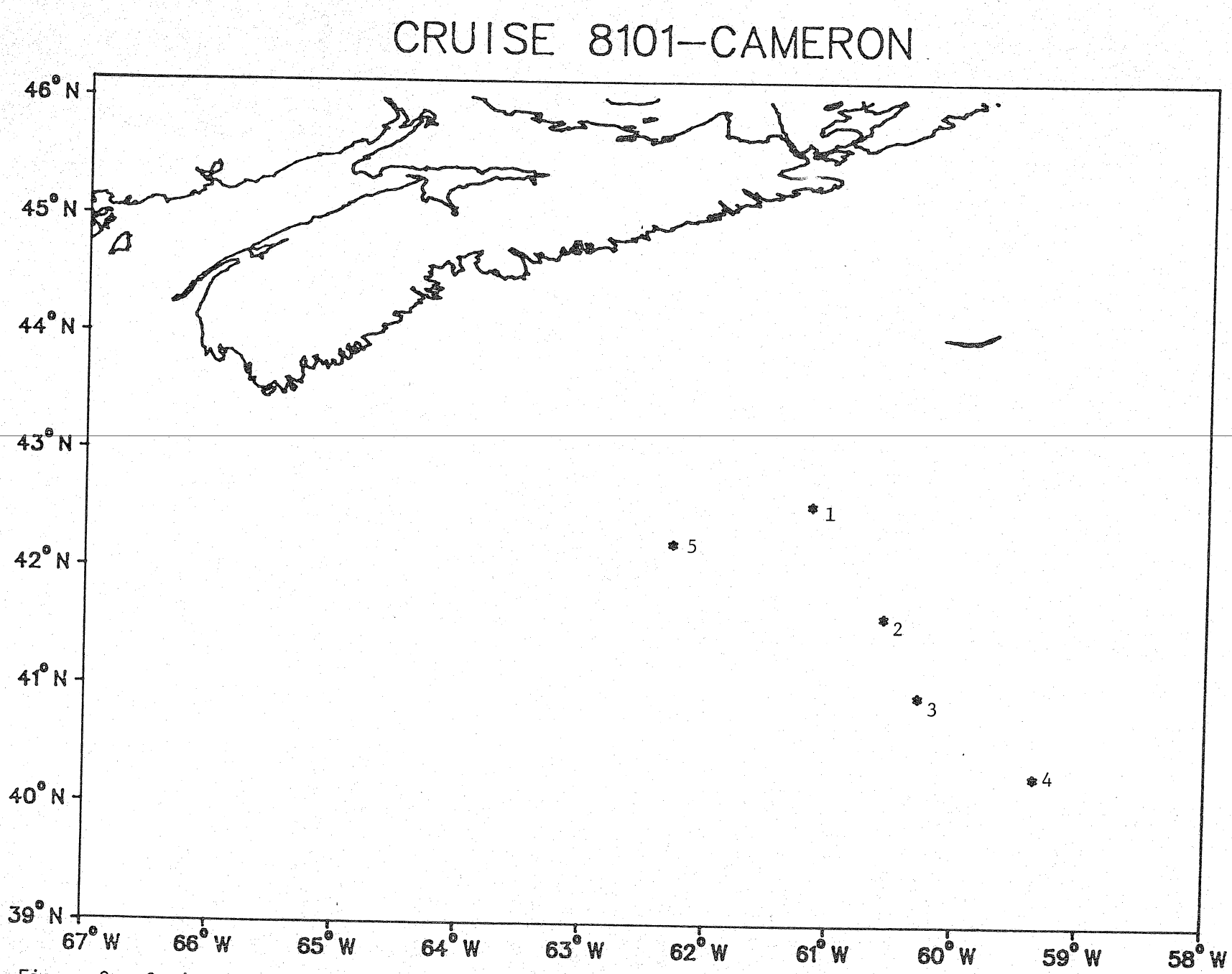


Figure 3. Cruise track of stations surveyed during Cruise 8101 on RV *A.T. Cameron*, 24 January-1 February 1981.

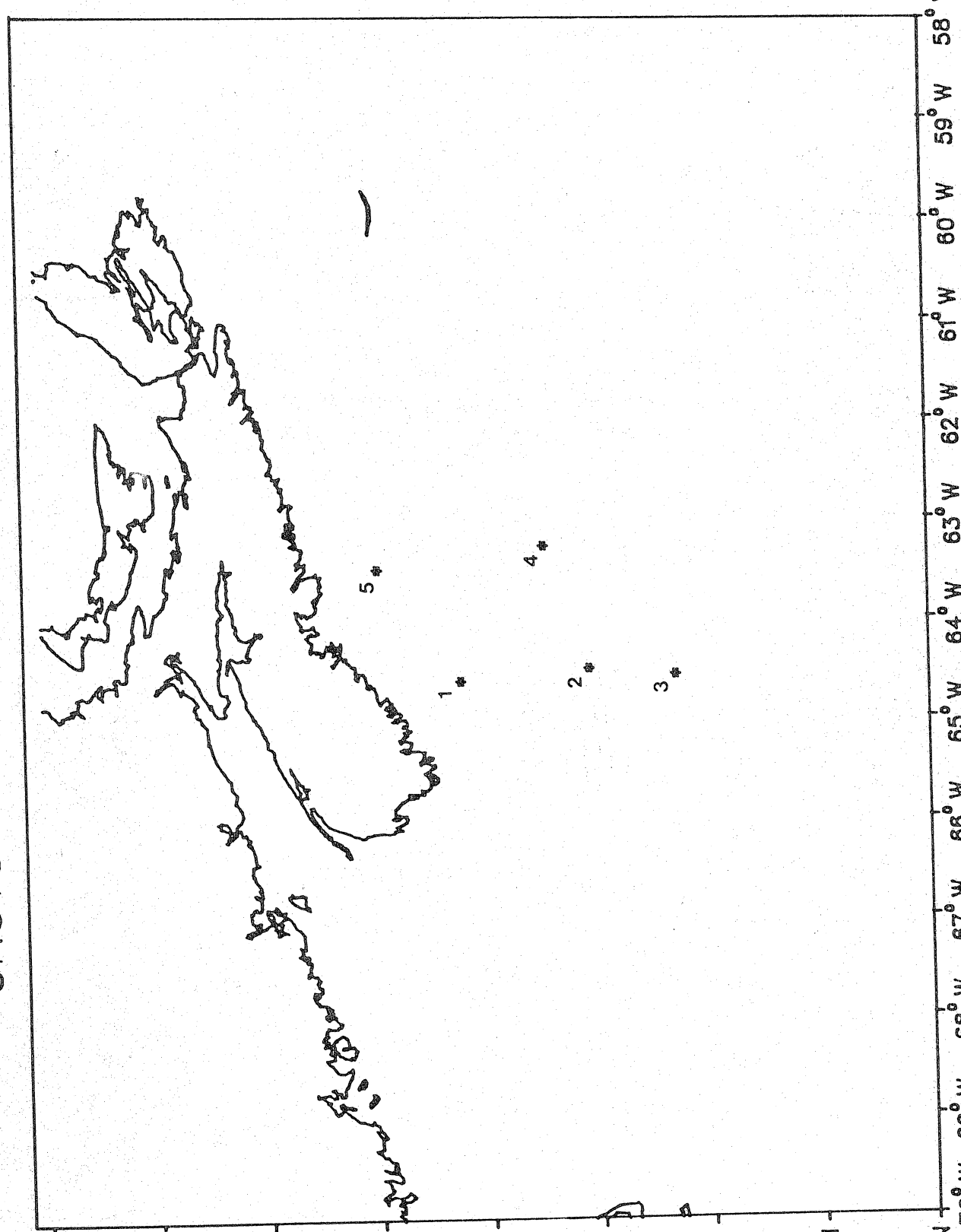


Fig. 4. Cruise track (leg 2) of *A.T. Cameron*, 13-16 February 1981.

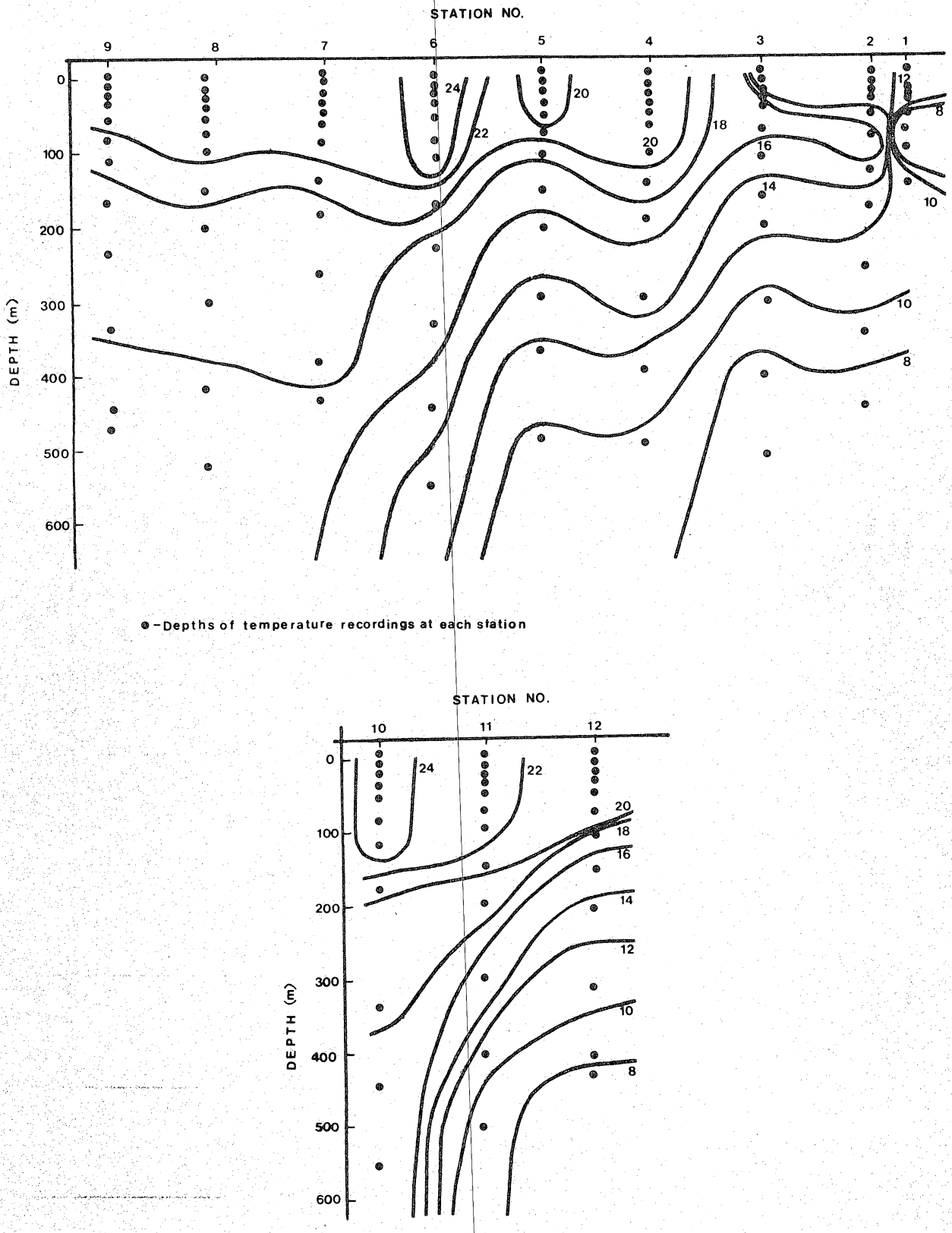
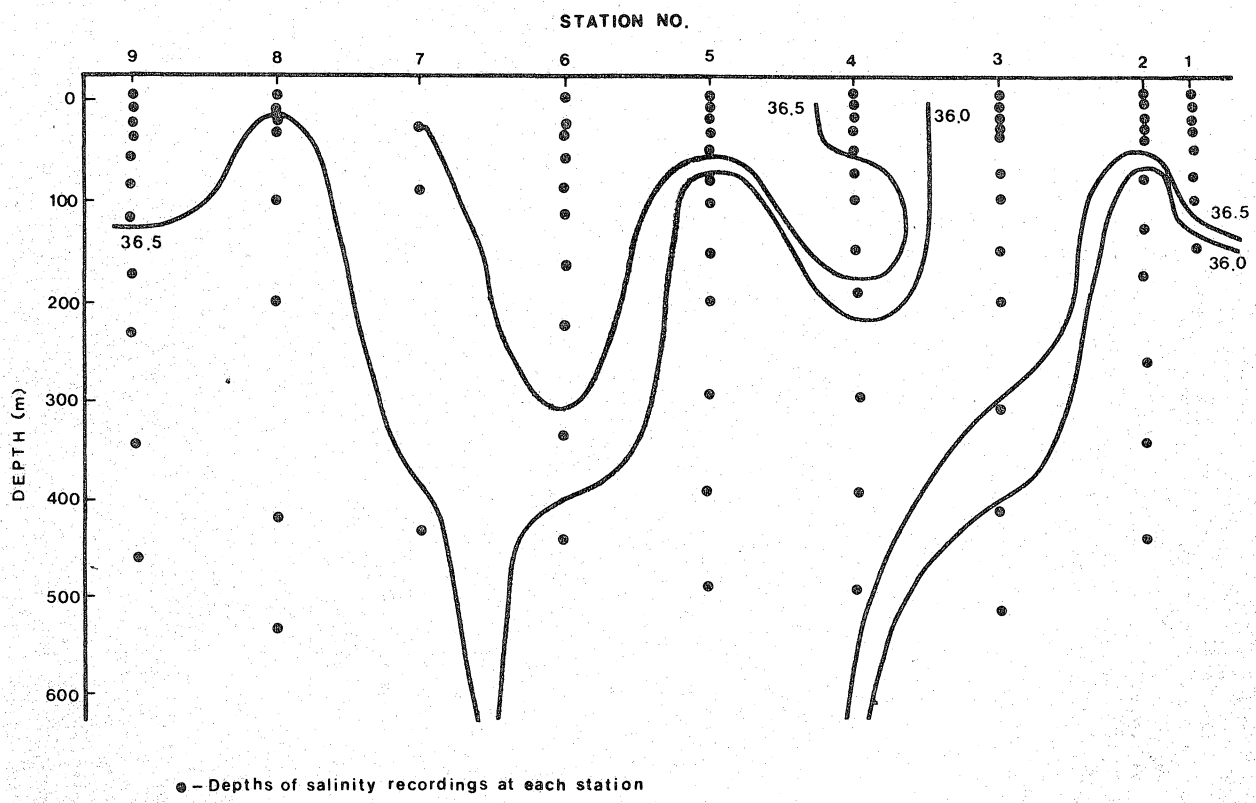


Fig. 5a. Temperature profiles at stations surveyed during Cruise 8009 of RTM Argus, 1-15 November 1980.



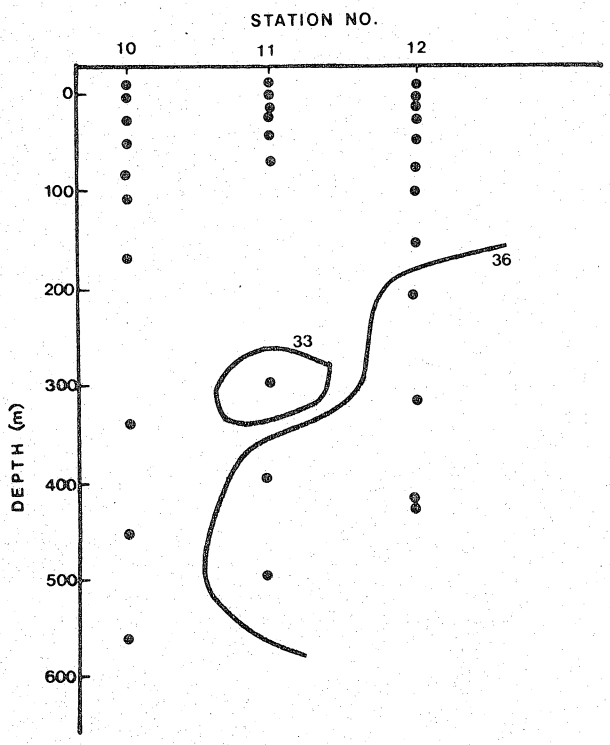


Fig. 5b. Salinity profiles at stations surveyed during Cruise 8009 of RTM Argus, 1-15 November 1980.

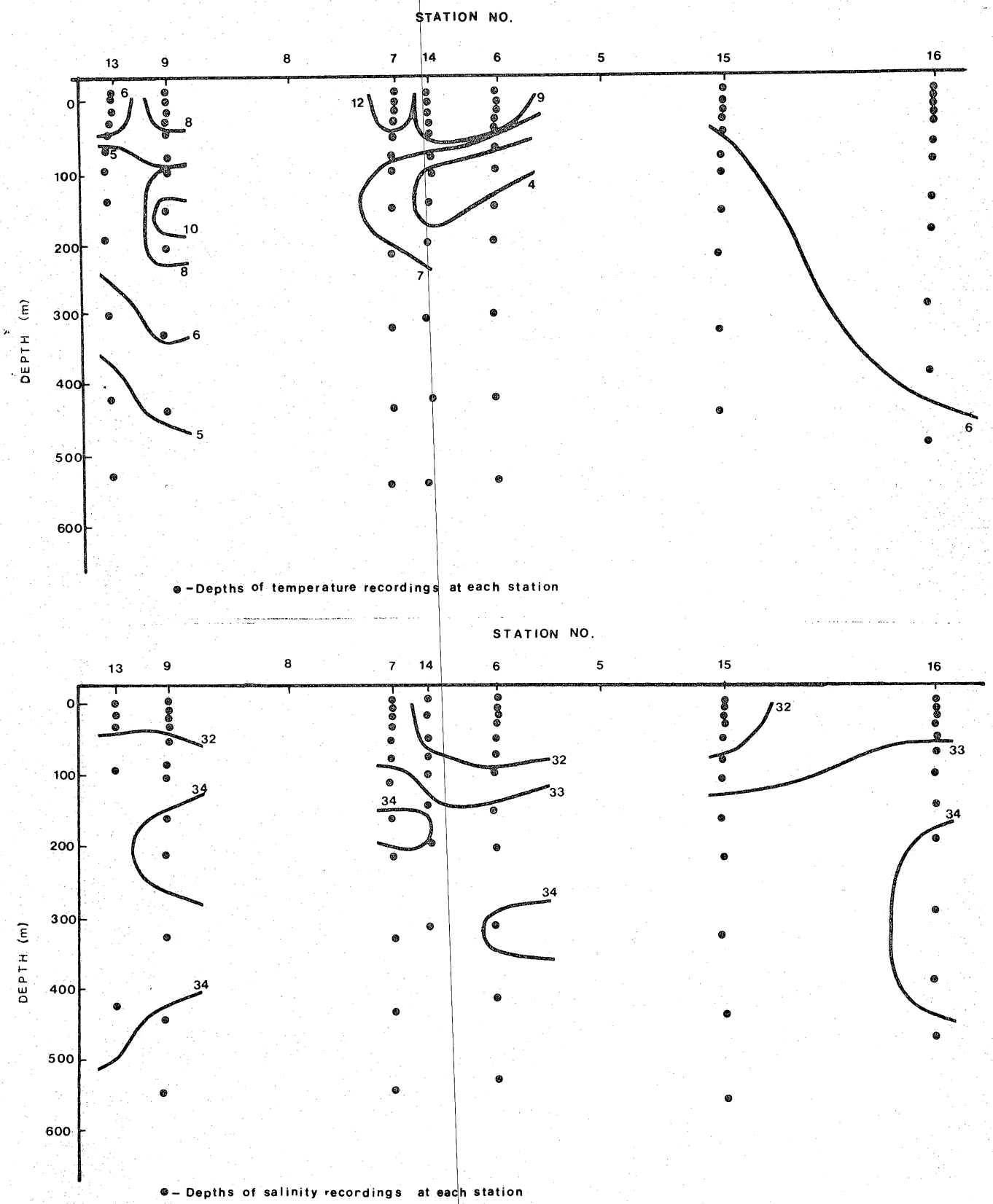


Fig. 6. Temperature (upper) and salinity (lower) profiles of stations surveyed during Cruise 8010 of RTM Argus, 16 November-1 December 1980.