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Review of Scotian Shelf Shrimp Fishery

by

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ABSTRACT

The Scotian Shelf shrimp fishery displays two distinct phases. The first, centered near Roseway Bank, took place in the late 1960's and ceased with the virtual disappearance of the stock. The current fishery off Cape Breton began in the late 1970's and has annual catches up to 1000 t. The productive potential of the Cape Breton area stock is estimated to be of the order of 4000 t.

RESUME

La pêche des crevettes sur le plateau Scotian comporte deux phases distinctes. La première, concentrée dans le voisinage du banc Roseway, eut lieu vers la fin des années 1960 et prit fin avec la disparition virtuelle du stock. La seconde, qui se poursuit présentement au large du Cap-Breton, débuta vers la fin des années 1970 et récolte annuellement jusqu'à 1 000 t. On estime à environ 4 000 t le rendement potentiel du stock de cette région.

INTRODUCTION

The Scotian Shelf shrimp fishery can be split into two distinct phases. The former phase, approximately 1965 to 1975, was predominantly on the southwestern portion of the Shelf. It was the result of exploratory fishing chiefly undertaken by the province of Nova Scotia and collapsed due to the disappearance of the stock. The more recent phase, 1977 to the present, is situated in the southeasternly waters off Cape Breton and is identified with deep holes having water temperatures below 6°C.

EARLY PHASE - 1965 TO 1975

The Nova Scotia Department of Fisheries conducted exploratory trawling in the period 1965 to 1970. Unfortunately, different vessels and gears were used from year to year, making it difficult at best to compare results. The locations having catch rates greater than 100 lbs/h are given in Table 1.

An indication of the landings from this area can be derived from two sources. In his report of the 1969 to 1970 trawl survey, Ernest Cadegan reports landings from southwestern Nova Scotia to be 19 t in 1968, 0.5 t in 1969, and 640 t in 1970. In the following tables, the landing statistics from the Federal Department of Fisheries and Oceans are by port of landing and not area caught; however, the series of inshore landings should reflect local activity.

Nova Scotia Inshore Landings (t)

1966	'67	'68	'69	'70	'71	'72	'73	'74	'75	'76
1	1	1	-	4	-	-	-	-	-	2

Nova Scotia Offshore Landings (t)*

1966	'67	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80
-	2	16	5	796	221	208	6	69	-	-	407	673	782	1643

*Offshore landings before 1970 are probably dominated by Scotian Shelf stocks. After 1970 a number of other areas opened up for commercial exploitation.

In 1979, S. Labonté conducted a research cruise encompassing both the southwestern Shelf and the Cape Breton areas. His results are summarized in the following table.

	Roseway Basin	La Have Basin	Emerald	White Head (Canso)	Louisbourg
Depth (fm)	75-100	80-130	60-130	90-140	90-160
Temp (°C)	6.0-7.3	8.2-9.3	7.6-9.4	1.9-4.0	3.9-4.9
Catch (kg/h)	< 5	0	0	150-200	150-200

These results clearly show the collapse of the shrimp biomass in the southwestern area; however, they cannot be applied to the present situation. They are presented to show the potential for the south shore and also to demonstrate the volatility of this species.

CAPE BRETON FISHERY

The Federal Department of Fisheries and Oceans carried out research trawl surveys for shrimp in 1978, 1979, and 1981. The 1981 data have not yet been analyzed, and most of the following is from Labonté (1980) and Cormier (1981). Concentrations of shrimp are localized to deep holes, and it is not known to what degree the stocks interact between holes. Therefore, the identified holes, Canso, Louisbourg, and Misaine, are assumed to contain independent stocks. In an oceanographic sense, the holes are defined by depths greater than 180 m, having waters less than 6°C.

The approximate locations of the three holes are indicated in Table 2.

Research data from 1978 and 1979 trawl surveys give mean catch rates, biomass estimates, MSY's, and TAC's which are summarized in the following table. Biomass was determined by areal expansion of research catch rates, and the methods of establishing MSY are given in Labonté (1980).

	Canso	Louisbourg	Misaine	Total
Catch rate - 1978 (t/kn)	11.7±1.14	10.7±1.41		
Catch rate - 1979 (t/kn)	8.7±2.1	8.2±1.3		
Catch rate - 1981 (preliminary) (kg/h)	132	150-160	100-120	
Biomass - 1978 and 1979 (t)	4646	6124	9399	20169
MSY (t)	1086	1553	2382	5021
TAC (2/3 MSY) (t)	700	1000	1500	3200

Maximum sustainable yields assume a constant environmental carrying capacity. As was seen for the southwestern Shelf, it can vary considerably, especially as the shrimp are at the southern limit of their range. Also, the research data represent a limited effort over space and time and extrapolation is dangerous.

Commercial data for this area begin in 1977.

Commercial Fishing Data

Year	Canso catch	Louisbourg catch	Misaine catch	Total catch	CPUE (kg/h)
1977				309.0	105.0
1978				358.0	97.0
1979	534.0	295.5	8.5	838.0	134.0
1980	360.0	491.5	133.0	984.0	97.0
1981					

The commercial catch rates show some seasonal trends over the usual May to October fishery. 1977 and 1979 showed a decreasing trend in catch rate, with the final rate being about 30% lower than the initial rate. The 1978 catch rate data fluctuated but displayed no definite trend, while it approximately halved over the 1980 season.

The mesh size used in the shrimp fishery typically ranges from 32 mm (which is also used for research cruises) to 40 mm diagonal stretched. This small mesh could cause a by-catch problem. Research data from October to November, 1979, for all of Cape Breton was comprised of approximately 45% shrimp, 15% silver hake, 12% redfish, 10% squid, and 18% other species by weight. The size composition of the redfish ranged from 15 cm to 40 cm, with a dominant mode at 30 cm and sub-modes at 20 cm and 35 cm. Cod by-catch was mostly in the 35 cm to 40 cm range. The silver hake by-catch distributions had modes at 20 cm and 30 cm.

The NAFO Statistical Bulletin for 1979 shows the following for bottom trawls in the 50 t to 150 t size:

Shrimp	77%
Cod	10
Redfish	6
American Plaice	4
Greenland Halibut and Other	3

MSY

Two factors have been identified as primary determinants of shrimp abundance: effort and bottom temperature. Figures 1 and 2 show the July bottom temperatures for the Scotian Shelf from groundfish survey trawls. 1970 was the best year for landings from Roseway Bank and the temperatures were 3° to 5° in that area. In 1976 the bottom temperatures were 5° to 9° and no shrimp were found. This supports the hypothesis of environmentally determined abundance. Figure 3 shows Gulf of Maine water temperature and catch for the 28-year period from 1936 to 1962. These data have been interpreted as representing an optimal temperature range with reduced catch (and hence abundance) at the extrema. These conclusions should be compared to observations in literature. Stickney (MS 1977) reports that egg mortality shows no change in the range 2° to 12°. Haynes and Wigley (1969) state that the viable temperature range for adults is -2° to 11° and the upper limit for larvae is 14°. These temperatures are warmer than those observed in the holes on the Scotian Shelf.

On the other hand, patterns of overfishing and collapse would resemble the catch history in Figure 3. Also, the MSY's based on Ulltang's (1978) method allow only for effort as an abundance determinant. The current basis for setting MSY as $0.5\ MB_o$ is more vague but is also an effort-based model. In light of the probability that environment, not effort, is the major determinant of stock size, it would appear, therefore, that MSY's from classical fisheries models must be received critically if not cynically.

LITERATURE CITED

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Table 1. Shrimp surveys on Scotian Shelf and Bay of Fundy, with average catch ≥ 100 lbs/h.

Area	Dates	Gear	No. of tows	Average catch (lbs/h tow)
Southeast of Scatarie Long. 58°20'W Lat. 43°37'N	July/65 Oct./65	120 ft headrope	10	106.3
Off Petit-de-Grat Long. 60°25'W Lat. 45°33'N	Aug./65 May/66	120 ft headrope	8	112.9
Off Whitehead Long. 60°55'W Lat. 44°55'N	Aug./65 May/66 Nov., Dec./66 Feb./67	120 ft headrope 120 ft headrope 80 ft headrope	86	216.5
Chedabucto Bay Long. 60°40'W Lat. 45°22'N	May/66 Feb./66	120 ft headrope 80 ft headrope	15	157.6
Bay of Fundy between Bliss Island and Pt. Lepreau Long. 66°40'W Lat. 45°03'N	June/66 March/67	60 ft headrope	13	159.5
Northeast Roseway Long. 64°05'W Lat. 43°55'N	Jan./67	80 ft headrope	23	105.7
Eastern Hole/ Roseway Basin Long. 64°30'W Lat. 43°20'N	Dec./69	80 ft headrope	13	365.0
Eastern Hole/ Roseway Basin Long. 64°30'W Lat. 43°20'N	Jan./70	80 ft headrope	18	425.0

Table 2. Approximate coordinates of the shrimp holes on the eastern Scotian Shelf.

	Longitude	Latitude
Canso holes	60°06'00"	44°30'30"
	60°10'00"	44°59'30"
	60°53'00"	45°06'30"
	61°19'30"	44°51'30"
Misaine holes	60°06'00"	45°00'00"
	60°06'00"	44°35'30"
	58°48'00"	44°38'30"
	58°10'00"	44°54'00"
	58°10'00"	45°00'00"
Louisbourg holes	58°37'30"	45°57'30"
	59°10'00"	45°47'00"
	59°10'30"	45°35'30"
	58°55'00"	45°33'00"
	58°21'30"	45°50'30"

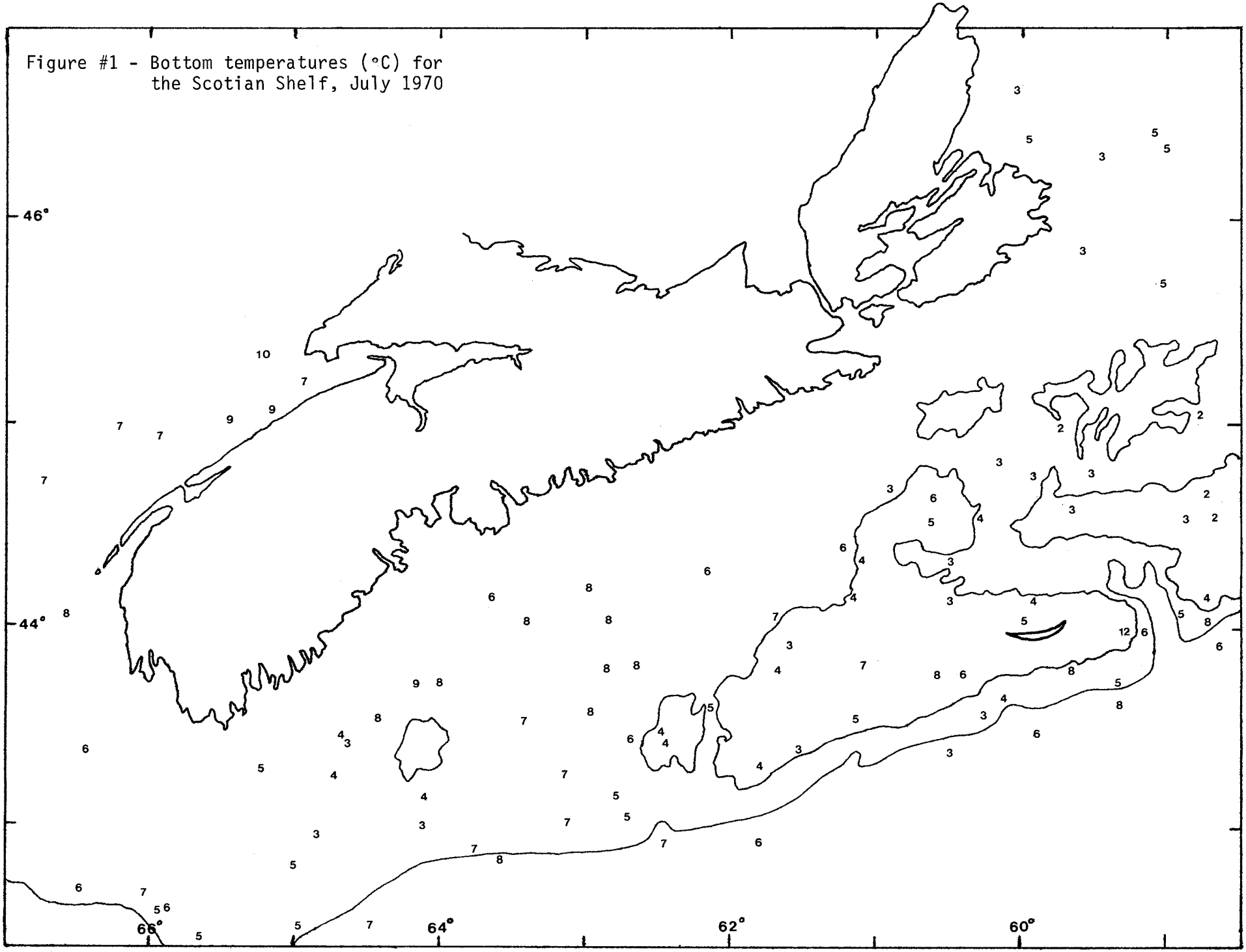

Figure #1 - Bottom temperatures (°C) for the Scotian Shelf, July 1970

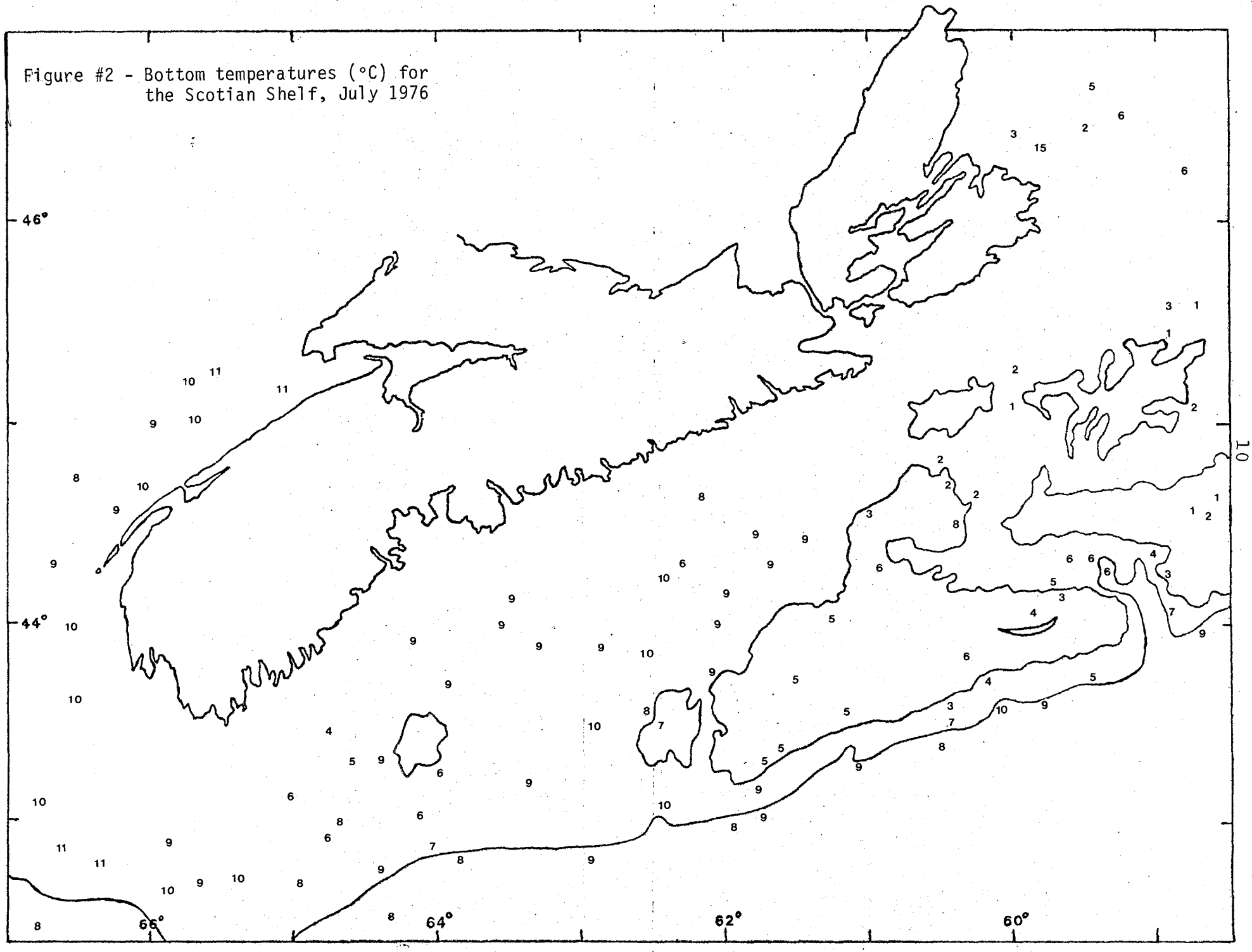

Figure #2 - Bottom temperatures (°C) for the Scotian Shelf, July 1976

Figure #3 - Catch and water temperature data for Gulf of Maine, 1935 to 1962 [Dow, Comm. Fish. Rev., Vol. 28(3)].