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A review of the southern Gulf of St. Lawrence snow crab (Chionoecetes opilio)
management zone boundaries

by

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Abstract

Historical data from trawl surveys, sampling of commercial catches and fishermen's logbooks were analysed in an attempt to redefine snow crab management zones based on biological characteristics of snow crab, spacial distribution of crab and distribution of fishing activities in the southern Gulf of St. Lawrence.

The 1990 distribution of fishing effort and concentrations of snow crab indicated that there were common snow crab concentrations shared by groups of fishermen from different management zones especially between zone 25 and 18 and on the eastern tip of zone 26. There are similarities in the size distribution of male crab between zone 25 and 18.

The survey data also showed differences in the percentage of morphometrically mature males between zones 18 and 19 which may suggest that zone 18 is a recruitment zone. The possible movements of crab between the two zones will be studied.

More trawl survey data is required for zones 18 and 19 before the snow crab management zones for the southern Gulf of St. Lawrence can be redefined. Historical data showed that the size composition, concentration of biomass and distribution of fishing effort from commercial fisheries may change considerably on yearly basis.

Résumé

Les données historiques des campagnes de chalutage, d'échantillonnages des prises commerciales et des carnets de bord des pêcheurs ont été analysées dans le but de redéfinir les zones de gestion du crabe des neiges basé sur les caractéristiques biologiques du crabe des neiges, sa distribution spatiale ainsi que sur les activités de pêche au crabe dans le sud du golfe du Saint-Laurent.

La distribution de l'effort de pêche et des concentrations de crabe des neiges en 1990 a indiqué qu'il y avait des concentrations de crabe des neiges communes partagées par des pêcheurs de différentes zones de gestion, spécialement dans les zones 25, 18 et 26. La distribution de taille des crabes mâles est similaire entre les zones 25 et 18.

Les données de campagnes de chalutage ont aussi révélé des différences entre le pourcentage de crabes mâles morphométriquement matures entre les zones 18 et 19, ce qui pourrait indiquer que la zone 18 est une zone de recrutement. Le mouvement de crabes entre les deux zones sera étudié.

Plus de données à partir de campagnes de chalutage seront nécessaires afin de redéfinir les zones dans le sud du golfe du Saint-Laurent. Les données historiques ont démontré que la distribution de tailles, les concentrations de crabe et la distribution de l'effort dans la pêche commerciale peut changer considérablement sur une base annuelle.

Introduction

The exploitation of southern Gulf of St. Lawrence snow crab, *Chionoecetes opilio* first started in the mid 1960's. Since then, zones have been established according to management needs on a regional basis.

Zone 12 is the major fishing ground in the midshore area exploited by the New Brunswick and Québec vessels (Figure 1).

Initially, the snow crab grounds off Cape Breton Island were commercially exploited by a group of fishermen based in Chéticamp. The New Brunswick and Québec offshore boats started to fish sporadically the same area soon after. With the increasing value of snow crabs in the late 1970's and early 1980's, the fishery gradually expanded to cover all the snow crab grounds off the western coast of the Island. In 1978, zone 19 was established as an inshore fishing zone on the western coast of the Island to be used exclusively by inshore vessels less than 13.7m (45ft) in length. Zone 18 was first exploited in 1979 by 14 inshore vessels with exploratory permits with a maximum of 30 traps per permit. These permits were upgraded to licenses the following year and 9 additional licenses were issued to explore an area further from shore. In 1981, all 23 entrants were issued licenses and allowed to fish anywhere in zone 18. Larger mobile vessels from New Brunswick and Québec fished in zone 18 from 1980 to 1982. In 1983, the mobile fleet did not participate in this fishery as their season closed before the opening date for the inshore area. In 1984, the offshore vessels were excluded from the zone and northern and southern boundaries were established (Figure 1).

An exploratory snow crab fishery was initiated off the coast of Prince Edward Island (P.E.I.) in 1985 and is composed of management zones 25 and 26 (Figure 1). The number of exploratory permits was increased from 16 in 1985 to 30 in 1986 (Comeau and Davidson, 1987). The initial 16 exploratory permits were issued as licenses for the 1987 snow crab fishing season. In late 1990, the P.E.I. zones officially became exclusive to the P.E.I. fishermen.

The present study is an attempt to define snow crab fishing zones in the southern Gulf of St. Lawrence based on biological characteristics, spacial distribution of crab and distribution of fishing activities on which specific management measures could be applied.

Material and Methods

Trawl survey

A post season trawl survey was conducted in the southern Gulf of St. Lawrence between June 18th and August 31st, 1990 and included 140 stations in zone 12 (midshore fishery); 21 stations in zone 26, 8 stations in zone 25 (P.E.I. fishery); 28 stations in zone 19, and 18 stations in zone 18 (western Cape Breton Island fishery; Figure 2).

A standard 20m Nephrops trawl equipped with a SCANMAR electronic net sensor was used on a chartered vessel. Stations were sampled on a twelve hour basis during daylight. The duration of the tows varied from 4 to 8 minutes at a speed of 2.0-3.5 knots. A standard trawl haul started when the predetermined amount of cable (usually three times the depth) was let out and the winch drums locked. The catch was sorted by sex, carapace width (C.W.), morphometric maturity as described by Conan and Comeau (1986) molt stages and the presence/absence of external eggs on females.

A geostatistical technique, Kriging (Conan, 1985; Conan *et al.*, 1988) was used to calculate biomasses and map density contours in this study. Density contours were estimated based on a variogram calculated from samples collected over the whole southwestern Gulf. The fishable surfaces were estimated based on the contours of variance from the trawl survey over the whole sampling areas. The swept surface covered by the trawl net was estimated from the data on net opening width measured by the SCANMAR electronic net sensor and the distance towed.

The size frequency distribution of males captured during the survey was standardized to the same swept surface (10^5 m^2) for each zone.

The dates of fishing seasons and trawl survey for 1990 is as follows:

<u>Zone</u>	<u>Fishing season</u>	<u>Trawl survey</u>	<u>Fishing season</u>
12	April 29-June 9	June 18-August 31	-
25&26	April 21-May 18	June 18-August 31	-
18	April 23-27 May 29-June 13	June 22-30	Sept.3-Nov.13
19	-	June 22-30	July 14-Sept.15

Logbook data

The logbook data were acquired and compiled on computer by the Statistics and EDP Systems Division of the Department of Fisheries and Oceans. The overall distribution of fishing effort calculated from the logbooks was plotted by sub areas of 10 min. of latitude x 10 min. of longitude for all zones.

Results and Discussion

The variogram plots for the morphometrically mature male crabs larger than 95 mm C.W. and the immature male crabs larger than 56 mm C.W. showed a range of approximately 10.0 km and 19.3 km respectively beyond which no more spatial covariance effects were detected (Figure 3).

The density contours of male crab in the 1990 trawl survey suggests a continuity of the P.E.I. fishing grounds with zone 12 and zone 18 fishing grounds. Two high densities of morphometrically mature legal size crab were observed : One concentration is located between the zone 25 and zone 18 while the other is located between the zones 25, 26 and the midshore zone (Figure 4). Density contours of immature male ≥ 56 mm show a continuity between the P.E.I. zones and the midshore zone (Figure 5).

The percentage of morphometrically mature sub-legal males from the trawl survey was higher in zone 12 (19.2%), zone 18 (13.0%) and zone 19 (16.7%) compared to zones 25 (3.6%) and zone 26 (3.2%). Comparisons between zone 18 and 19 show that the percentage of morphometrically mature males between 60 and 94 mm C.W. was higher for zone 19 (50.9%) than zone 18 (16.5%). The composition of the catch in percentages for each zone was as follows (numbers in brackets represent the standardization to N=100):

Zone 12

	I	M	T
Non legal	72.2(80.8)	17.2(19.2)	89.4(100)
Legal	3.4(32.1)	7.2(67.9)	10.6(100)
Total	75.6	24.4	100.0

Zone 25

	I	M	T
Non legal	70.5(95.4)	2.7(3.6)	73.9(100)
Legal	11.2(42.9)	14.7(56.3)	26.1(100)
Total	81.6	17.4	100.0

Zone 26

	I	M	T
Non legal	84.3(96.5)	2.8(3.2)	87.4(100)
Legal	8.0(63.5)	4.4(34.9)	12.6(100)
Total	92.3	7.2	100.0

Zone 19

	I	M	T
Non legal	46.9(73.3)	16.6(16.7)	64.0(100)
Legal	7.4(20.6)	28.0(77.8)	36.0(100)
Total	54.3	44.6	100.0

Zone 18

	I	M	T
Non legal	44.5(86.4)	6.7(13.0)	51.5(100)
Legal	14.3(29.5)	32.8(67.6)	48.5(100)
Total	58.9	39.5	100.0

I= Morphometrically immature; M= Morphometrically mature; T= Total

Results from past sampling have shown a higher proportion of morphometrically immature crab in the catch of zone 18 compared to zone 19 except for 1990 where the percentage for zone 18 was the lowest recorded. The percentages of morphometrically immature crab were as follows (N=total number of snow crab sampled):

Year (source)	Zone 18		Zone 19	
	Sea samples % (N)	Port samples % (N)	Sea samples % (N)	Port samples % (N)
1986 (1)	39.9 (706)		24.4 (982)	22.1 (2892)
1987 (2)	51.4 (511)	34.3 (1140)	14.6 (1366)	18.6 (4417)
1988 (3)	60.1 (3305)		13.0 (1770)	
1989 (4)	63.3 (731)		11.6 (1201)	5.3 (1151)
1990	19.8 (2861)S 16.6 (1442)F	16.9 (243)	26.3 (1601)	5.5 (1610)

(1) Davidson and Comeau (1987)

(2) Chiasson *et al.* (1988)

(3) Chiasson *et al.* (1989)

(4) Chiasson *et al.* (1990)

S=spring fishery;

F=fall fishery

Size frequency distributions of male crab from the trawl survey varied among the different zones in the southern Gulf (Figure 6). In zone 12, there is only one mode of

morphometrically immature crab at 68-70 mm while several modes of smaller sizes (25-27 mm C.W., 35-37 mm C.W. and 47-49 mm C.W.) and larger sizes (83-85 mm C.W. and 89-91 mm C.W.) are present in the P.E.I. zones. Size frequency distributions were also different between the Western Cape Breton Island zones. Zone 18 showed modes at 54 mm C.W. and at approximately 78-99 mm C.W. while modes were detectable at 27 mm C.W., 57 mm C.W. and at 93 mm C.W. for zone 19.

The distribution of fishing effort during the 1990 season was continuous between zone 12 fishing grounds and zone 26 (Figure 7). There was also a concentration of fishing activities on the eastern tip of zone 25 bordering zones 18, 19 and 12.

Conclusion

The 1990 distribution of fishing effort from commercial fisheries data and concentration of snow crab from trawl survey data indicated that there were common snow crab concentrations shared by groups of fishermen from different management zones especially between zone 25 and 18 and on the eastern tip of zone 26. Although biological data from the trawl survey does not clearly differentiate groups of crab between these zones, there are similarities in the size distribution of male crab between zone 25 and 18.

The survey data also showed differences in the percentage of morphometrically mature sub-legal males (60 to 94 mm C.W.) between zone 18 (16.5%) and zone 19 (50.9%) which may suggest that zone 18 is a recruitment zone. A tagging program will be undertaken in order to study the possible movements of crab between the two zones.

More trawl survey data is required for zones 18 and 19 before the snow crab management zones for the southern Gulf of St. Lawrence can be redefined. The data from the past trawl survey and fisheries logbook showed that the size composition, concentration of biomass and distribution of fishing effort from commercial fisheries may change considerably on yearly basis.

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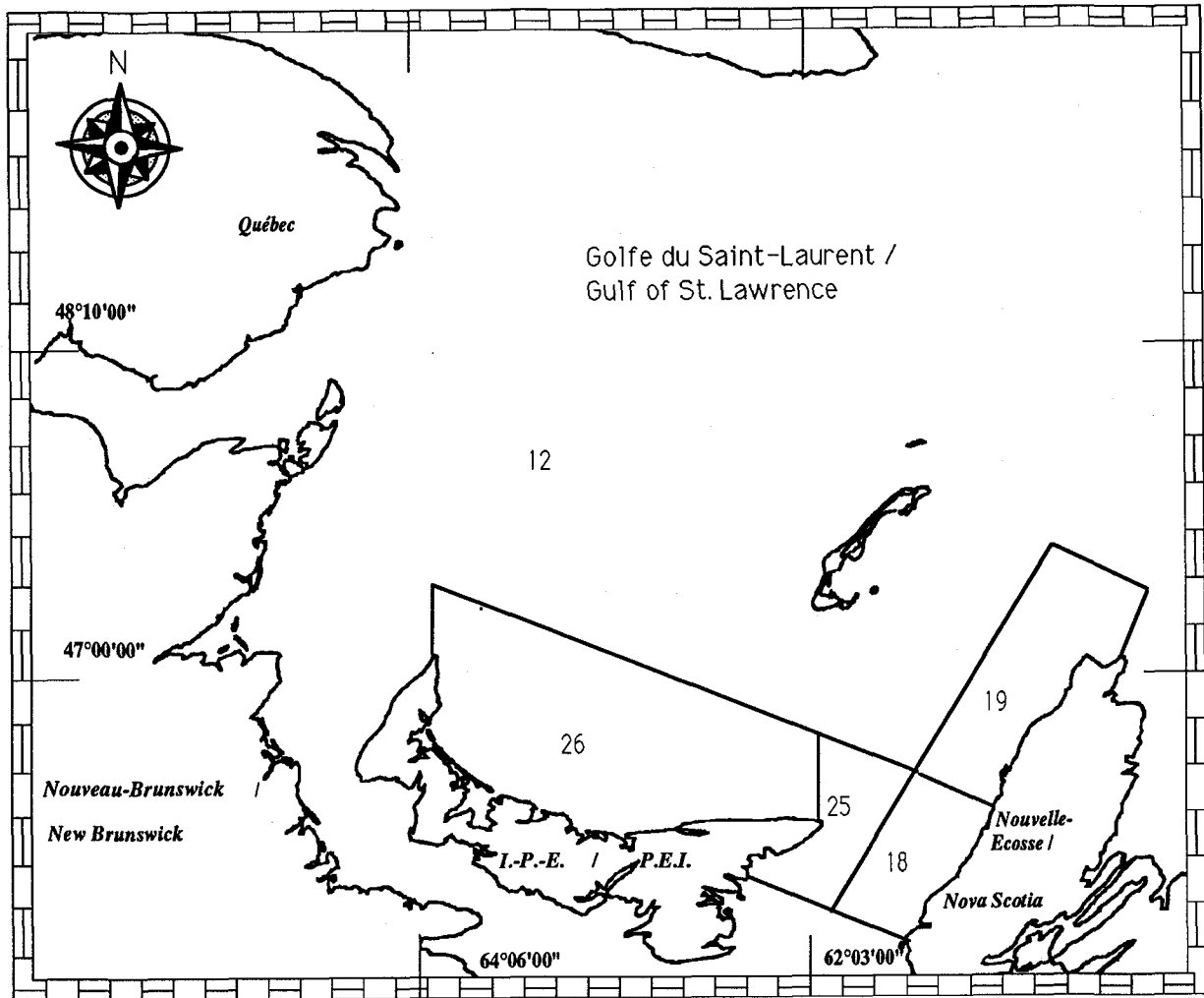


Figure 1. Southern Gulf of St. Lawrence snow crab, *Chionoecetes opilio* management zones.

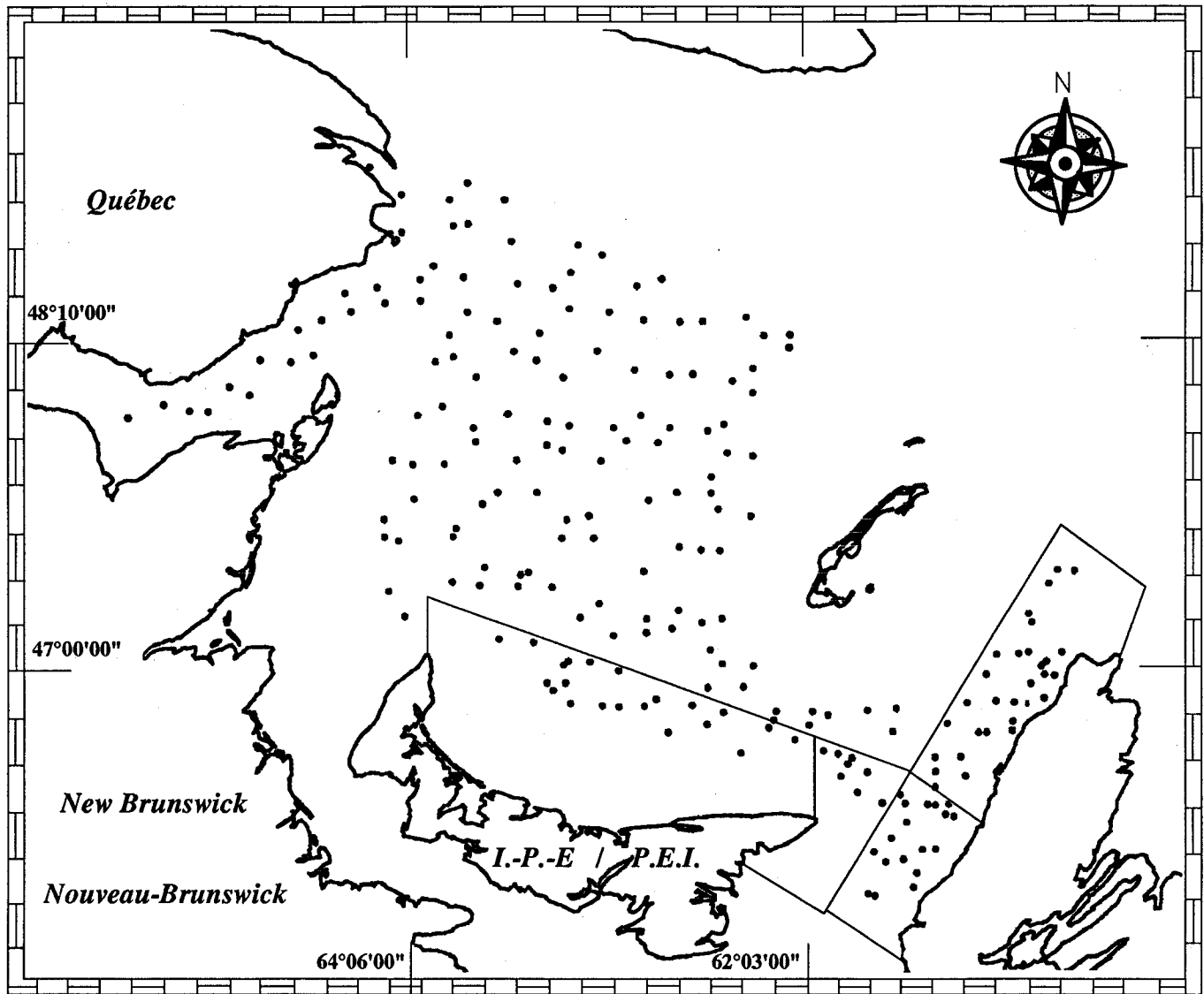


Figure 2. Geographical locations of the trawl survey in the Southern Gulf of St. Lawrence in 1990.

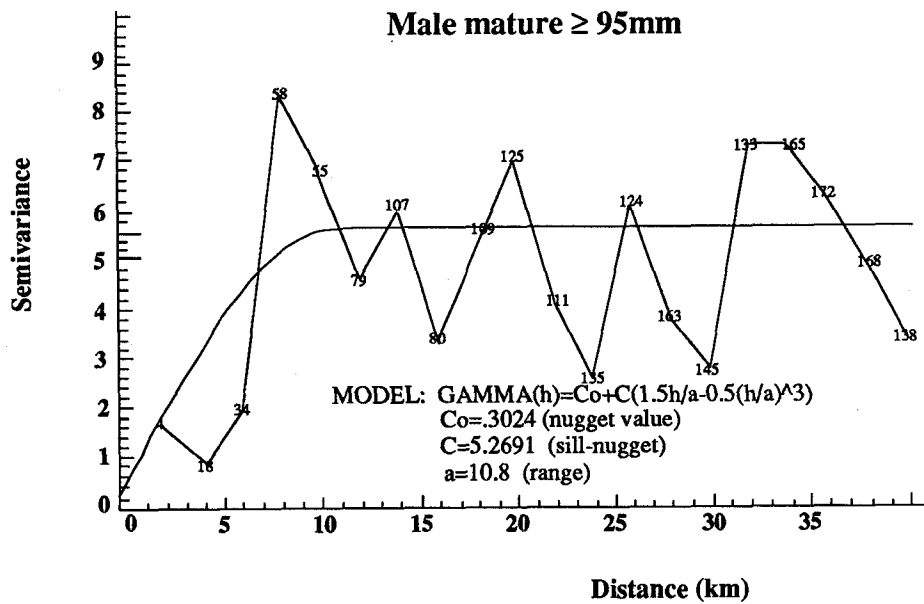
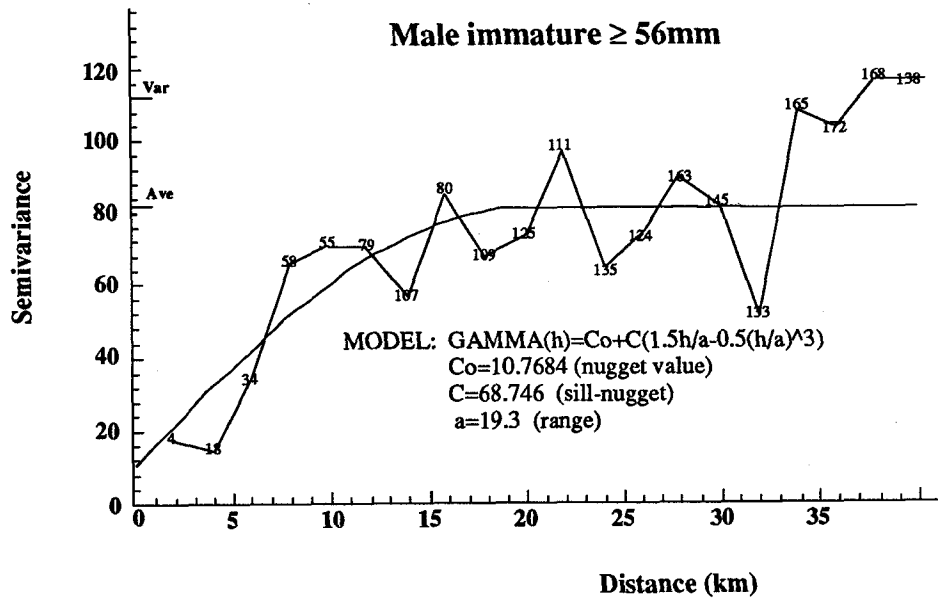


Figure 3. Variogram for morphometrically mature males $\geq 95\text{ mm C.W.}$ and immature males $\geq 56\text{ mm C.W.}$ used in the kriging calculations for the 1990 trawl survey.

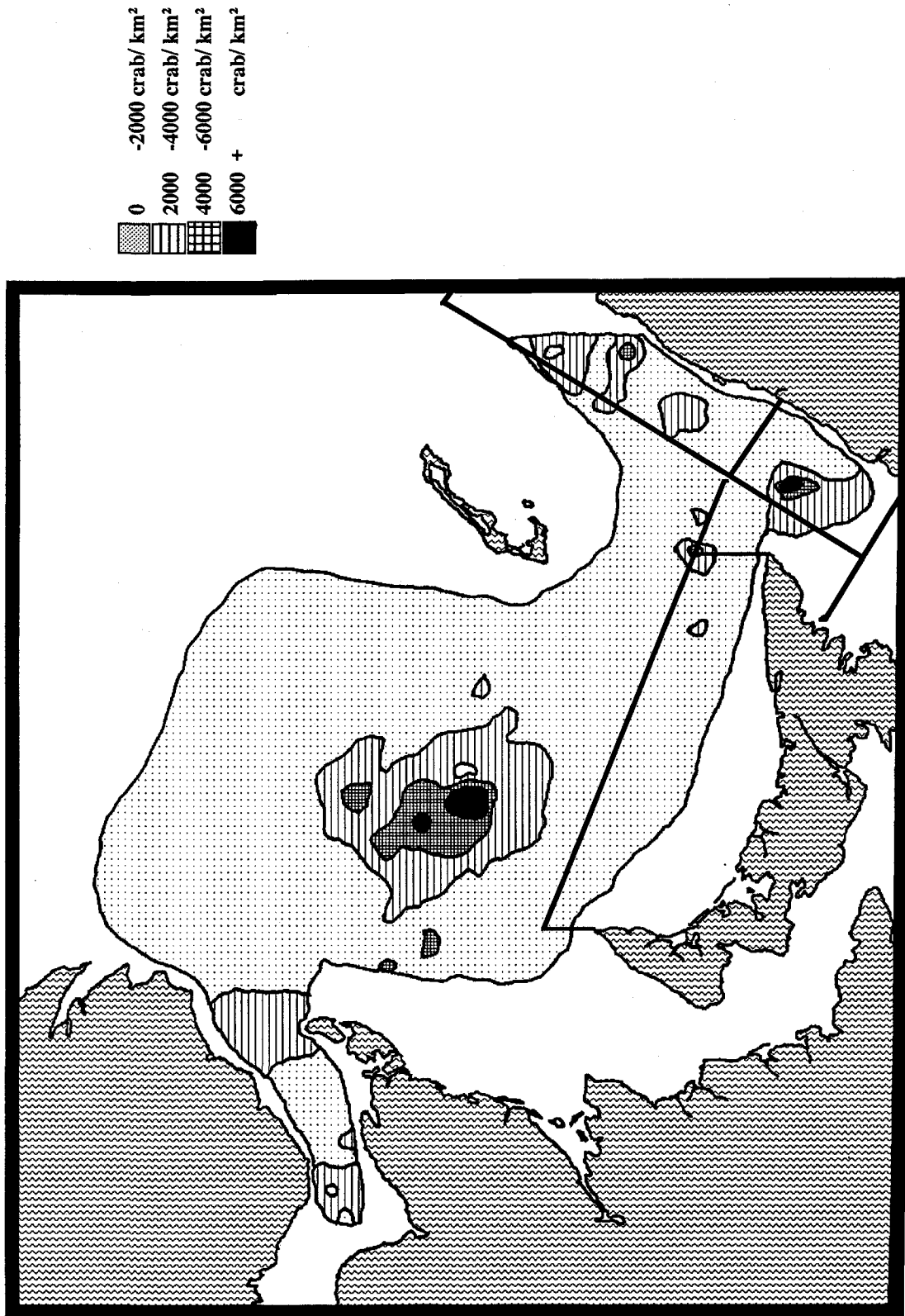


Figure 4. Density contours of mature male crab ≥ 95 mm calculated from the trawl survey data in 1990.

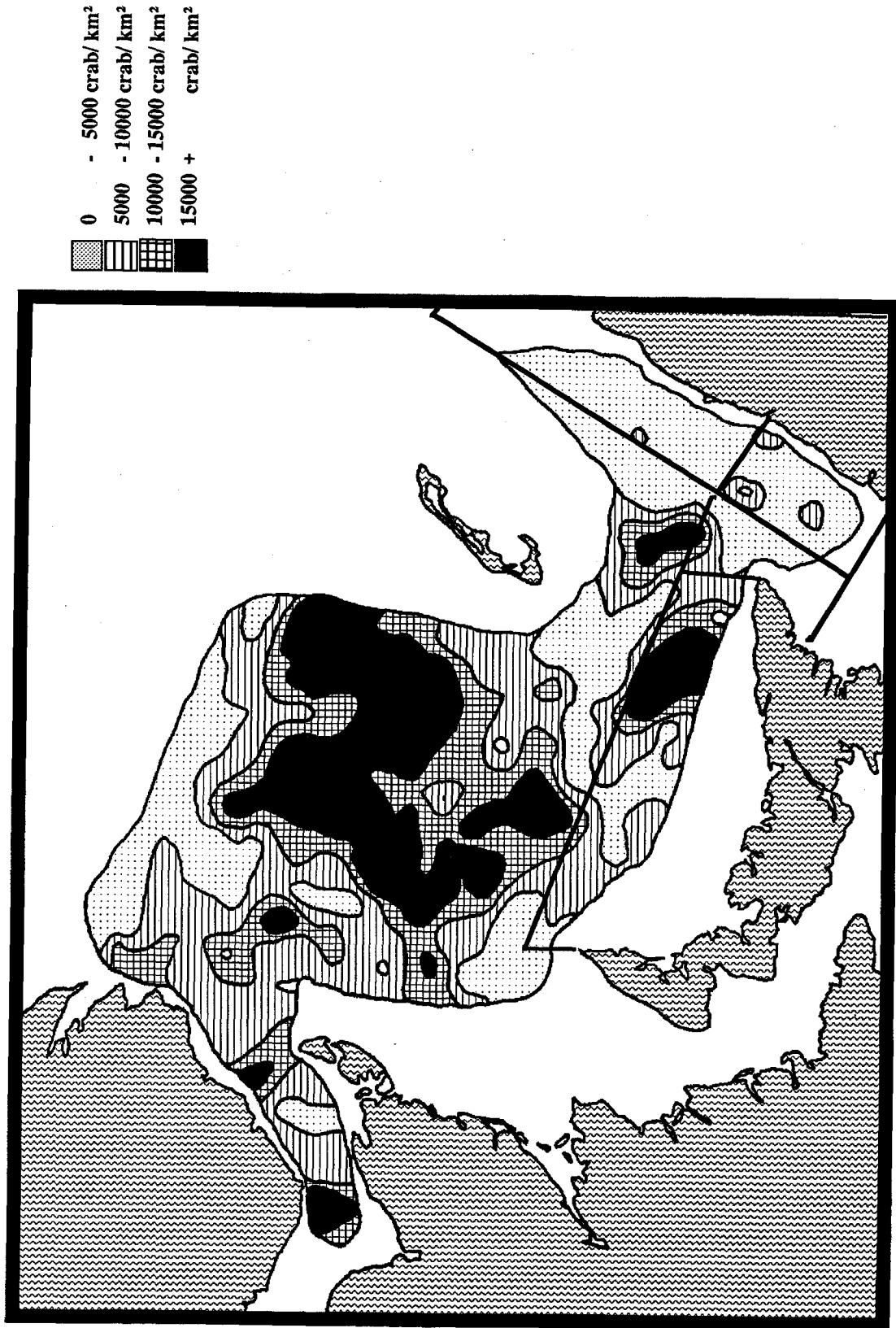


Figure 5. Density contours of immature male crab ≥ 56 mm calculated from the trawl survey data in 1990.

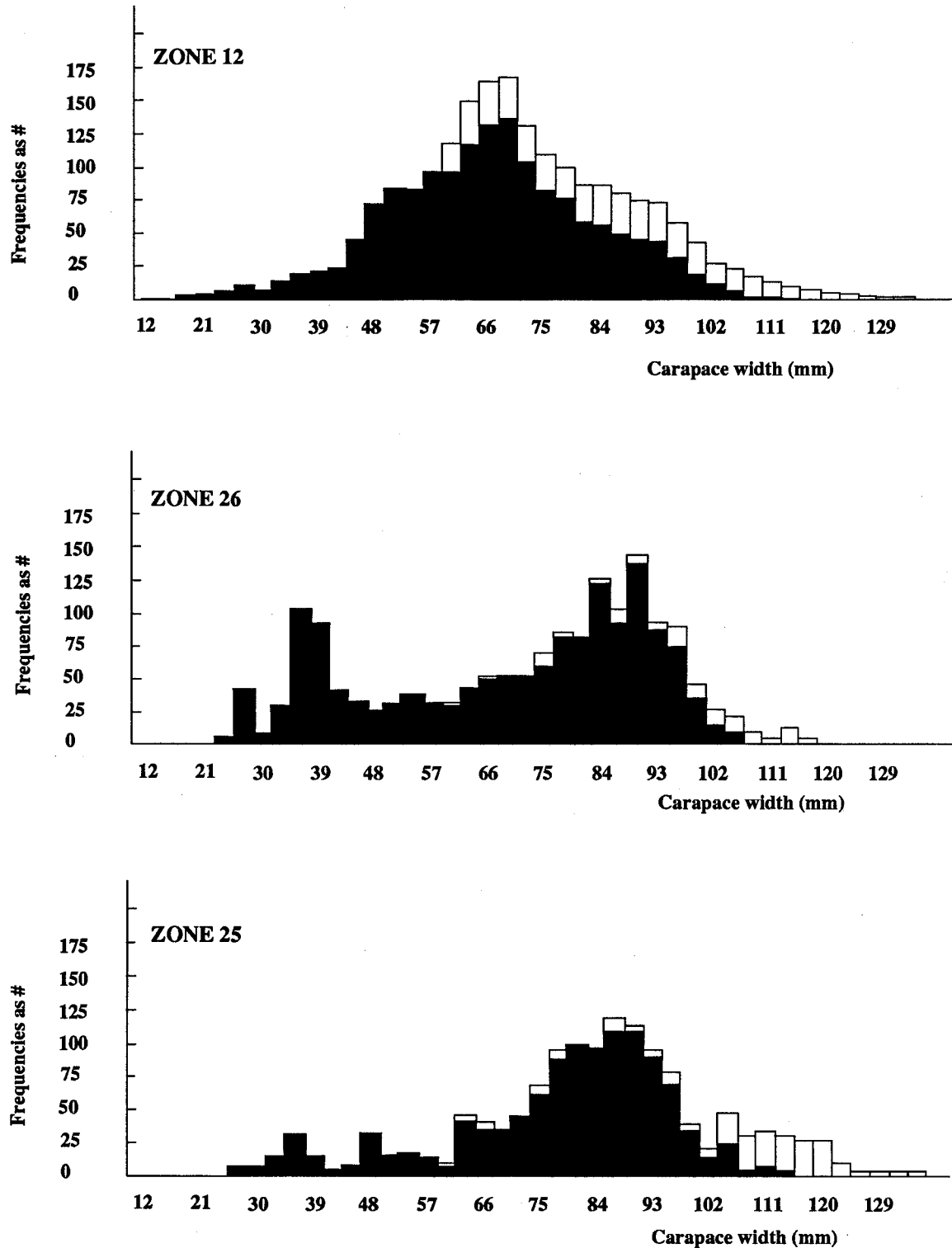


Figure 6. Size frequency distributions of male snow crab, *Chionoecetes opilio*, collected during the 1990 trawl survey in the Southern Gulf of St. Lawrence.

Number of immature in black; number of mature in white

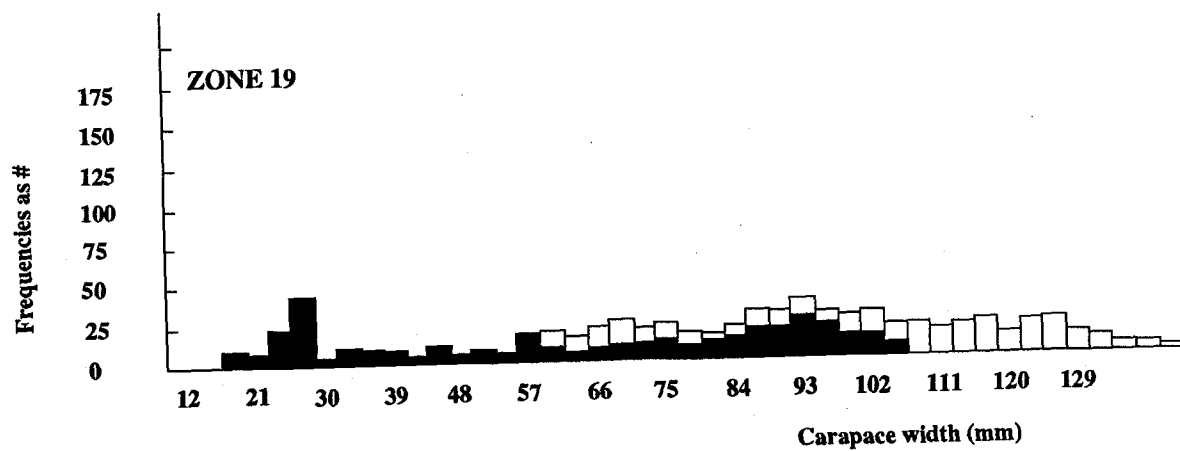
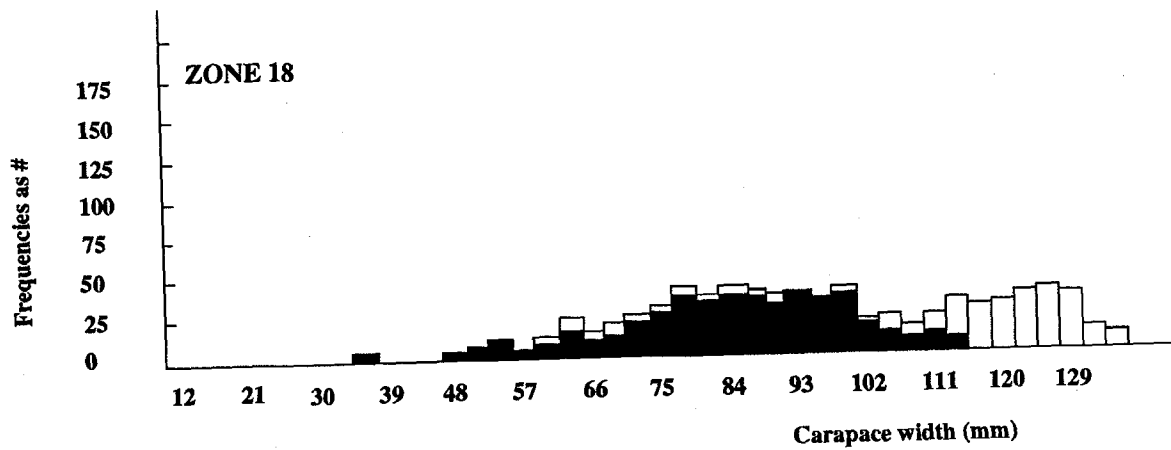


Figure 6. cont

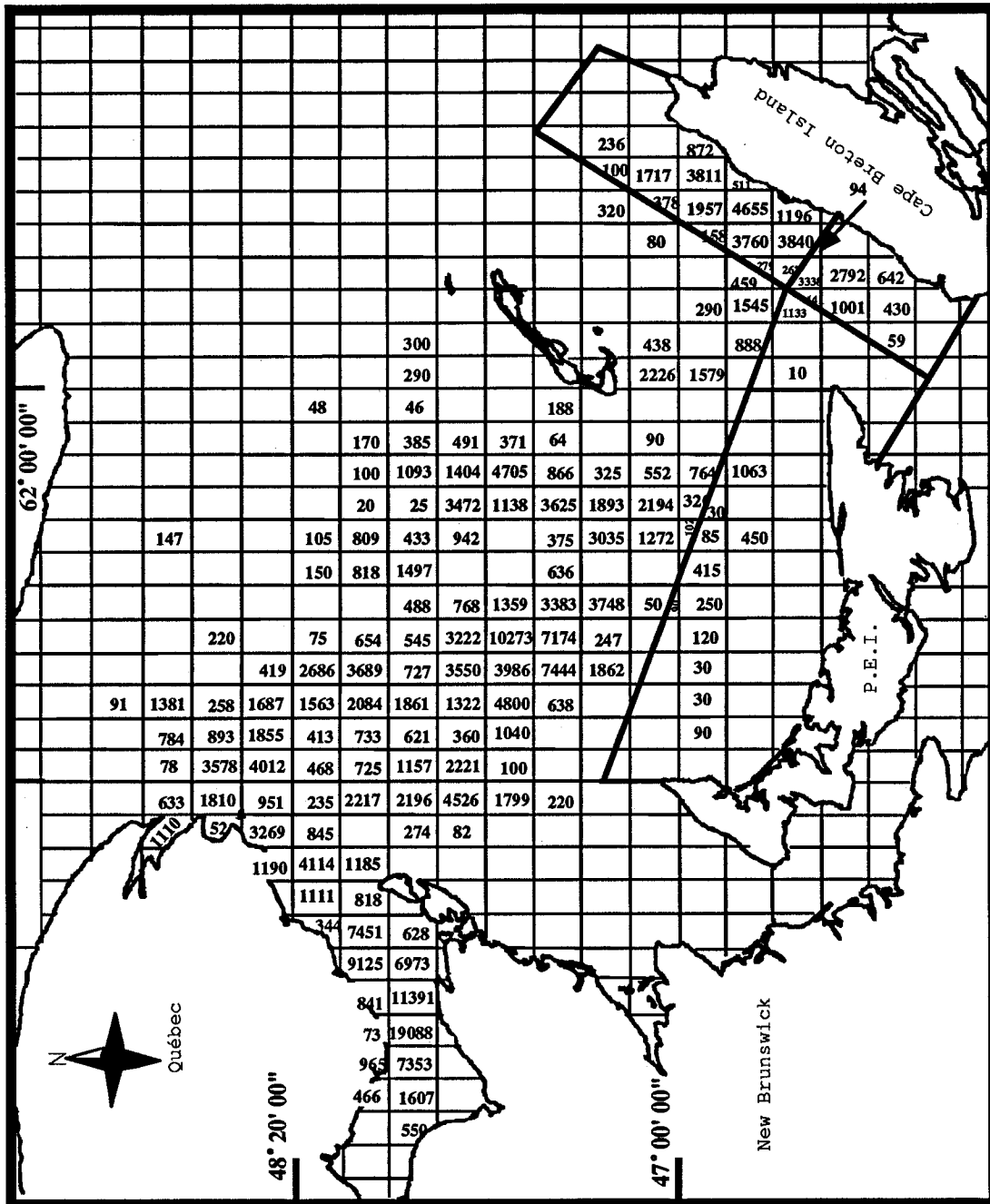


Figure 7. Distribution of fishing effort (in number of traps) as reported in the logbook in the southern Gulf of St. Lawrence fisheries (zones 12,18,19,25, and 26) in 1990.