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Canadian Offshore Lobster Fishery, 1985-86, and Assessment of the  
Potential for Future Increases in Catch

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## ABSTRACT

Catch and effort data for 1981-86 are presented, along with a review of the impact of the International Court of Justice (ICJ) decision on the offshore fishery and an assessment of the potential for increased fishing effort in the Browns/Georges Banks area. The ICJ decision resulted in no new lobster fishing grounds on Georges Bank; however, it eliminated American effort from Crowell and Georges Basins. Though no change has been observed in the catch from Crowell Basin, the Canadian catch from Georges Basin has increased from 14 t in 1983 to 267 t in 1985. The TAC was increased in 1985, from 408 t applied only to 4X to 720 t applied both to 4X and 5Ze. Landings in 1985 and 1986 were >720 t. The potential for increased Canadian effort following American effort removal appears fully exploited. Movement studies indicate a mixing of Browns Bank and Georges Basin lobsters. Increased effort on Georges Basin could have a detrimental effect on the Browns Bank fishery. It is too early to assess the effect of the 1985 management plan on the stock. Given the uncertain history of the total catch offshore, and the relationship between inshore and offshore stocks, an increase in effort in the 4X and 5Ze areas is not recommended.

## RÉSUMÉ

On présente des données sur les prises et sur l'effort de pêche pour les années 1981-1986; on présente également une étude sur les répercussions de la décision de la Cour internationale de justice (CIJ) sur la pêche hauturière ainsi qu'une évaluation de la possibilité d'accroître l'effort de pêche dans la région du banc Browns et du banc Georges. La décision de la CIJ n'a pas donné lieu à l'exploitation de nouvelles zones de pêche au homard dans le banc Georges; toutefois, elle a fait disparaître les pêcheurs américains des bassins Crowell et Georges. Bien qu'aucun changement n'ait été observé dans les prises réalisées dans le bassin Crowell, les prises canadiennes dans le bassin Georges ont augmenté de 14 t en 1983 à 267 t en 1985. Le TPA a été augmenté en 1985, de 408 t pour la division 4X seulement à 720 t pour les divisions 4X et 5Ze combinées. Les débarquements en 1985 et 1986 ont été supérieurs à 720 t. Il semble que la possibilité d'accroître l'effort de pêche canadien par suite du retrait des Américains a été pleinement exploité. Les études sur les mouvements des stocks indiquent un mélange des homards provenant du banc Browns et du bassin Georges. Un effort accru dans le bassin Georges pourrait avoir des effets néfastes sur la pêcherie du banc Browns. Il est trop tôt pour évaluer l'effet du plan de gestion de 1985 sur le stock. Étant donné l'incertitude qui entoure l'évolution historique des prises totales au large, et étant donné la relation entre les stocks côtiers et hauturiers, un accroissement de l'effort dans les divisions 4X et 5Ze n'est pas recommandé.

## INTRODUCTION

The Canadian offshore lobster fishery operates along the edge of the Scotian Shelf from south of Baccaro Bank to the International Court of Justice (ICJ) Line on of Georges Bank and in the Gulf of Maine (Fig. 1). The fishery began in 1971 when licences were made available to the 56 vessels displaced by the closure of the swordfish fishery. Five licences were issued in 1972. The fleet expanded to eight before new entries were stopped in 1975. The history of catch, effort, and management methods between 1971 and 1984 are reviewed in Pezzack and Duggan 1985.

The ICJ boundary ruling (Canada/U.S.A. Gulf of Maine boundary) and record high offshore landings in 1985 and 1986 have resulted in renewed requests from some fishermen for offshore lobster licences. The catch/effort history from 1981 to 1986, the impact of the ICJ decision on offshore lobster fishing areas, the effects of a new management plan introduced in 1985, and the potential for increased effort and catch are examined.

## IMPACT OF 1984 ICJ DECISION ON THE CANADA/U.S.A. GULF OF MAINE BOUNDARY

The ICJ ruling (Fig. 2) had no detrimental effect on the Canadian lobster fishery generally, and in particular did not change the Canadian Georges Bank trapping fishery, an area exclusively Canadian since the early 1970's. There may, however, be a reduction of the total catch from the Canadian portion of the Bank since American trawlers had taken lobster as by-catch or directed catch. The amount cannot be quantified from the American statistics.

The new boundary did, however, eliminate American effort in Crowell and Georges Basins (Fig. 2b), thus increasing the opportunities for Canadian vessels. Canadian vessels fished Crowell Basin between 1975-79 but abandoned the grounds in 1980 due to low catches. A single vessel returned in 1982 and has found good catch rates during the late-fall period. A number of American vessels fished the Basin between 1980 and 1984, but their removal has had no apparent effect on the catch rates of the Canadian vessel operating there.

Since the ICJ ruling, Canadian vessels have exploited Georges Basin between late fall and early summer. The observed distribution of effort in 1986 (Fig. 3) is probably an accurate reflection of commercial lobster distribution. Vessels fishing Georges Basin in winter fish southwestern Browns Bank, southeastern Browns Bank, and Georges Bank from early summer to late fall.

Canadian fishermen indicate that American effort in Georges Basin began in the early 1980's, and by 1984 had reached a high level. It was during this period that annual Canadian catches declined in 4X by approximately 100 t, raising the possibility that the lobsters were being intercepted before they reached the shallower spring and summer grounds fished by Canadians.

Prior to the ICJ line the size of the American catch and locations fished are unknown. Based on estimates of vessel number and size, and official American landings data, we estimate an annual removal of 200 t by American vessels from Crowell and Georges Basins. Canadian landings from

these areas have increased by over 260 t since the new boundary was established. It would appear that the potential for increased landings, following the ICJ decision, has been exploited already.

#### CANADIAN OFFSHORE LOBSTER MANAGEMENT PLAN

The Canadian Offshore Lobster Management Plan was developed in the spring of 1985 following discussions between the offshore lobster licence holders and Department of Fisheries and Oceans personnel. The Plan introduced enterprise allocations (EA); increased the TAC from 408 t applied only to 4X, to 720 t applied both to 4X and 5Ze; removed the 3-mo closed season; and set the season from August 1 to July 31. The Plan took effect August 1, 1985; and catches prior to that date were not included in the new TAC.

Industry requested the new season. It would permit a better match between catch and market demand. An October 15 through 14 season is now in effect. To facilitate the change the 1985-86 season was extended. The TAC for the 14.5-mo 1985-86 season was set at 870 t.

The Management Plan has been in place for only one full season - too short a period to assess it. When developed, a 3-yr period for review and modification was planned.

#### CHANGES IN FLEET

The fleet underwent major changes between 1984 and 1986. Four of the wooden vessels were replaced with steel-hulled side trawlers. The average vessel size increased from 25 m (range 17-32 m) to 33 m (range 17-43 m). Five of the eight vessels are steel-hulled; two of the wooden vessels are 20 and 32 yr old respectively. The remaining licence holder has used a chartered herring seiner to fish only the spring period.

The smaller vessels are generally limited to a single fishing ground, while the larger vessels can rapidly move gear in response to changes in lobster distribution or catch rates. The wider weather window of the larger vessels makes winter fishing easier and increases the total fishing days.

#### CATCH AND EFFORT TRENDS 1981-1986

Annual catch and effort data for 1981-86 are grouped into five fishing areas (Table 3; Fig. 4) and 1971-86 data by the three areas previously used (Table 1; 2; Fig. 5). The five groups better reflect the present fishing areas.

Total offshore landings peaked in the mid to late 1970's (Fig. 6) then slowly declined until 1985. Landings increased by 79% in 1985 and a further 3% in 1986. The new TAC of 720 t was exceeded in both years due to changing of the TAC's season and adjustments made for that change.

Southwestern Browns Bank landings have remained relatively stable during the 1981-86 period (Fig. 7). Southeastern Browns Bank landings declined sharply in 1982 but showed some recovery in 1985 and 1986. Georges Bank catches declined steadily between 1978-85, but increased slightly in 1986.

The Crowell Basin area, not fished in 1980 or 1981, has produced stable fall landings from 1982 to 1985, and showed a significant increase in 1986. The largest change occurred in Georges Basin, where catches increased from 14 t in 1983 to 267 t in 1985.

Effort trends are similar to landings (Fig. 8), except in 1982-83 when effort increased as landings decreased. The disappearance of lobsters from traditional spring and summer fishing areas in 1982 caused fishermen to explore new areas. CPUE's declined in 1982 (Fig. 9) on southwestern and southeastern Browns and Georges Banks. Since 1983, CPUE has increased in all fishing areas.

Seasonal trends in catch, effort, and CPUE have been variable since the ICJ line was established and the new TAC introduced in 1985. Fishermen are adjusting to the new season, the greater flexibility of the larger vessels, and the removal of American competition from Georges Basin.

The monthly landings for the 1985/1986 season (Fig. 10) show high catches on all grounds during November to January; but, in all areas except Georges Basin, catches decline during the winter months. Landings increase during the spring and early summer on all grounds except Crowell Basin. Monthly CPUE (Fig. 11) shows a fall and spring increase on all grounds and a decline in winter. Southwestern Browns Bank has a fishery in August, while in all other areas fishing stops at the end of July due to declined catch rates.

Pezzack and Duggan (1985) reviewed the potential for using CPUE to assess abundance in the offshore. They concluded that observed changes in CPUE may reflect changes in catchability and vessel captains' skills rather than changes in stock sizes.

#### AREA OF GROUNDS FISHED PER VESSEL

Offshore lobster fishermen require large fishing grounds, as their lobsters occur at densities 0.1% to 5% of those of inshore grounds (Cooper and Uzman 1980). Trawls of 50-100 traps are used, with a total length of 1.3-2.7 km. They are generally set along depth contours and moved up or down the slope following lobster densities. The two Georges Bank vessels each fish approximately 55 km of shelf edge at any one time.

The commercial concentrations are often found in small pockets around canyons, gullies, or in holes within a basin. Crowding of grounds has in the past resulted in gear conflicts and possibly decreased catch. Along the slope, traps are set parallel to the shelf edge and within a narrow depth range. Steep sloping bottoms and strong tides make it difficult for more than one vessel to fish an area of scope. Gear lost adds to fishing cost and can result in ghost fishing by lost gear. At present, gear loss is believed to be small; and ghost fishing is not considered a problem in the offshore areas.

#### MOVEMENT AND STOCK STRUCTURE

Mature lobsters move seasonally from winter habitats on the shelf slope or deep basins of the Gulf of Maine to summer habitats on the shallower regions of the banks. Findings from the offshore tagging program suggest strong movement between some grounds and little exchange between others.

Lobsters making long-distance movements (>90 km) show seasonal movements between: a) southeastern and southwestern Browns Bank, b) Browns Bank (closed area) and southwestern and southeastern Browns Bank, c) Browns Bank and Georges Basin (Fig. 12), and d) Corsair Canyon and Georges Shoal in American waters (Fig. 13). Little or no movement has been observed between: a) Crowell Basin and southwestern or southeastern Browns Bank (Fig. 14), b) Georges Bank and Browns Bank (Fig. 12 and 13), and c) Georges Bank and Georges Basin (Fig. 13).

The low-level exchange of lobster observed between Browns and Georges Banks suggest the two areas could be managed separately if larval transference is minimal. Recent oceanographic studies suggest the exchange of larvae between the two areas could be minimal (Perry and Hurley 1986).

Georges Basin straddles the 4X/5Ze line, but the movement data indicate that it has closer ties to Browns Bank than to Georges Bank. Georges Basin catch and effort statistics should thus not be split between Browns (4X) and Georges (5Ze) Banks. Though two vessels are presently restricted to 5Ze to avoid overconcentration of effort in 4X, a large portion of their catch now comes from Georges Basin.

American tagging studies in the Jordan and Crowell Basins and Canadian tagging in the middle and inshore grounds indicate some exchange of lobsters between the inshore and offshore fisheries. Thus, mid-shore effort must be considered in assessing offshore effort.

The stock structure of the Gulf of Maine lobsters remains unclear (Pezzack 1987). Movement data indicate that exchange occurs between distant areas within the Gulf of Maine Area, but the data do not yet permit a quantification of interaction. The impact of the observed movement on overall population size and recruitment cannot be determined.

The observed relationship between grounds may change with annual, or longer-term, variation in movement patterns in response to changes in deep-water physical properties. Cool, deep-water temperatures in the 1960's likely limited lobster movement within the Gulf of Maine. It is unlikely the present large-basin-centered fisheries would have existed with fall bottom water temperatures of only 5-6°C (Davis 1978; Mountain 1982), compared to the present 8-10°C.

#### GEORGES BASIN LOBSTER SIZE FREQUENCIES

Sales slip data from the Georges Basin fishery show 68% of the catch in the 1-3 lb size class - a higher percentage than that found from the slopes of southeastern Browns and Georges Banks - lower, however, than that of Crowell Basin or southwestern Browns Bank. Size-frequency data (Fig. 15) show a mean size the same as that of Crowell Basin. The mean size of lobsters from Crowell Basin has traditionally been the smallest of any offshore area, and has shown no change since first sampled in 1978. The data suggest that the deep basin areas are populated by immature and newly matured animals. Fishing pressure in these basins should not be increased without a better knowledge of the relationship between these animals and the remainder of the Gulf of Maine population(s).

## ASSESSMENT OF STOCK

The offshore lobster fishery has traditionally been assessed by monitoring changes in CPUE and size-frequency trends (Stasko and Pye 1980; Pezzack and Duggan 1985). Pezzack and Duggan (1985) indicated that CPUE may be a poor reflection of stock health. As well, size-frequency data may not be appropriate, as little is known about the influence of trap selectivity, spatial separation of sizes, varying recruitment levels, and growth rates on the observed size frequencies. There are suggestions that under some situations size frequencies may not accurately reflect real changes in size structure (Addison 1986).

The 1985 TAC increase was based on an estimate of American catches and both on stable catch rates and size frequencies. Size frequency should continue to be monitored, but future increases in TAC's should not be justified on stable size frequencies alone. Reliable techniques do not yet exist, for offshore lobsters, which would permit accurate measures of abundance and project future trends. Future research should concentrate on techniques that permit resolution of these problems.

## DISCUSSION

Our knowledge of offshore lobsters has increased markedly over the last 10 yr, but we still cannot accurately estimate stock size, nor can we quantify the relationship between inshore and offshore lobsters. Management has been based on the hypothesis of an inshore-offshore linkage, and offshore effort and catch has been strictly controlled. The offshore fishing of the 1970's has had no observable effect on inshore landings, which are now at record high levels. It is felt the 1985 TAC increase resulted in no real increase in total offshore lobster catches. The Canadian catch increase is based on what is thought to have been previously removed in the American fishery. It is felt that further increases would represent a real increase in total removal.

Further TAC increases are not yet recommended. There is uncertainty about the catch history, and concern over potential effects on inshore recruitment. There has been insufficient time since the TAC was increased, to assess the long-term impact on the stocks.

An increase in licence numbers without a corresponding increase in TAC would nullify the benefits of the Management Plan, which was designed in part to improve the economics of the fishery. If new licences are to be given in the near future they must be limited to 4W, outside the traditional offshore grounds.

## SUMMARY

1. Georges Basin represents the only grounds new to Canada, resulting from the ICJ ruling. The Basin supports a fall-to-spring fishery of lobsters that appear to migrate seasonally from Browns Bank and Crowell Basin.
2. Canadian vessels have replaced the traditional American effort. The total catch from Georges and Crowell Basins appears unchanged. If this is the case, then any additional effort would result in an increase over past catches (total Canadian and American).

3. Offshore lobster vessels require large fishing grounds. Available fishing space on the traditional 4X/5Ze grounds is limited.
4. The new Canadian Offshore Management Plan has been in effect for only one season, an insufficient time to assess its worth.
5. Landings exceeded 720 t in 1985 and 1986. Catch rates are increasing on several grounds, but CPUE may not be a reliable measure of stock health.
6. Movement data show a strong link between Georges Basin and Browns Bank, but not between Georges Bank and Georges Basin. Georges Basin, including the 5Ze section, should be considered a part of the Browns Bank stock.
7. The mean size of Georges Basin lobsters is similar to that of Crowell Basin. The smaller size, in part, has been the cause for increased effort, a trend which no doubt will continue.
8. Increased catch is not recommended at this time because we still lack a reliable means of assessing the size of the offshore stock and its relationship to inshore recruitment.

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Table 1. Canadian offshore lobster landings in t (% of total in parenthesis) and landed value by area fished as reported in fishermen's logs. Landings are based on fishermen's logs, Fisheries Officers' reports, and sales slips. Where log records were not available, locations are estimated on the basis of previous and subsequent locations fished by each boat. Landed value is based on sales slips.

Year	No. of vessels	Landings (%)								Landed Value (\$ ,000)	
		West Browns (4XP, 4XQ)		Southeast Browns (4XN)		Total 4X		Georges Bank (5Ze)			Total (4X + 5Ze)
1971	5			8	( 8)	8	( 8)	92	(92)	100	177
1972	6	22	( 7)	158	(47)	180	(54)	154	(46)	334	785
1973	7	136	(27)	181	(37)	317	(64)	176	(36)	493	1,166
1974	6	132	(32)	149	(36)	281	(68)	135	(32)	416	1,059
1975	8	171	(31)	201	(37)	372	(68)	173	(32)	545	1,527
1976	7	378	(56)	118	(17)	496	(73)	182	(27)	678	2,167
1977	8	290	(46)	68	(10)	358	(56)	277	(44)	635	1,971
1978	8	297	(43)	84	(12)	381	(56)	303	(44)	684	2,249
1979	8	215	(35)	158	(26)	373	(61)	236	(39)	609	2,175
1980	8	147	(27)	210	(38)	357	(65)	192	(35)	549	2,066
1981	7	136	(24)	247	(43)	383	(67)	189	(33)	572	2,348
1982	8	135	(30)	142	(32)	277	(62)	173	(38)	450	2,232
1983	8	200	(42)	114	(24)	314	(66)	156	(33)	470	2,650
1984	7	153	(35)	118	(27)	271	(62)	164	(38)	435	2,634
1985	8	366	(47)	210	(27)	576	(74)	201	(26)	777	5,407
1986	8	408	(51)	170	(21)	578	(72)	221	(28)	799	

Table 2. Catch (t), effort (,000's of trap hauls), and CPUE (kg/TH) for the subareas of the Canadian offshore lobster fishing district, based on log books, fishery officer reports, and sales slips.

Year	West Browns 4XP, 4XQ			SE Browns 4XN			Total 4X*			Georges Bank 5Ze			Total Canadian offshore*			% of Catch in log books
	C	E	CPUE	C	E	CPUE	C	E	CPUE	C	E	CPUE	C	E	CPUE	
1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1973	56.3	20.2	2.79	4.7	2.3	2.10	61.0	22.4	2.72	139.7	45.5	3.07	200.7	68.0	2.95	41
1974	127.9	63.9	2.00	22.3	15.4	1.45	150.3	79.3	1.89	127.9	55.3	2.31	278.2	134.6	2.07	67
1975	171.1	96.9	1.77	102.0	44.0	2.32	273.2	141.0	1.94	173.1	58.6	2.95	446.2	199.5	2.24	82
1976	356.9	136.2	2.62	102.8	51.2	2.01	459.7	187.4	2.45	160.4	50.8	3.16	620.1	238.2	2.60	91
1977	250.4	101.8	2.46	53.2	27.3	1.94	322.4	136.5	2.36	238.9	83.3	2.87	602.2	240.0	2.51	95
1978	267.8	98.3	2.73	64.6	27.7	2.33	380.7	135.2	2.82	303.3	94.3	3.22	684.0	229.5	2.86	100
1979	214.5	85.6	2.51	158.1	55.1	2.87	372.6	140.7	2.65	235.9	76.1	3.10	608.6	216.8	2.81	100
1980	147.3	66.3	2.22	187.4	61.9	3.03	334.7	128.2	2.61	183.6	57.2	3.21	518.3	185.4	2.80	95
1981	135.8	52.5	2.59	247.3	61.0	4.06	383.1	113.5	3.38	189.1	48.0	3.35	572.2	161.5	3.54	100
1982	134.7	67.6	1.99	141.6	78.0	1.82	276.3	145.6	1.90	173.7	64.7	2.68	450.0	210.2	2.14	97
1983	199.7	95.6	2.09	113.9	51.4	2.22	313.6	146.9	2.13	156.5	81.8	1.91	470.1	228.0	2.06	99
1984	153.1	72.7	2.10	117.5	49.0	2.40	270.6	121.7	2.22	164.0	75.7	2.17	434.6	197.4	2.20	99
1985	366.3	115.6	3.17	210.2	75.4	2.79	576.5	191.0	3.02	201.2	70.8	2.84	777.7	261.8	2.97	100
1986	408.4	140.2	2.91	170.2	51.6	3.30	578.6	191.8	3.02	220.9	76.3	2.90	799.5	268.1	2.98	100

\*Some trips could not be broken down into specific areas, but were included in the total for the combined Area 4X and/or yearly totals; thus, area or yearly totals can be greater than the sum of the parts.

Table 3. Catch (t), effort (, 000 trap hauls) and CPUE (kg/TH) for the subareas of Canadian offshore lobster fishery districts based on log books, fisheries officer reports, and sales slips.

YEAR	CROWELL BASIN			SW BROWNS			GEORGES BASIN			SE BROWNS			GEORGES BANK		
	C	E	CPUE	C	E	CPUE	C	E	CPUE	C	E	CPUE	C	E	CPUE
1981	0	0	-	121.9	44.4	2.8	13.9	8.1	1.7	246.5	60.6	4.1	181.3	46.9	3.9
1982	26.3	10.5	2.5	105.4	56.2	1.9	7.8	3.7	2.1	140.1	77.5	1.8	166.0	61.0	2.7
1983	51.7	20.9	2.5	137.1	62.6	2.2	13.9	12.8	1.1	115.0	51.6	2.2	156.6	81.8	1.9
1984	43.2	11.5	3.8	93.4	50.6	1.8	34.5	18.7	1.8	112.5	47.3	2.4	145.9	67.6	2.2
1985	49.8	11.4	4.4	138.7	47.0	3.0	267.5	86.0	3.1	207.8	74.2	2.8	133.8	43.2	2.6
1986	95.4	27.5	3.5	143.5	53.8	2.7	235.3	83.3	2.8	169.3	51.1	3.3	155.8	52.1	3.0

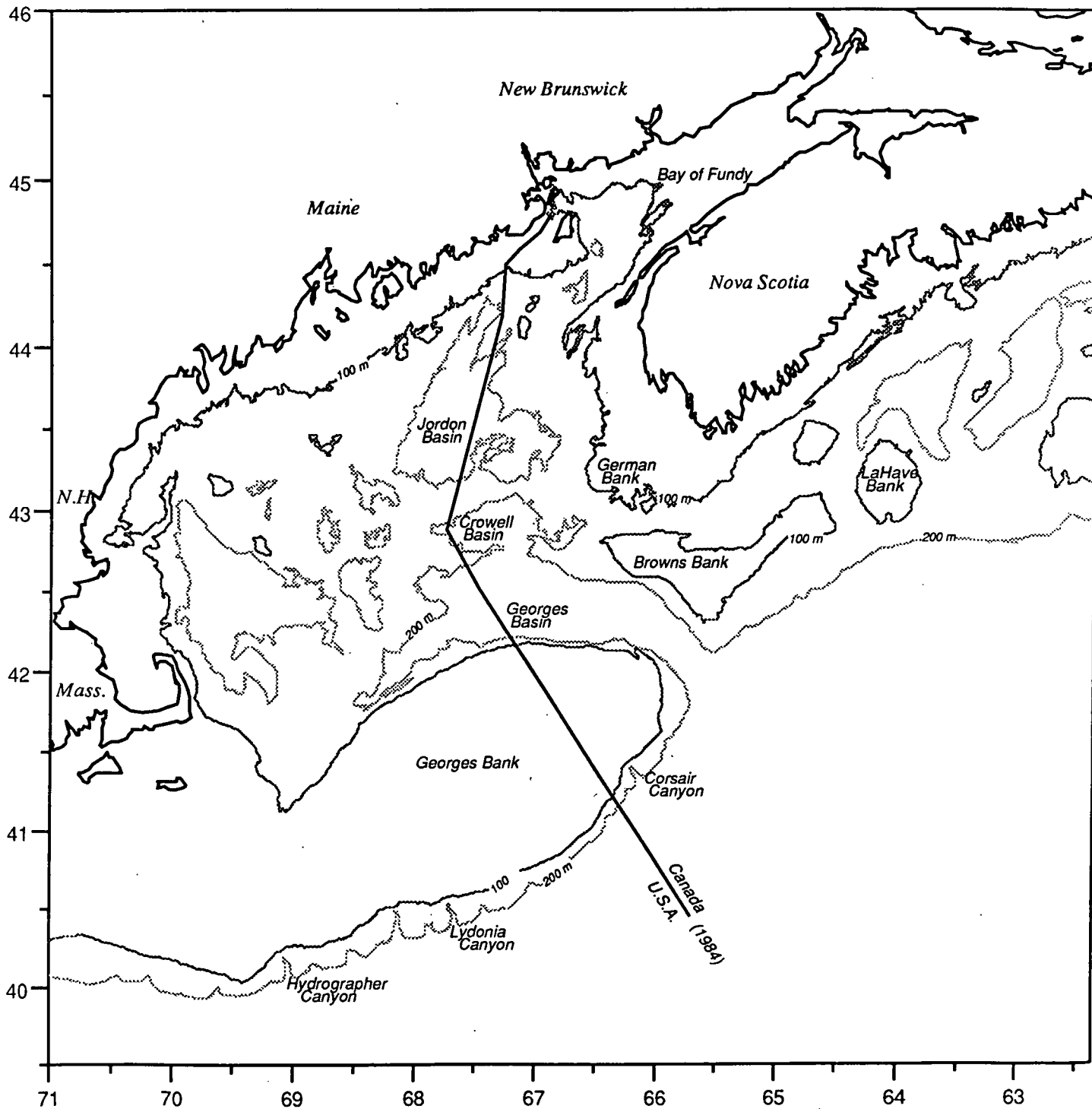
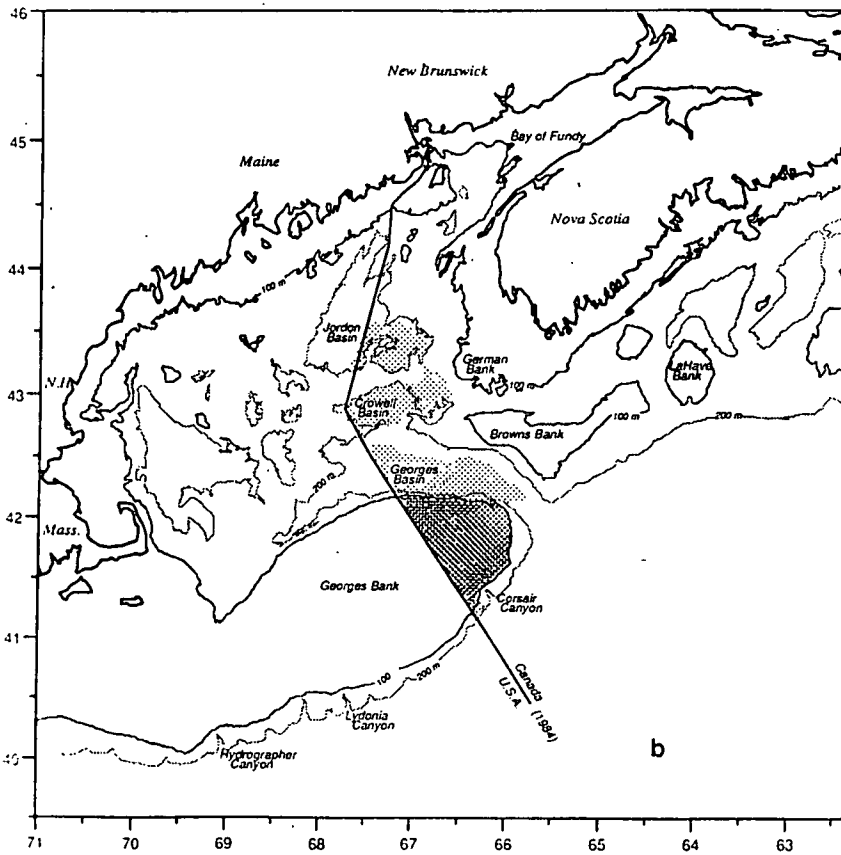
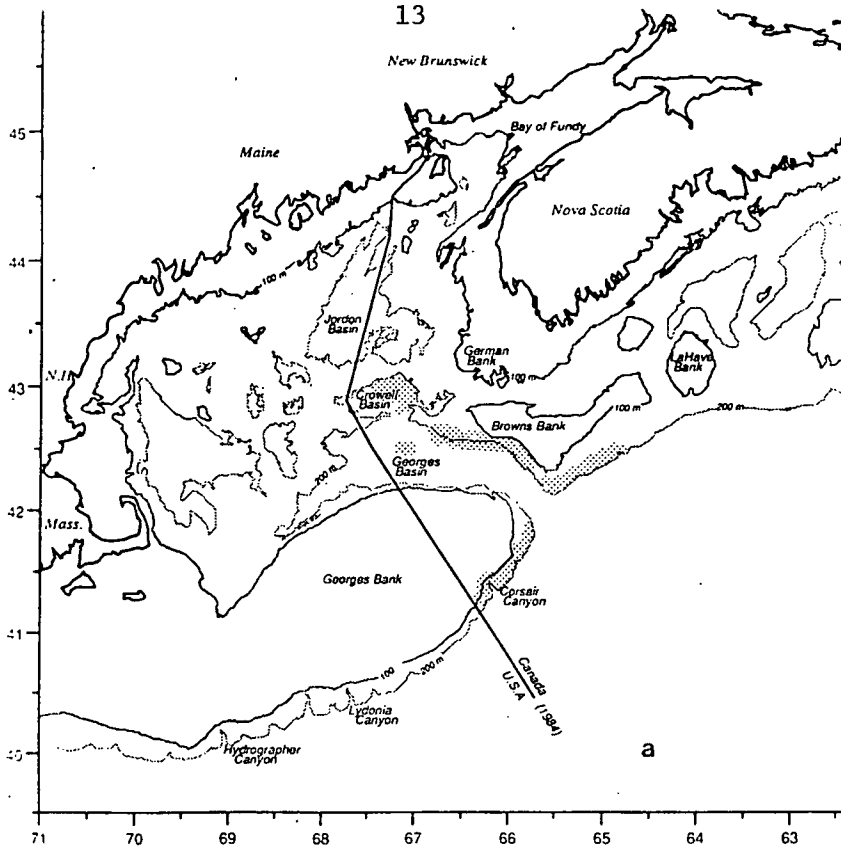


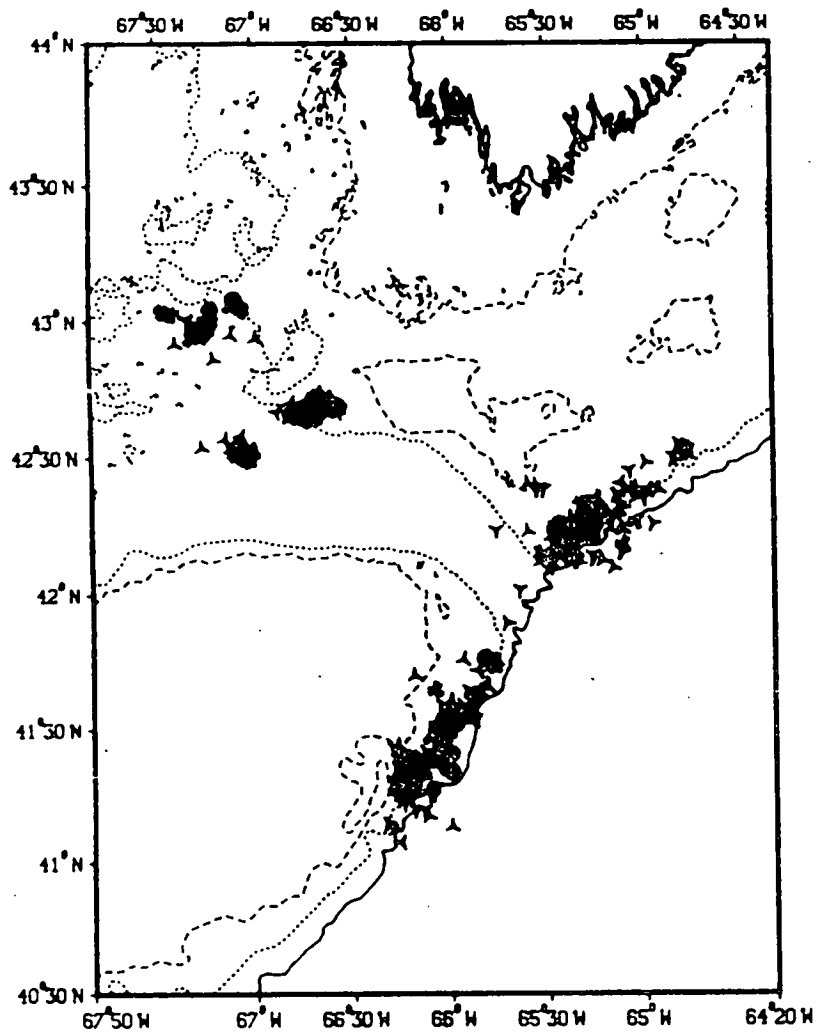


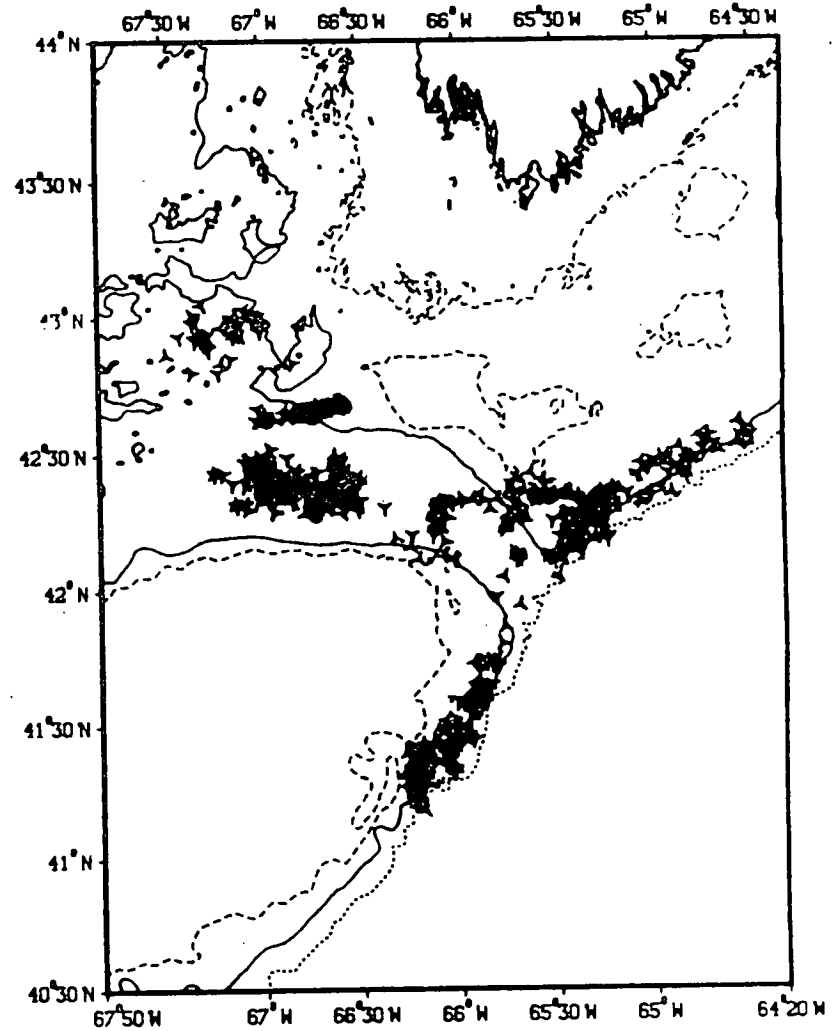
Figure 1 Gulf of Maine area



**Figure 2** Offshore lobster fishing areas prior to the ICJ decision (a) Canadian, (b) American (Trawler based: ; Trap based .



1983 Fishing Locations



1986 Fishing Locations

**Figure 3** Canadian offshore lobster fishing locations 1983 and 1986, based on logbook returns.

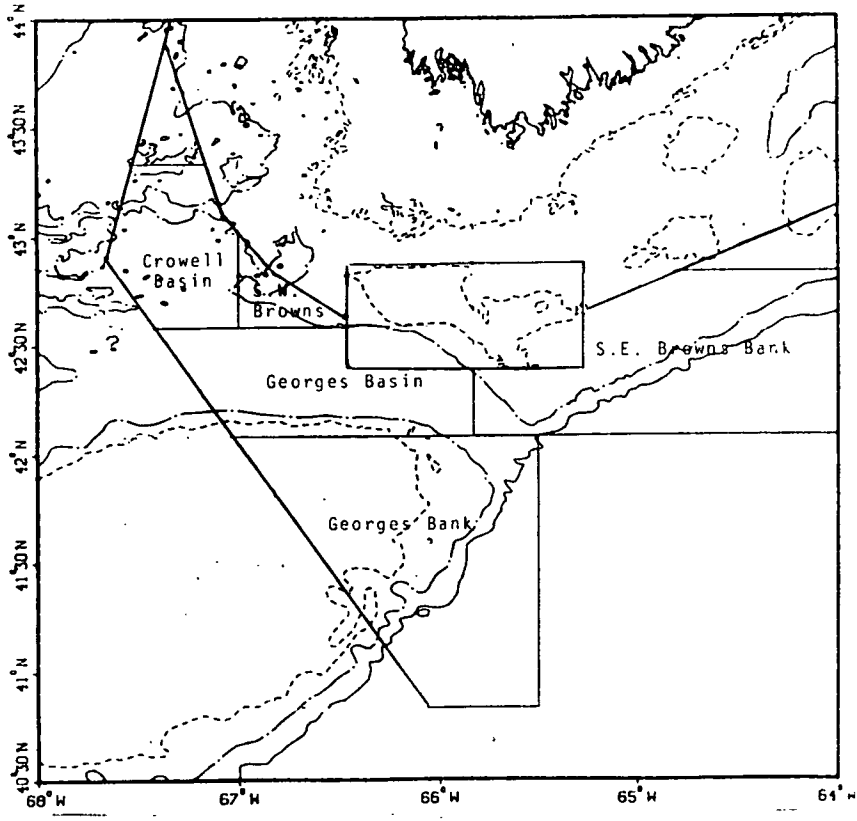


Figure 4 Canadian offshore lobster fishing areas as of 1986.

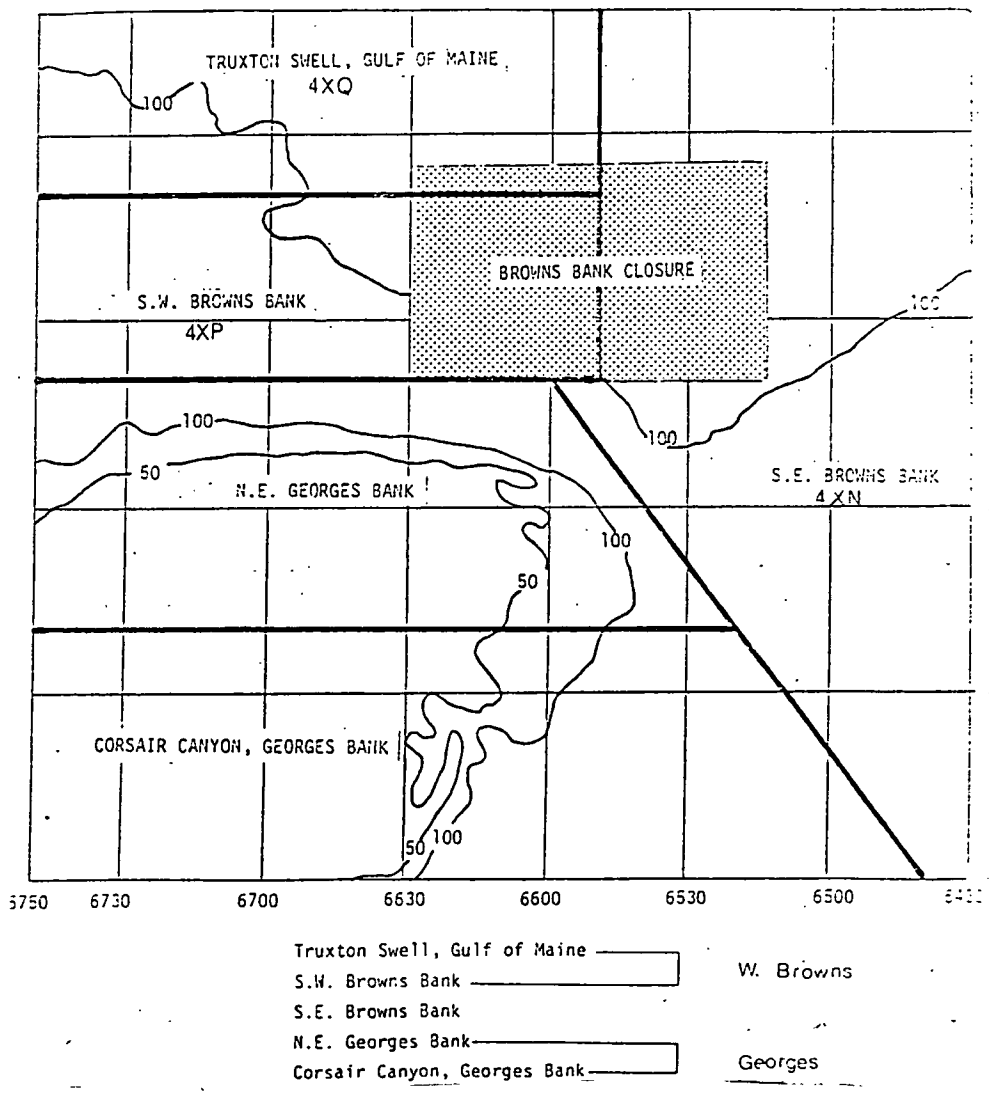


Figure 5. Canadian offshore fishing areas 1971-85.

### Canadian Offshore Lobster Landings

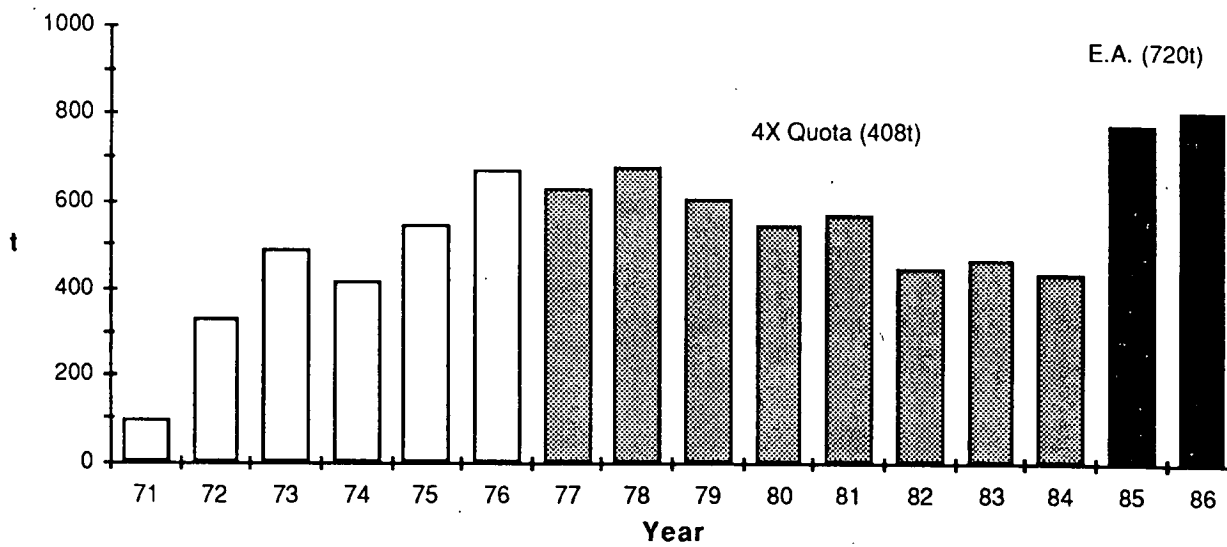
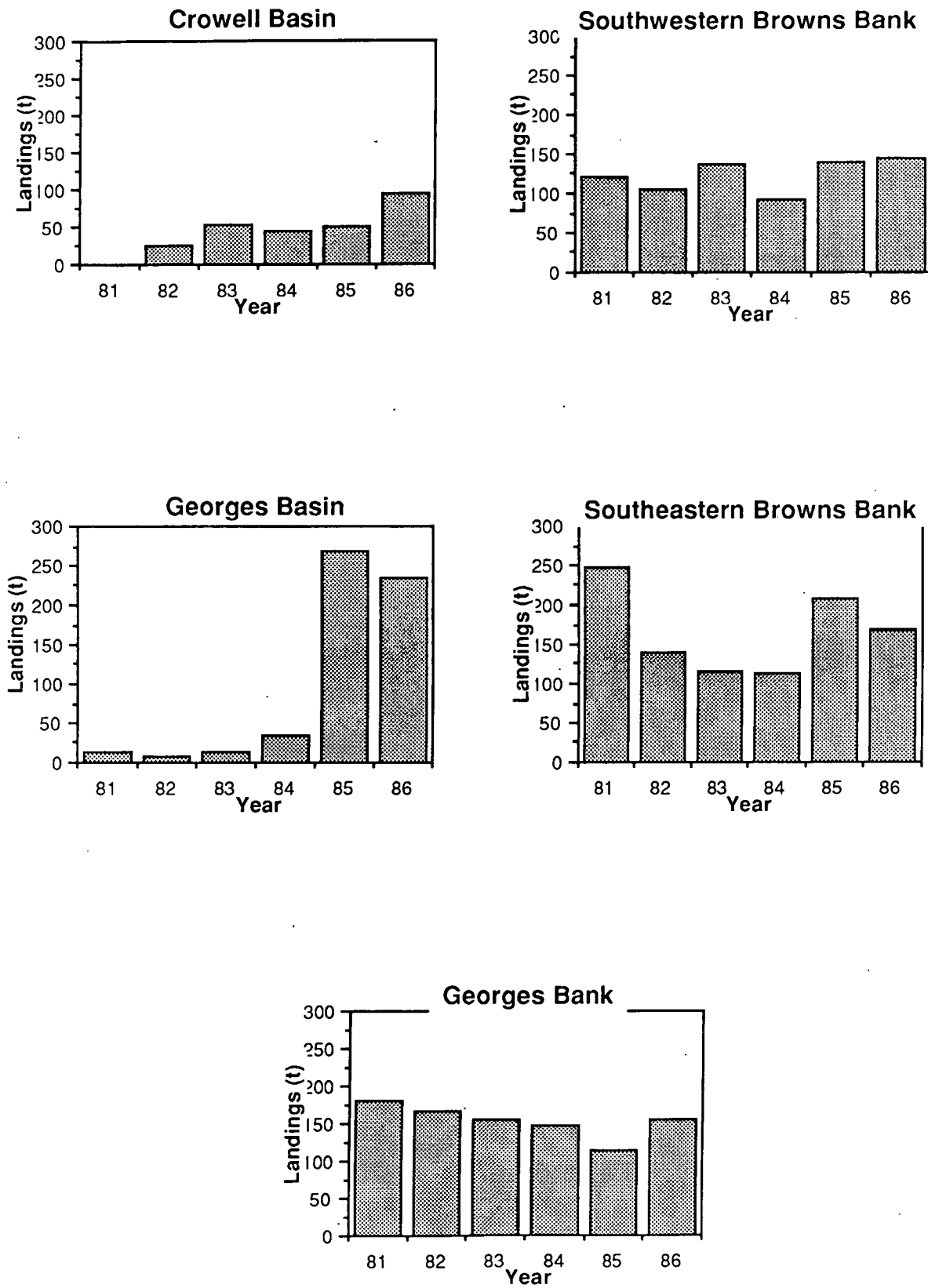
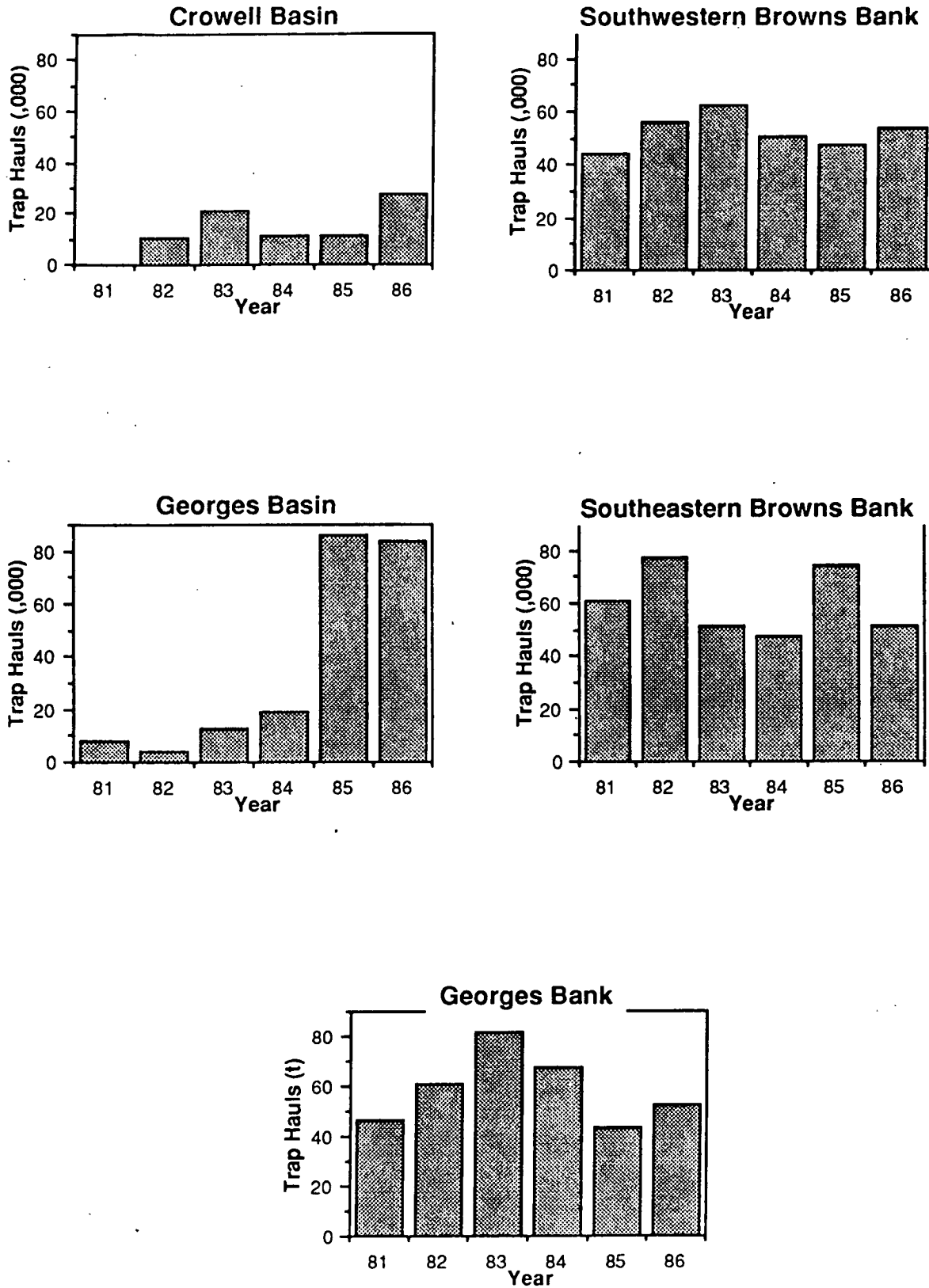


Figure 6 Annual Canadian offshore lobster landings (t) 1971-1986.





**Figure 7** Annual Canadian offshore lobster landings (t) 1981-86 by area (Figure 4).



**Figure 8** Annual Canadian offshore lobster effort (trap hauls) 1981-86 by area (Figure 4).

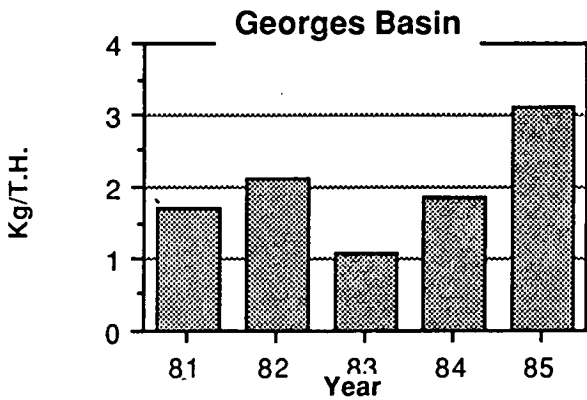
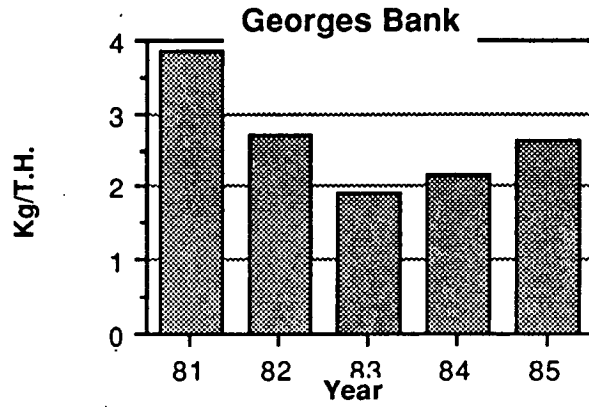
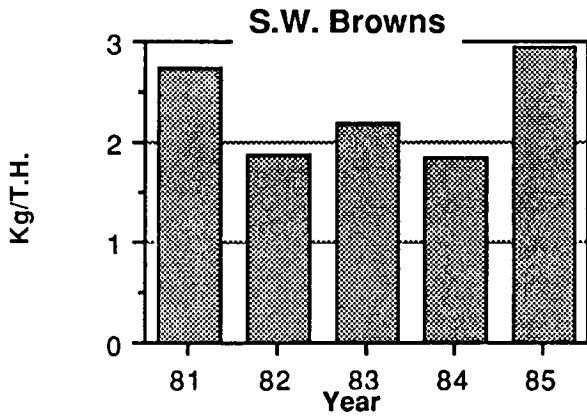
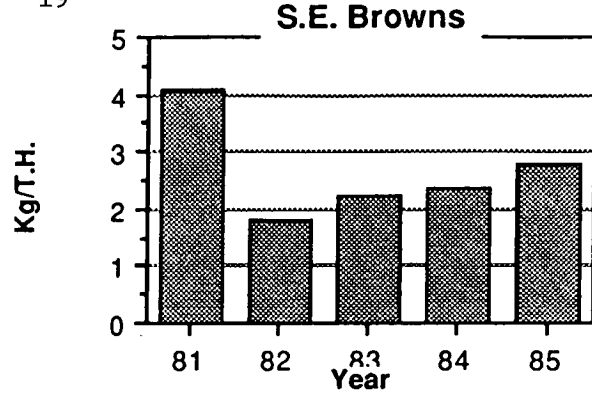
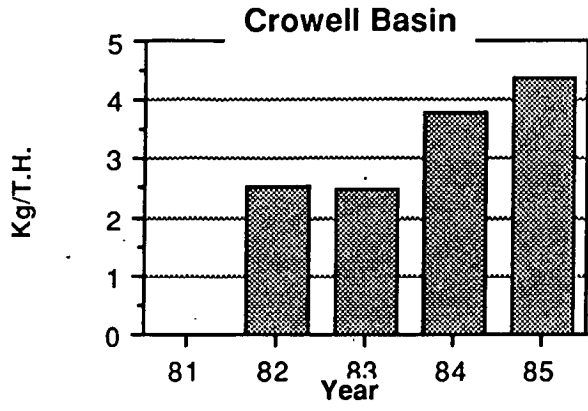
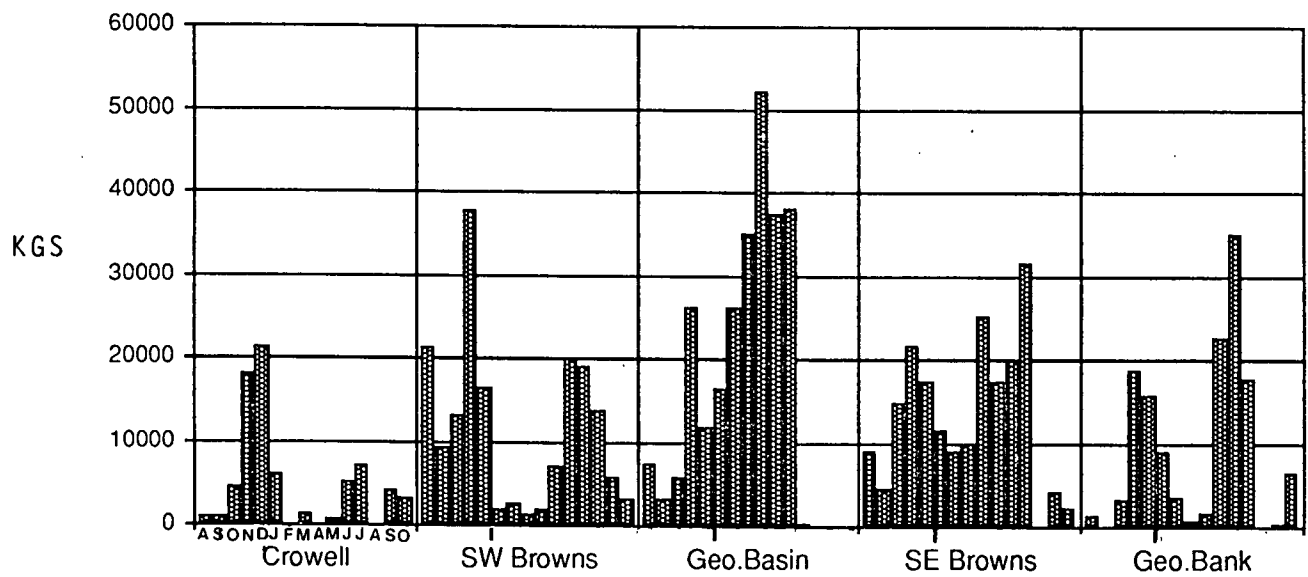


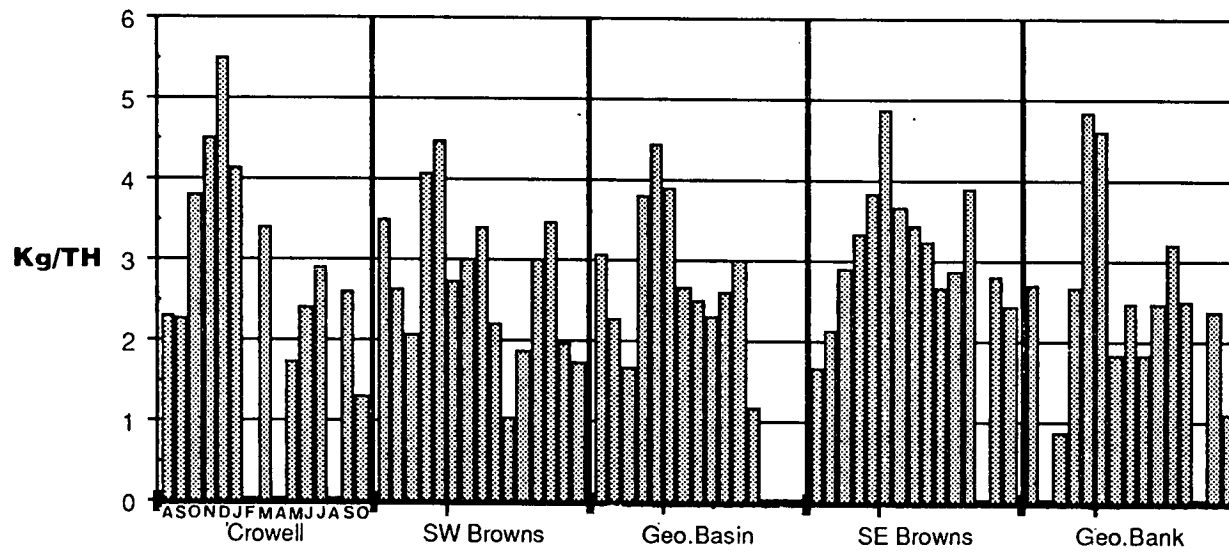
Figure 9 Annual Canadian offshore lobster CPUE (kg/TH) 1981-86 by area

**Canadian Offshore Lobster Landings  
1985-86 Season**



**Figure 10** Monthly offshore lobster landings (t) August 1985- October 1986.

**Canadian Offshore Lobster Fishery  
Monthly C.P.U.E. (Kg/TH) 1985-6**



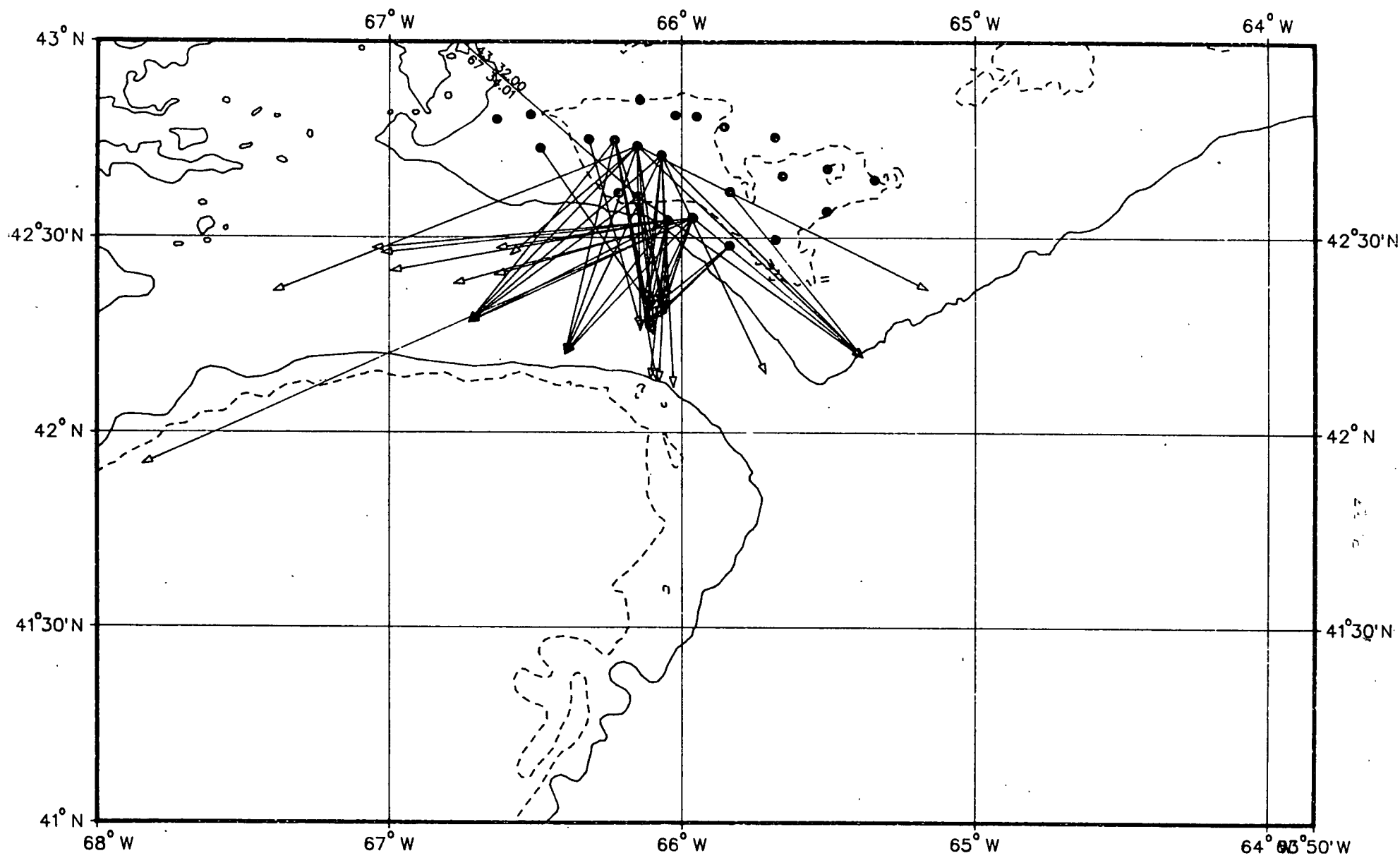
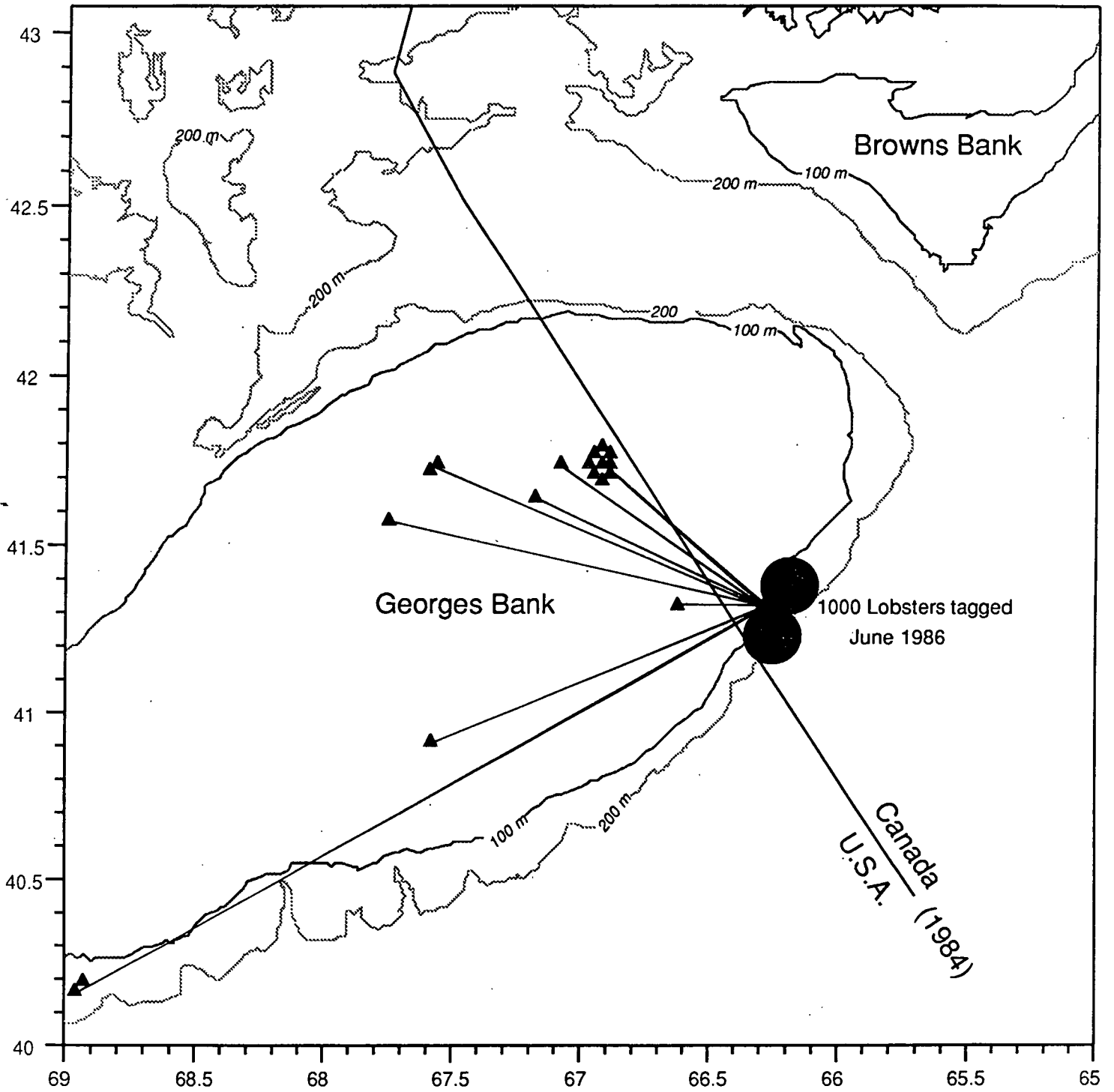


Figure 12 Tag returns (  $\Delta$  ) of lobsters released (  $\bullet$  ) on Browns Bank July 1985.



**Figure 13:** Tag returns (  $\Delta$  ) of lobsters caught >50 km from the release site in Corsair Canyon

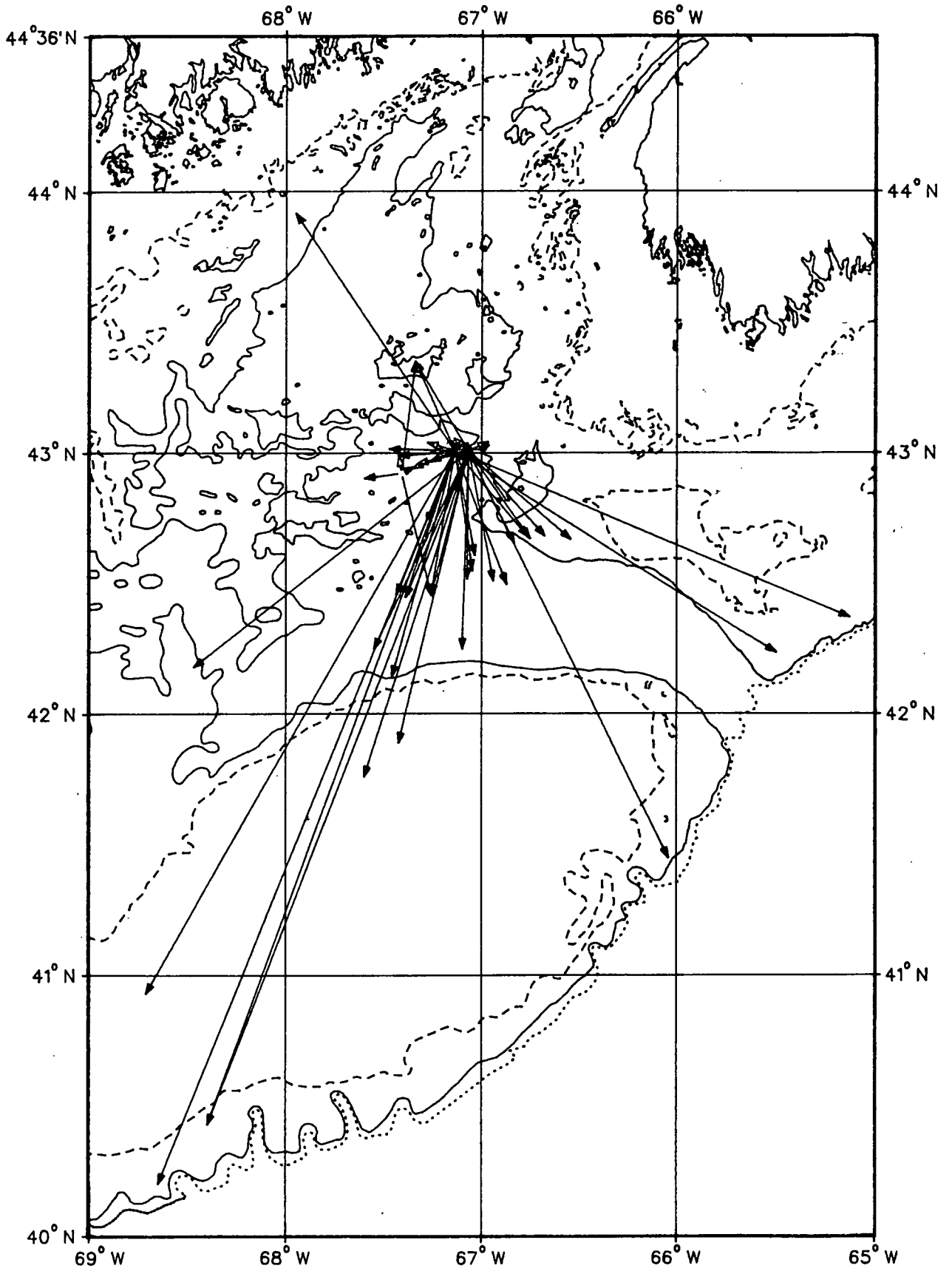
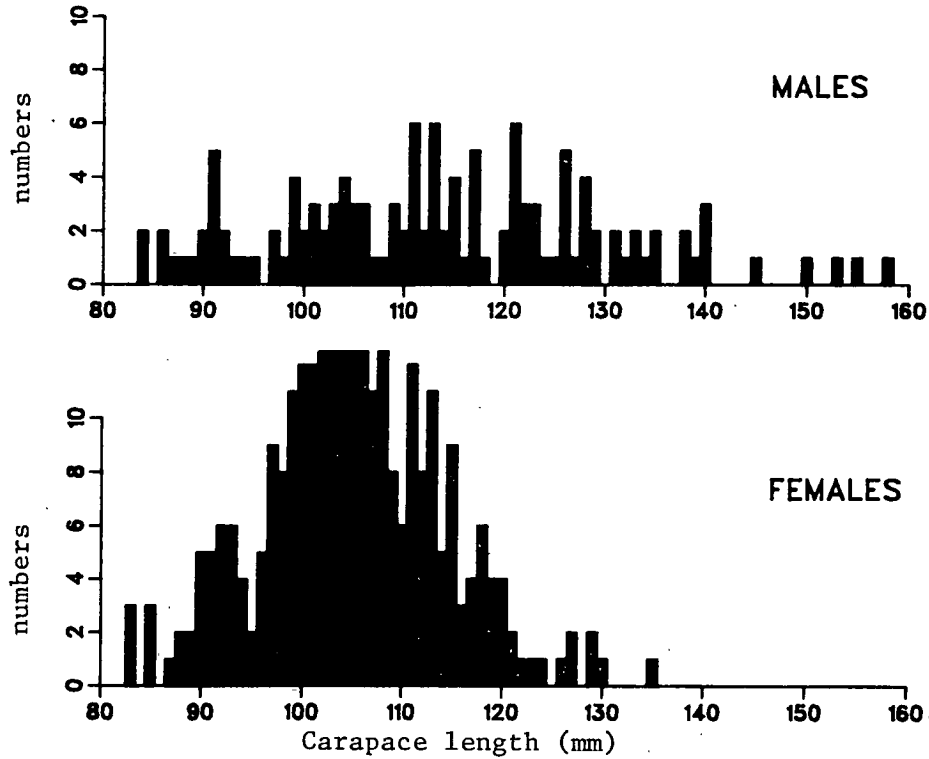


Figure 14 Tag returns ( Δ ) of lobsters released in Crowell Basin November 1983.





B. GEORGES BASIN OCT./DEC.1986

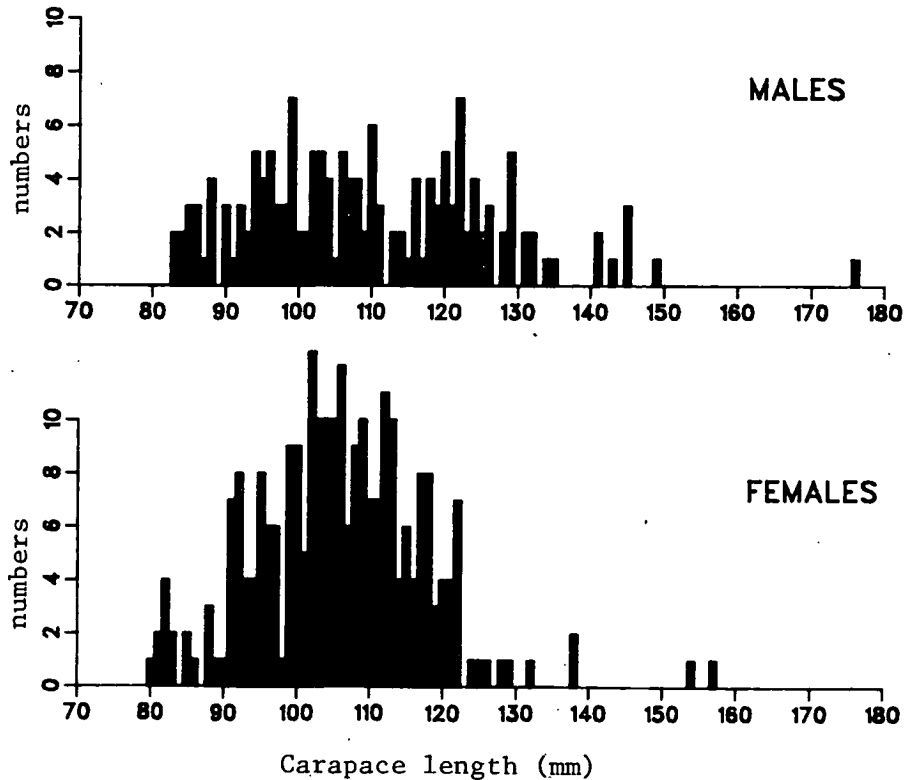


Figure 15 Lobster size frequency distribution from fall 1986 port sample (a) Crowell Basin, (b) Georges Basin.