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## Update of the Scotian Shelf Shrimp Fishery - 1991

By

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## ABSTRACT

The Scotian Shelf shrimp fishery covers three areas with depths greater than 200 m, referred to as SFA13 (Shrimp Fishing Area) or Louisbourg Hole, SFA14 or Misaine Hole, and SFA15 or Canso Hole. These areas have traditionally been fished by Gulf-based vessels. In 1991 both Scotia-Fundy and Gulf boats fished the Eastern Scotian Shelf. Catches were reported from April to September. The landings for 1991 were the highest since 1984.

In 1991 Scotia-Fundy boats accounted for 63% of the total catch landed while the Gulf boats, the remaining 37%. Effort from Gulf based boats increased 62% from 1990. There was a slight increase in the standardised catch-rate. By-catch species were somewhat less frequent and lower than in other years for Gulf based boats. Scotia-Fundy boats had little or no by-catch; they were required to use the Nordmøre separator grate.

For the last three years, advice was given for a TAC at 2,580 t. Since the CPUE patterns for the last 4 years are quite similar and the quota was not reached, it seems reasonable to assume that this figure would be adequate for 1992 and 1993. The Nordmøre separator grate used by the Scotia-Fundy fishermen is an important contribution to a renewal in utilization of that resource.

## RESUME

Sur le plateau néo-écossais la pêche à la crevette se poursuit dans trois endroits à des profondeurs supérieures à 200 m, les cuvettes de Louisbourg ou Région de Pêche à la Crevette 13 (RPC), Misaine (RPC 14), et Canso (RPC 15). Des navires provenant de la région du Golfe ont traditionnellement pêché ces endroits. En 1991 tant des navires de Scotia-Fundy que du Golfe ont pêché le plateau néo-écossais à l'Est. On a rapporté des prises d'Avril à Septembre. Les débarquements pour 1991 sont les plus élevés depuis 1984.

En 1991 les navires de Scotia-Fundy représentent 63% du total des débarquements alors que les navires du Golfe, ce qui reste, 37%. L'effort pour les navires du Golfe a augmenté de 62 % depuis 1990. Il y a eu une légère élévation dans le taux de capture standardisé. Les prises accidentelles ont été moins fréquentes et plus basses que précédemment pour les navires du Golfe. Les navires de Scotia-Fundy avaient très peu ou pas de prise accidentelle; ils devaient utiliser un chalut à crevettes avec une grille Nordmøre.

Pour les trois dernières années on avait suggéré un TPA dérivé biologiquement à 2,580 t. Etant donné que les PPUEs des quatre dernières années sont fort semblables et que le contingent n'a pas été atteint, il semblerait raisonnable d'assumer que ce niveau serait adéquat pour 1992, et 1993. La grille Nordmøre employée par les pêcheurs de Scotia-Fundy est une importante contribution pour relancer l'utilisation de cette ressource.

## INTRODUCTION

The Scotia-Fundy shrimp (*Pandalus borealis*) fishery has been concentrated primarily in three areas with depths >200m on the Eastern Scotian Shelf (NAFO Areas 4V and 4W) over the last 12 years. These areas are referred to as SFA13 (Shrimp Fishing Area) or Louisbourg Hole, SFA14 or Misaine Hole and SFA15 or Canso Hole (Figure 1). In 1991, about 804 t of shrimps were caught, the highest landings since 1984 (Table 1). This amount represented approximately 31% of a quota of 2,580 t. For the first time in four years, boats from Scotia-Fundy are actively participating in the fishery. The Scotia-Fundy boats landed 63% of the total catch landed while the Gulf based boats landed the remaining 37%. The Eastern Scotian Shelf catch can be divided into 81 t from Louisbourg, 583 t from Misaine, and 140 t from Canso according to log and sales slip information (Table 2). Effort for the Gulf based boats increased 62%, from that of 1990. The percentage of shrimp in relation to by-catch for the Gulf based boats has increased approximately 5 % over 1990. The use of the Nordmøre separator grate (Butler and Robert, 1991) by the Scotia-Fundy boats seems to have almost completely eliminated the fish by-catch. By-catch over the 10% limit had seriously compromised the potential of the fishery in the past. There were no reported landings from NAFO area 4X<sup>s</sup> in 1991.

## METHODS

### Fishery Data

The commercial fishery data was extracted from logs completed and submitted by the fishermen. The total commercial catches found in Table 2 are from both the Scotia-Fundy and Gulf Statistics Branches and Foreign and Domestic Quota Monitoring (Fisheries Operations Branch, Halifax). In 1991, the shrimps caught on the Eastern Scotian Shelf were fished by boats from both Scotia-Fundy regular and exploratory licensed vessels using the Nordmøre separator grate and Gulf based boats from eastern New Brunswick. The regular licenses or limited entry licenses are issued on a yearly basis along with a groundfish and possibly other licenses. The fisherman must have held or banked the licenses the previous year to be issued licenses for the current year. The exploratory licenses are a limited number of permits issued once and valid only until the end of that year. Certain conditions apply to these permits. To qualify for a subsequent year the fisherman must fish shrimp for a minimum of five days and reapply; however, there is no guarantee another permit will be issued to the same fisherman the next year. The Gulf based boats landed in both Scotia-Fundy and Gulf ports. To obtain reasonably accurate shrimp catch figures, the catches recorded by both the Scotia-Fundy and the Gulf Region Statistics Branches must be combined.

Statistics Branches in both regions compile their statistics by NAFO areas and subareas although it might not always be the best way to sectorise the fisheries for different species. Historically, the three holes fished have been referred to as NAFO subarea 4Vn or SFA 13 for Louisbourg, 4Vs or SFA 14 for Misaine, and 4Wd or SFA15 for Canso. Unfortunately as these fishing holes may overlap NAFO areas and subareas (Butler-Connolly and Robert 1990), Loran bearings or latitude and longitude from the logged catch locations must be used to confirm the area in which the catch should be listed from. Foreign and Domestic Quota Monitoring lists the catch according to the named fishing areas instead of just NAFO areas and its figures cover the Atlantic region.

A Yankee 36 trawl was used during the previous shrimp surveys (Etter and Mohn 1989). The commercial data had to be standardized for the comparison of results from past years and to compare with the survey results from previous years. For comparisons of commercial gear types the effort also had to be standardized. Each gear type for the Gulf based boats was standardized to a Yankee 36 trawl and the correction factors used to standardize the effort before calculating the catch-rates. Effort from the Scotia-Fundy regular and exploratory boats cannot be

standardized as the required information, height and wingspread (width) of the trawl, is not available for each boat. Each fisherman uses a trawl that has been modified to maximize catches for his boat. All catch rates for the Scotia-Fundy boats are unstandardized as the effort is not corrected for a Yankee 36 trawl.

In 1991 the Gulf based commercial vessels used five types of gear, a Labrador Shrimp trawl, a Sputnik trawl, a Nord Sea 938 trawl, a modified Terra Nova trawl, and an I.C. trawl. When they are standardized to a Yankee 36 the correction factors vary from 3.0 to 6.0 (Table 3).

Table 3 indicates a difference in catch-rates between gear types. This could be attributed to the difference in size of the trawls or, as had been indicated in past years, an overcorrection when standardizing for a Yankee 36 which is a much smaller trawl than the ones used commercially. There has been a tendency towards fishing with trawls that are much larger than the Yankee 36 in the past few years. It is quite possible that the correction factors need a re-evaluation and that trawl efficiency should be researched.

## RESULTS

The Scotia-Fundy Region issued 25 regular shrimp licenses in 1991 (Table 4). All the licenses issued were for boats <19.8m L.O.A. (length over all). The licenses were limited to fishing in specific areas. There were 5 licenses issued for the NAFO areas 4V and 4W; 17 licenses issued for NAFO area 4X only; and 3 licenses issued for areas 4V, 4W and 4X. Although the number of licenses has decreased slightly over the last few years there was a slight increase in the number issued in 1991 (Table 4). This increase might be attributed to a renewed interest in the shrimp fishery with the introduction of the Nordmøre separator grate and continued decrease in groundfish availability. These licenses are usually renewed along with other licenses each year. In 1991, 4 of these licenses actively directed for shrimp. There were 9 'exploratory' shrimp licenses issued in 1991. Of these, 5 licenses actively participated in the fishery (Table 5). A condition of the license is the use of the Nordmøre separator grate. The definition of active participation is landing shrimp and submitting a log detailing the trip and/or the issuance of a sales slip recording landed catch.

The Gulf Region issued 22 shrimp licenses in New Brunswick in 1991. These licenses were issued for eastern Scotian Shelf areas 4Vn, 4Vs, and 4W (Shrimp Fishing Areas 13, 14, and 15). Of that number, 5 licenses were issued for boats <19.8m L.O.A. and 17 licenses issued for boats 19.8m to 30.5m L.O.A. The number of licenses has remained constant from 1984 to 1991 with one exception and that was 1989 when 17 licenses were issued for boats 19.8m to 30.5m L.O.A. In recent years only the 19.8m to 30.5m L.O.A. have landed shrimps from the Scotian Shelf.

The shrimp fishery continues to maintain catches well below the yearly quotas. As the quotas have decreased, the catches have generally stayed below 1,000 t. The 1991 catches were the highest since 1984 but still only fractions of the actual set quotas (Figure 2). The 1991 catches have increased by approximately 87% over the 1990 figure mainly due to concentrated fishing by the Scotia-Fundy boats. The fishery effort in 1991 for the Gulf based boats has also increased, almost 62% from 1990. An increase in the number of boats fishing may be responsible for a portion of the increase in effort. This may be a positive indication of stable biomass if the gear standardization is correct.

Historically the Gulf based shrimp boats have fished every year on the eastern Scotian Shelf. Up to 1991, the Gulf boats had caught between 91% and 100% of the shrimp landed while the Scotia-Fundy boats caught from 1 % to 9 % of the landings according to log and sales slip information (Table 6). The low Scotia-Fundy share might had been caused by low catch-rates and the 10% by-catch limit. In 1991 the ratio changed drastically as the Scotia-Fundy boats landed the majority of the catch, 63%, while the Gulf based boats landed the remaining 37%. The issuance of

exploratory licenses and the introduction of the Nordmøre separator grate to the Scotia-Fundy license holders are mainly responsible for the change. The lack of groundfish also contributed.

Both Scotia-Fundy and Gulf boats concentrated fishing activities in the Misaine hole in 1991. The Scotia-Fundy boats then targeted Canso hole with only a day or two of fishing in Louisbourg hole. The Gulf boats did the reverse, fishing Louisbourg hole as a second choice with only a day in Canso hole. The Misaine hole had a catch of 583 t, the highest catch on record. The Canso hole a catch of 140 t, and the Louisbourg hole a catch of 81 t for the combined landings from Scotia-Fundy and Gulf boats (Table 7).

Boats from New Brunswick in the 19.8m to 30.5m L.O.A. category logged catches in the Eastern Shelf areas. These boats accounted for 37% of the total catch. Of an Eastern Scotian Shelf total of 294 t, 80 t were logged catches reported from Louisbourg hole, 213.5 t logged catches from Misaine hole and approximately 0.4 t from Canso hole (Table 7). The average yearly catch-rate for the Cape Breton area was 45.6 kg/h corrected for a Yankee 36 trawl (Table 8). This is a minimal increase of 2% from the 1990 catch-rate of 44.9 kg/h. The yearly catch-rate uncorrected for 1991 was 197.9 kg/h. This was a substantial increase from the 1990 uncorrected catch-rate of 134.5 kg/h. The yearly CPUE has been steadily increasing from 1989 to 1991 (Figure 3). This may be attributed to the increase in number of boats fishing and their larger fishing trawls. The increase in the 1991 catch-rate, along with the proportional changes in the catch and the effort figures might indicate a relatively stable biomass.

The Louisbourg hole had a yearly catch-rate of 36.2 kg/h from fishing in May, June, July, August and September. Misaine's yearly catch-rate was 51.2 kg/h and Canso's yearly catch-rate was 20.9 kg/h (Table 8). The Canso catch-rate was based on only one day of fishing in the month of August so it may not be representative of catch-rates in the area. All values were calculated using effort corrected for gear type from the Gulf based boats.

Scotia-Fundy boats in the <19.8m L.O.A. category accounted for 63% of the shrimp landed in 1991. Of a total of 510 t, the exploratory boats landed 398 t and the regular boats landed 112 t. According to logged catches the exploratory boats fished 1.5 t from Louisbourg hole. There were no reported landings from Louisbourg for the regular boats. Approximately 369 t were landed from Misaine hole, the exploratory boats contributed 264 t and the regular boats 105 t. Approximately 140 t were landed from Canso hole, exploratory boats accounted for 133 t and the regular boats landed 7 t (Table 7). The average yearly unstandardized catch-rate from the exploratory boats was 140.4 kg/h (Table 9). The unstandardized catch-rate for the regular boats was 120.5 kg/h (Table 10). The difference in the catch-rates might be attributed to the limited fishing activities of the regular boats. There were fewer boats and the fishing took place in the month of July with only one vessel making a couple of short trips in September when the catch-rates generally decrease.

The monthly CPUEs for the Gulf based boats for the years 1986 through 1991 are shown in Figure 4. The general trend indicates lower catch-rates during the early months of the year with the catch-rates peaking during the months of June and July and then decreasing toward the end of the year. This may be attributed to increased fishing effort during peak months. In some cases monthly CPUE has been based on only one or two fishing days in a particular fishing area in that month which may also account for higher or lower values before and after those peak months. The month of July for 1988 when CPUE decreased below that of either June or August is an exception to the general trend but then a minimum of commercial fishing took place during those particular months. In 1991 for the month of September, the CPUE is based on only a few days fishing in one fishing area. Months with no reported fishing activity (zero CPUE in graphs) have increased over the years.

Unstandardized catch-rates for exploratory boats followed similar trends as the Gulf based boats. Intra-seasonal boat trends are illustrated in Figure 5 for two of the exploratory boats that fished the season. The catch-rates and catches seem to peak in June and July and then steadily decrease as the year progresses. The exceptions are May and September. This may be due to fishing only a few days of each of these months in a particular area.

The percentage of shrimp for Gulf based boats in the 1991 monthly catch increased from the similar period in 1990 and is much higher than that of 1990 (Table 11). The percentage composition of the by-catch showed a general decrease again, this year, in the primary species, cod and redfish. This might be attributed to the continued lack of availability of groundfish in 1991. There has also been a slight increase in the number of different species caught as by-catch in 1991. It could also be due to the efficiency of the newer, larger gear, and the captains could also be directing more for shrimp. Some of the by-catch species are usually found only in specific areas, on a seasonal basis.

The Scotia-Fundy boats indicated that there was little or no by-catch associated with the shrimp landings when using the Nordmøre separator grate as test trials had shown. They reported that the small amount of by-catch usually consisted of juvenile fish which had gone through the grate (pers. comm. fishermen).

The shrimp fishery takes place during different months each year (Table 6). This makes comparisons of shrimp and by-catch for different years difficult. Due to much reduced or nearly nonexistent by-catches of redfish during the months fished in 1991, it is not possible to give an accurate comparison of shrimp with cod and redfish.

During 1991 there were no reported shrimp catches from NAFO area 4X.

## DISCUSSION

The recommended quota for shrimp in 1992 is 2,580 t (Table 1). This is the figure used for the past four years. Since the CPUEs for the last five years are quite similar and the quota was not reached in the past, it seems reasonable to assume this figure will be adequate for 1992 and 1993. As no research survey work took place in 1991 to obtain a biomass estimate, it is difficult to derive a better quota figure as had been done in previous years (Etter and Mohn 1988).

The steady, gradual decline in CPUE's from 1984 to 1989 with the slight increases in 1990 and 1991 should be interpreted with caution (Table 2). With the increased fishing activities from the Gulf boats (numbers of boats and fishing trips) in 1991, the slight increase in CPUE might indicate a relatively stable biomass.

In 1991, the introduction of the Nordmøre separator grate to the Scotia-Fundy exploratory and regular license holders resulted in the increased participation in this fishery and the highest landings since 1984. The landings from the Scotia-Fundy boats exceeded those for the Gulf boats although more Gulf boats made more trips in 1991. Although the 10% by-catch limit is still in effect it seems the use of the Nordmøre separator grate has substantially reduced some of the by-catch problem. The exception to this is some juvenile groundfish mortalities reported by fishermen. The juvenile groundfish can get trapped in the codend after passing through the grate. With larger trawls without the grate, the juveniles get caught in the small mesh. The mortalities of juvenile groundfish should be reduced and research into a second grate to allow escape of juvenile fish would be useful.

The Gulf based boats seemed to adhere to the 10% by-catch limit while directing for shrimp. More selective trawls and/or the lack of groundfish may help to achieve the limit.

With the positive results from the use of the Nordmøre separator grate, some of the limiting factors in this underexploited fishery may be removed. It is reasonable then to maintain the quotas at previous years levels to protect these stocks.

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Table 1. Shrimp quotas (t) and actual catches (t) for Scotian Shelf (Shrimp Fishing Areas 13, 14 and 15), (NAFO Area 4V and 4W ) 1980-1991.

Year	Quotas (t)			Total	Actual Catch (t)
	SFA 13 (Louisbourg)	SFA 14 (Misaine)	SFA 15 (Canso)		
1980	1553	2382	1086	5021	984
1981	---	---	---	---	454
1982	1400	1800	1000	4200	569
1983	2000	2400	1400	5800	1010
1984	1800	2500	1400	5700	928
1985	1790	2420	1350	5560	133
1986	1460	1600	740	3800	126
1987	1070	860	210	2140	152
1988	1160	1050	370	2580	82
1989	1160	1050	370	2580	82
1990	1160	1050	370	2580	104
1991	1160	1050	370	2580	804
1992*	1160	1050	370	2580	

\*Proposed values.

Table 2. Eastern Scotian Shelf (NAFO 4V, 4W) commercial shrimp landings and CPUE.

Year	Catch (t)				CPUE (kg/h)*	
	Louisbourg	Misaine	Canso	Total	Unstd.	Std.**
1977	---	---	---	269	128.5	104.5
1978	---	---	---	306	121.9	97.3
1979	295	8	534	838	174.6	128.0
1980	491	133	360	984	130.9	97.3
1981	418	26	10	454	131.8	92.8
1982	316	52	201	569	128.0	80.4
1983	483	15	512	1010	127.7	81.2
1984	600	10	318	928	109.5	77.6
1985	118	---	15	133	75.4	40.7
1986	126	---	---	126	87.3	58.1
1987	148	4	---	152	90.7	39.9
1988	75	6	1	82	85.1	51.0
1989	77	3	---	80	133.4	44.4
1990	90	14	---	104	134.5	44.9
1991	81	583	140	804	197.9	45.6

\* CPUE's are from Gulf based vessels.

\*\* Standardized to a Yankee 36 trawl.



Table 3. Corrected catch-rates (kg/h) for the Gulf based boats fishing off southeastern Cape Breton, 1991.

No. of boats	Gear type	Louisbourg Area	Misaine Area	Canso Area	Correction factor
1	I.C. Trawl	27.4	---	---	6.0
1	Labrador	41.6	52.7	---	4.6
1	Nord Sea 938	73.6	73.9	---	3.0
1	Sputnik	---	30.1	34.9	3.0
2	Terra Nova (mod)	19.9	43.9	22.0	4.9

Table 4. Shrimp licenses issued in Scotia-Fundy for 1985 to 1991 according to designated fishing areas.

Year	NAFO Area			Total
	4V, 4W	4X	4V, 4W, 4X	
1985	7	17	2	26
1986	6	18	3	27
1987	4	17	3	24
1988	5	15	3	23
1989	5	15	3	23
1990	4	14	3	21
1991	5	17	3	25

Source: Licensing Unit, Department of Fisheries & Oceans, Scotia-Fundy Region.

Table 5. Exploratory shrimp licenses issued in Scotia-Fundy for 1990 to 1991.

Year	Issued	Active
1990	12	3
1991	9	5

Source: Licensing Unit, Department of Fisheries & Oceans, Scotia-Fundy Region.

Table 6. Proportion ( % ) of the catch by Gulf based and Scotia-Fundy based vessels from log and sales slip information.

Year	Gulf Region (%)	Scotia-Fundy (%)
1985	100.0	0.0
1986	100.0	0.0
1987	91.0	9.0
1988	96.0	4.0
1989	96.0	4.0
1990	99.0	1.0
1991	37.0	63.0

Table 7. Catch ( kg ) for 1991 for the Gulf and Scotia-Fundy shrimp license holders by fishing area.

Area	Gulf	Scotia-Fundy		Total
		Exploratory	Regular	
Louisbourg	79,693	1,518	---	81,211
Misaine	213,506	263,596	105,386	582,488
Canso	419	132,750	7,087	140,256
Total	293,618	397,864	112,473	803,955

Table 8. Monthly commercial shrimp fishery statistics for Gulf based boats for the Louisbourg, Misaine and Canso areas in 1991.

		May	June	July	August	September	Total
Louisbourg:	Catch (kg)	24,966	42,220	---	9,282	3,218	79,686
	Effort (uncor)	116	233	---	110	18	477
	CPUE (uncor)	215.2	181.2	---	84.4	178.8	167.1
	Effort (cor)	534	1043	---	539	88	2,204
	CPUE (kg/h)	46.8	40.5	---	17.2	36.6	36.2
Misaine:	Catch (kg)	231	136,173	56,647	2,164	---	195,914
	Effort (uncor)	3	590	293	24	---	910
	CPUE (kg/h)	77.0	230.8	193.3	90.2	---	214.5
	Effort (cor)	12	2,514	1,213	72	---	3,811
	CPUE (kg/h)	15.7	54.2	46.7	30.1	---	51.2
Canso:	Catch (kg)	---	---	---	419	---	419
	Effort (uncor)	---	---	---	4	---	4
	CPUE (kg/h)	---	---	---	104.8	---	104.8
	Effort (cor)	---	---	---	20	---	20
	CPUE (kg/h)	---	---	---	20.9	---	20.9
All areas:	Catch (kg)	25,197	178,393	56,647	11,865	3,218	275,320
	Effort (uncor)	119	823	293	138	18	1,391
	CPUE (kg/h)	211.7	216.8	193.3	86.0	178.8	197.9
	Effort (cor)	546	3,557	1,213	631	88	6,035
	CPUE (kg/h)	46.1	50.2	46.7	18.8	36.6	45.6

Table 9. Monthly commercial unstandardized fishery statistics for Louisbourg, Misaine and Canso holes from the Scotia-Fundy exploratory boats in 1991.

Area		April	May	June	July	August	September	Total
Louisbourg	Catch(kg)	---	---	---	1,518	---	---	1,518
	Effort(h)				10			10
	CPUE(kg/h)				151.8			151.8
Misaine	Catch(kg)	5,076	39,839	73,150	71,478	55,510	3,461	248,514
	Effort(h)	30	257	487	522	568	33	1897
	CPUE(kg/h)	169.2	155.0	150.2	136.9	97.7	104.9	131.0
Canso	Catch(kg)	7,013	74,910	24,499	11,999	---	3,978	122,399
	Effort(h)	44	385	159	106		51	745
	CPUE(kg/h)	159.4	194.6	154.1	113.2		78.0	164.3
Total	Catch(kg)	12,089	114,749	97,649	84,995	55,510	7,439	372,431
	Effort(h)	74	642	646	638	568	84	2,652
	CPUE(kg/h)	163.4	178.7	151.2	133.2	97.7	88.6	140.4

Table 10. Monthly commercial unstandardized fishery statistics for Louisbourg, Misaine and Canso holes from the Scotia-Fundy regular boats in 1991.

Area		April	May	June	July	August	September	Total
Louisbourg	Catch(kg)	---	---	---	---	---	---	---
	Effort(h)							
	CPUE(kg/h)							
Misaine	Catch(kg)	---	---	---	40,434	---	7,278	47,712
	Effort(h)				300		74	374
	CPUE(kg/h)				134.8		98.4	127.6
Canso	Catch(kg)	---	---	---	9,872	2,320	---	12,192
	Effort(h)				89	34		123
	CPUE(kg/h)				110.9	68.2		99.1
Total	Catch(kg)	---	---	---	47,522	2,320	7,278	59,904
	Effort(h)				354	34	74	497
	CPUE(kg/h)				134.2	68.2	98.4	120.5

Table 11. Percentage of the catch composition of commercial shrimp trips (Gulf based boats) from Eastern Scotian Shelf on a monthly basis when available for the last 8 years (Etter and Mohn 1987, 1988, 1989, Butler-Connolly and Robert 1990, and Butler and Robert 1991).

<b>1986</b>	Species	May	June	September	October
	Shrimp	54.8	40.8	64.5	40.6
	Cod	5.5	4.3	7.5	2.1
	Redfish	34.2	52.6	23.3	51.5
	Flatfish	1.8	1.1	3.0	3.5
	Hake	---	0.1	0.5	0.6
	Halibut	---	0.5	---	---
	Haddock	0.1	0.1	1.0	1.4
	Pollock	3.6	0.6	0.1	0.2
	Misc	---	---	---	---
	Total shrimp catch (kg)	37,554	9,902	7,630	2,354

<b>1987</b>	Species	June	July	September
	Shrimp	56.7	69.8	49.1
	Cod	32.8	20.7	3.3
	Redfish	5.4	2.9	43.8
	Flatfish	3.1	2.0	1.8
	Hake	0.1	---	0.4
	Halibut	0.6	0.1	---
	Haddock	0.1	---	0.2
	Pollock	0.9	4.2	0.7
	Misc	0.3	0.4	0.8
	Total shrimp catch (kg)	14,889	34,766	11,793

<b>1988</b>	Species	June	July	August	September	November	December
	Shrimp	84.4	82.0	80.3	49.9	47.6	67.7
	Cod	12.3	3.5	4.3	49.3	14.1	32.3
	Redfish	0.8	7.6	7.8	0.8	38.4	---
	Flatfish	2.1	6.7	7.6	---	---	---
	Hake	---	---	---	---	---	---
	Halibut	---	0.2	---	---	---	---
	Haddock	---	---	---	---	---	---
	Pollock	0.4	---	---	---	---	---
	Misc	---	---	---	---	---	---
	Total shrimp catch (kg)	44,182	28,828	1,471	4,284	2,465	635

/continued

Table 11. continued

<b>1989</b>	Species	May	June	July
	Shrimp	71.8	88.2	87.4
	Cod	5.2	9.4	0.9
	Redfish	20.7	2.4	6.2
	Flatfish	0.8	---	0.6
	Hake	---	---	---
	Halibut	1.0	---	4.9
	Haddock	---	---	---
	Pollock	0.5	---	---
	Misc	---	---	---
	Total shrimp catch (kg)	10,083	52,268	16,231

<b>1990</b>	Species	May	July	August	September
	Shrimp	91.2	92.8	89.5	82.7
	Cod	8.0	4.0	6.9	11.7
	Redfish	0.8	2.8	2.5	0.3
	Flatfish	---	0.1	0.4	5.3
	Hake	---	---	---	---
	Halibut	---	0.3	0.7	---
	Haddock	---	---	---	---
	Pollock	---	---	---	---
	Misc	---	---	---	---
	Total shrimp catch (kg)	17,543	30,709	40,382	15,166

<b>1991</b>	Species	May	June	July	August	September
	Shrimp	96.0	95.9	97.9	87.1	87.1
	Cod	3.0	2.4	0.5	---	---
	Redfish	---	0.2	0.3	12.7	12.7
	Flatfish	---	1.2	1.2	---	---
	Hake	---	---	---	---	---
	Halibut	0.4	0.1	0.1	0.3	0.3
	Haddock	---	---	---	---	---
	Pollock	---	---	---	---	---
	Misc	0.6	0.2	---	---	---
	Total shrimp catch (kg)	24,966	173,778	55,810	3,136	3,225

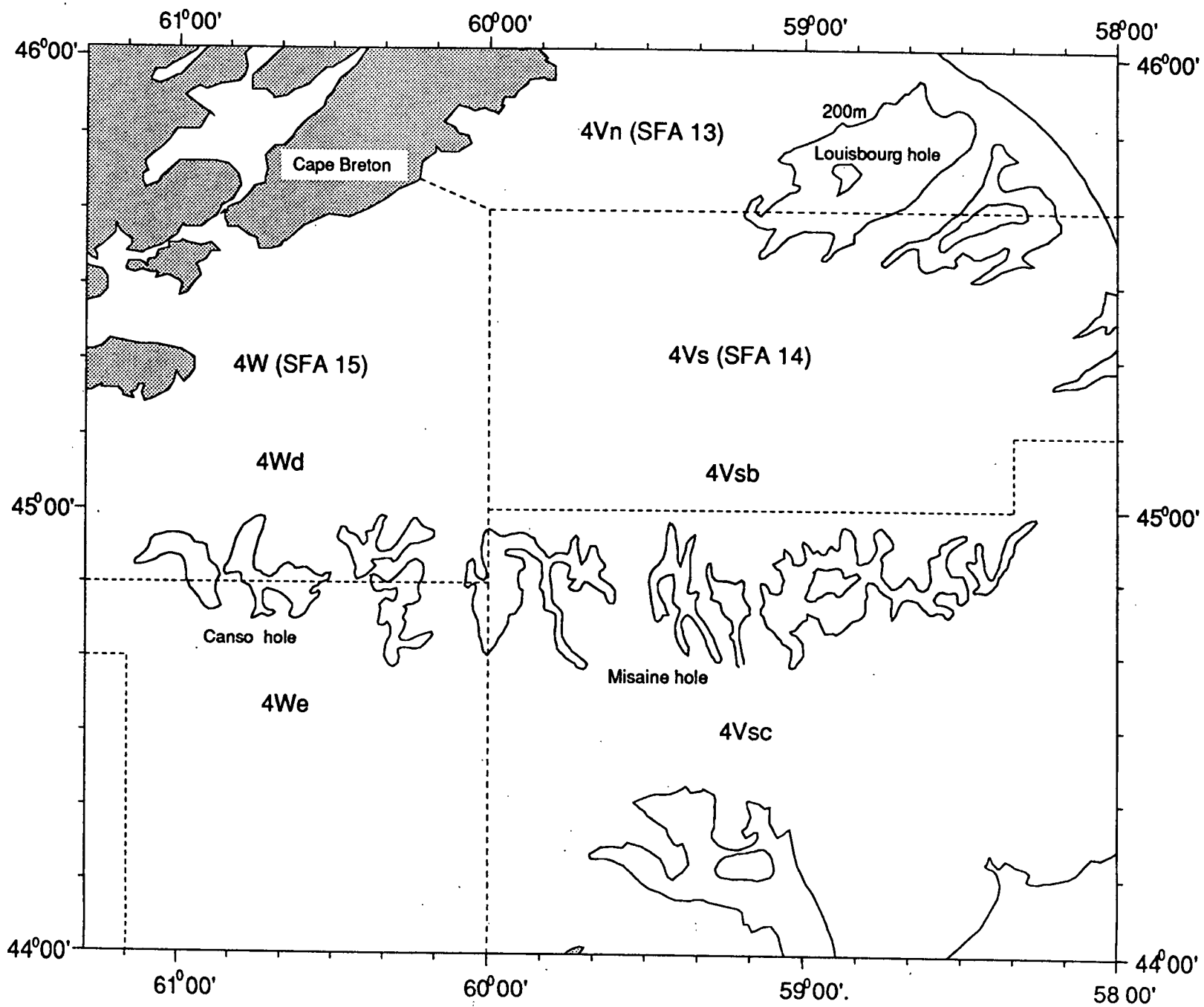


Figure 1. Eastern Scotian Shelf shrimp fishing areas.

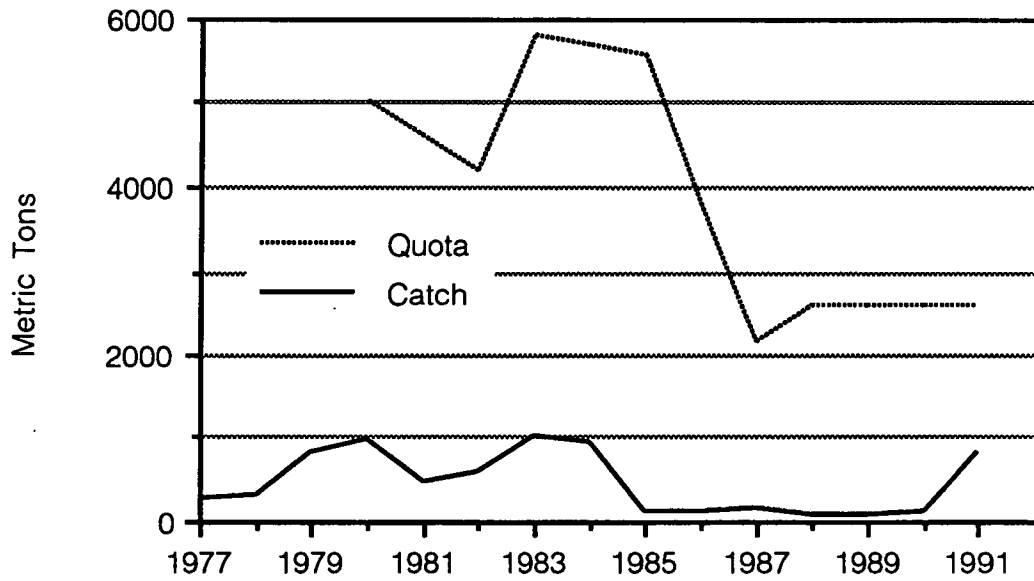


Figure 2. Eastern Scotian Shelf shrimp quotas (t) and catches (t) for the years 1977 to 1991 inclusive.

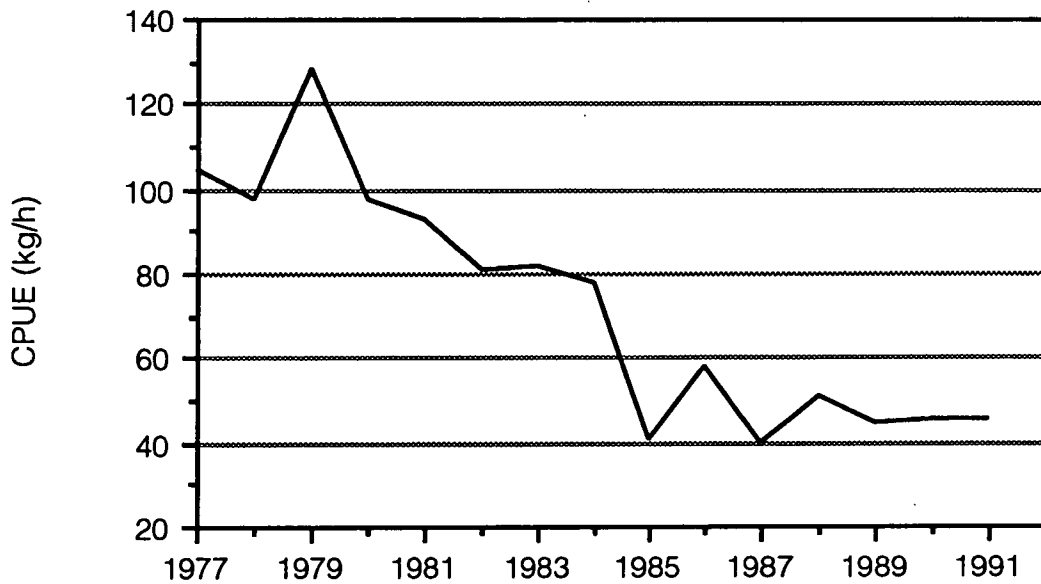


Figure 3. Eastern Scotian Shelf standardized shrimp CPUE ( kg/h ) from the Gulf boats for the years 1977 to 1991 inclusive.



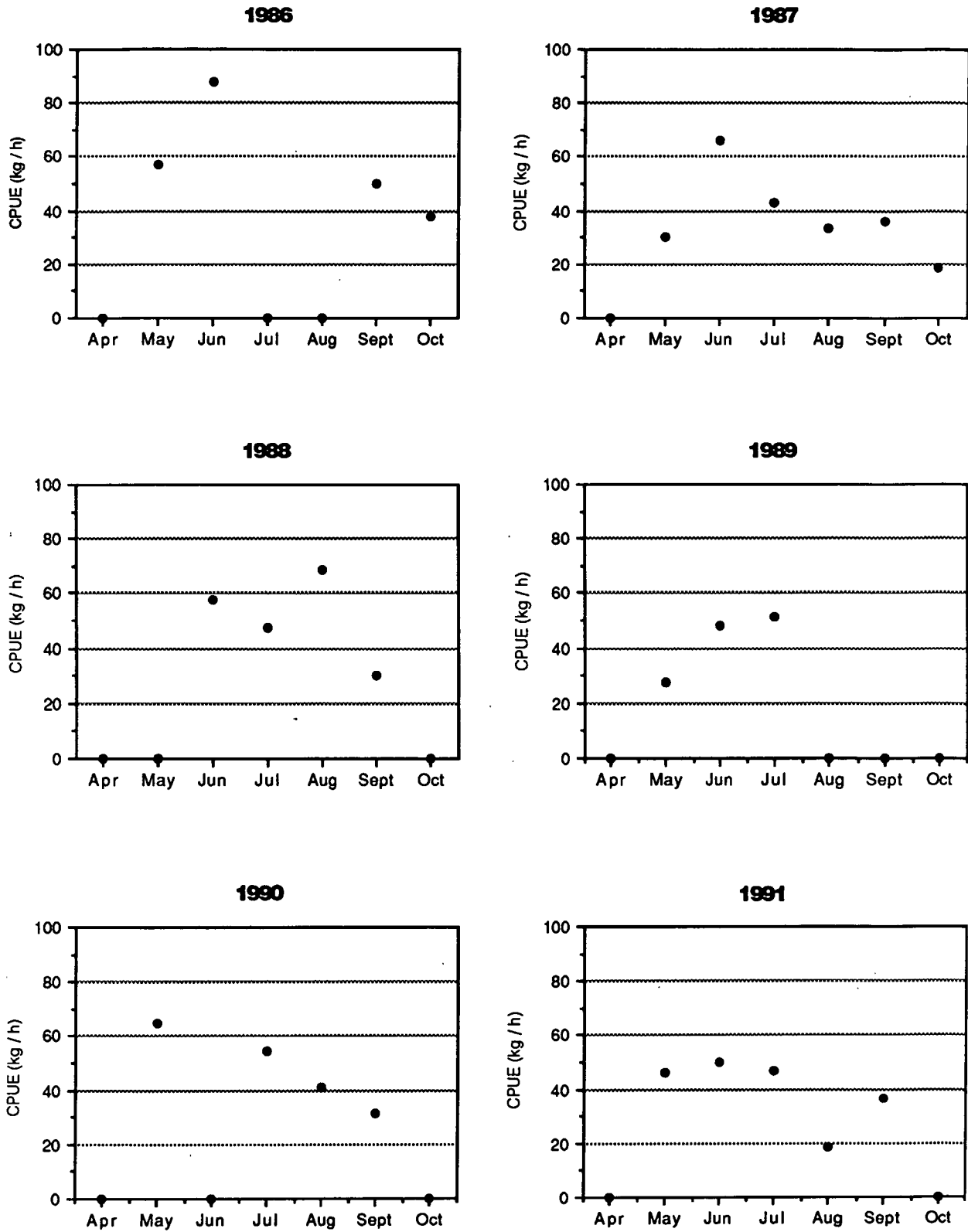


Figure 4. Monthly CPUE (kg / h) for the years 1986 to 1991 inclusive.

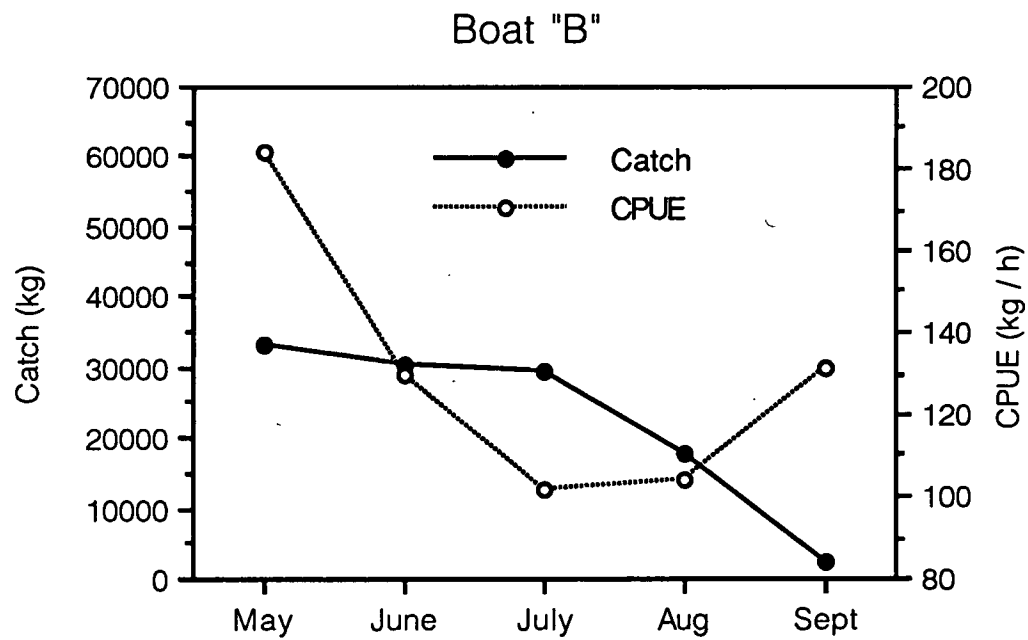
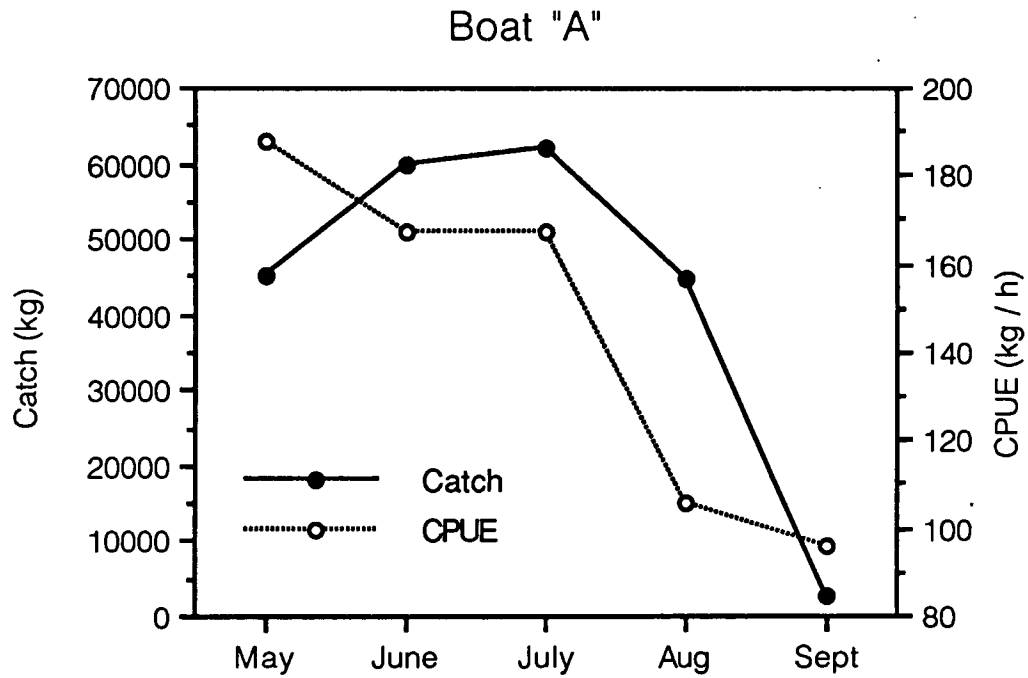


Figure 5. Intraseasonal boat trends using catches and unstandardized CPUE from the Scotia-Fundy exploratory fishery.