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The Lumpfish (*Cyclopterus lumpus*) Resource in Atlantic Canada

by

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Abstract

In Atlantic Canada, lumpfish (*Cyclopterus lumpus*) has been exploited, primarily for its roe, since the early seventies. The fishery is almost exclusively conducted in Newfoundland during the months of May and June when the female gonads are ripe. Landings of roe peaked in 1987 at approximately 3,700 t. Generally, between 40 and 60% of the landings originate from eastern Newfoundland (3K and 3L), about 30% from southern Newfoundland (3Pn and 3Ps) and the remainder from western Newfoundland (4R). The fishery is highly dependent upon the availability of markets. The decrease in landings observed in the last few years was due to low prices which led to a reduction in effort. Winter groundfish surveys conducted in areas 3Pn and 4RS tend to indicate a lower abundance in recent years; however, because of the semi-pelagic habits of the species, estimates of abundance are likely to be imprecise. Densities appear to be highest in area 3Pn. Length frequencies obtained from the commercial fishery in 1988 and 1989 indicate that larger fish tend to be landed in area 3Ps compared to areas 3K and 3L.

Résumé

Au Canada atlantique, la grosse poule de mer (*Cyclopterus lumpus*) est exploitée principalement pour sa rave depuis le début des années 70. Cette pêche est presque exclusivement pratiquée à Terre-Neuve au cours des mois de mai et juin alors que les gonades femelles sont matures. Les débarquements ont atteint leur maximum en 1987 à un niveau d'environ 3,700 t. Généralement , entre 40 et 60% des débarquements proviennent de la côte est de Terre-Neuve (3K et 3L), environ 30% du sud (3Pn et 3Ps) et le reste de la côte ouest de la province (4R). La pêche depend largement des conditions des marchés. La diminution des débarquements observée dans les dernières années est due principalement aux prix peu élevés qui ont produit une diminution de l'effort. Les relevés effectués en hiver sur les zones 3Pn et 4RS semblent indiquer que l'abondance est moins élevée dans les dernières années; cependant les habitudes semi-pélagiques de cette espèce font que ces estimés sont probablement imprecis. La densité semble plus élevée dans la zone 3Pn. Les fréquences-longueurs obtenues de la pêche commerciale en 1988 et 1989 indiquent que les poissons débarqués dans la zone 3Ps étaient plus gros que ceux des zones 3K et 3L.

1 - Introduction

The lumpfish (*Cyclopterus lumpus)* is a medium sized fish (up to 60 cm) found in cold and temperate waters (Scott and Scott 1988). Primarily demersal and found on rocky

bottom, this species is also semi-pelagic, particularly in early life. A synopsis of biological information on the species can also be found in Davenport (1985). Generally, in Atlantic Canada, lumpfish are found in deeper waters during the winter. An inshore spawning migration occurs during the spring with spawning normally taking place in May and June in shallow waters.

To date this species has almost been solely exploited for its roe, predominantly in Newfoundland. Stevenson and Baird (1988) reviewed the history and development of the Newfoundland lumpfish roe fishery, which commenced in the late 1960's off the northeast coast of the island. It expanded rapidly, from 21 t of roe landed in 1970 to more than 3,000 t in 1987, and spread to the south coast and later the west coast and Labrador.

This fishery is exclusively an inshore fishery, conducted primarily by small vessels less than 35 feet in length and, to a lesser extent, by vessels between 35 and 65 feet long (Stevenson and Baird, 1988). Although lumpfish are caught incidentally during the spring and early summer in cod traps and salmon nets, the lumpfish fishery is primarily a gillnet fishery (nets constructed from 10.5" - 11.0" stretched monofilament mesh).

Occasionally, small amounts of male lumpfish are taken for human consumption, but the fishery targets the larger females for the caviar market (Gavaris, 1985). The lumpfish fishery has provided a substantial source of income in the spring and early summer for many small-vessel, inshore fishermen during slumps in the inshore cod fishery and for those that lack lobster or salmon licenses.

In the Gulf of St. Lawrence, the fishery is primarily conducted off of western Newfoundland. In recent years, some landings have been recorded from Quebec, particularly on the lower north shore. Recorded landings for other provinces are minimal.

This paper documents trends in landings of lumpfish in Atlantic Canada since the beginning of the exploitation in the early seventies. Information on abundance trends derived from the winter survey in area 3Pn, 4RS and length frequency distributions are also presented.

2 - Landings

Data on landings were obtained from Statistics Branches in Gulf, Newfoundland, Québec and Scotia-Fundy Regions . No significant amounts of lumpfish landings were recorded in Scotia-Fundy Region. Landings of lumpfish roe account for almost all of the landings of the species (Table 1). Since the beginning of the fishery in the seventies, landings of roe have increased and peaked at 3725 t in 1987 and subsequently declined (Figure 1). Preliminary information for 1992 indicates landings of about 900 t, a 60% decrease over

1991. Currently, no conversion factor is used to convert roe to round weight. Stevenson and Baird (1988) found that roe generally accounts for 20 to 30% of the body weight. Catch biomass in round weight can therefore be estimated by multiplying roe weight by a factor of 4.0.

The peak landings of 1987 coincide with a peak in prices paid for roe. The fishery is largely dependent upon markets and prices paid for roe affect the level of effort in the fishery. For example, landings in western Newfoundland (3Pn and 4R, see Table 2) decreased from 397 t in 1989 to 215 t in 1991; over the same period, the number of vessels in the fishery has decreased in about the same proportion from 317 to 168. It is considered that the situation is similar in the other areas where the fishery is conducted.

Most of the fishery is conducted by Newfoundland fishermen, although significant landings were made by Québec North Shore fishermen between 1986 and 1989. Landings by NAFO Divisions (Table 2 and map on Figure 2) indicate that, since 1977, between 40 and 60% of the landings have originated from waters off eastern Newfoundland (3K and 3L), about 30% of the landings are made off the south coast (3Pn and 3Ps) and the remainder is from the Gulf of St. Lawrence (4R and 4S).

Because it is a roe fishery, fishing occurs when gonads are ripe just before spawning. Landings by month and Division (Table 3 and 4) show that most of the catch is taken in the months of May and June. Consequently, it is probable that spawning occurs at about the same time around Newfoundland.

3 - Abundance in the Gulf of St. Lawrence

Groundfish abundance surveys based on a stratified random design have been conducted in the Gulf of St. Lawrence since the early seventies. In most of these surveys, lumpfish have been caught. However, lumpfish can be semi-pelagic and their catchability in bottom trawls is unknown but probably low. Therefore, it is not possible to use these surveys as indices of abundance. Rather, the estimates produced probably represent minimum biomass estimates.

In the southern Gulf of St. Lawrence (4T), the surveys have been conducted in September since 1971 and lumpfish were only caught sporadically and in small numbers (< 10 individuals per tow) (Koeller and LeGresley 1981). In the northern Gulf of St Lawrence (3Pn, 4RS), surveys have been conducted in the summer since 1984 and in the winter since 1978. Because lumpfish are found in shallow waters during the summer, the summer survey, which has not included the shallowest strata until recently, is not considered to provide useful information.

The winter survey follows the stratification scheme illustrated in Figure 3. Biomass estimates by strata (Table 5) indicate that lumpfish are most abundant in the 50-150 fathom depth range in Divisions 3Pn and southern 4R. The highest densities tend to occur in 3Pn (Figures 4,5 and 6). Biomass estimates from the winter surveys have varied from a low of 1,417 t in 1985 to a high of 7,170 t in 1983. In 1991 and 1992, the estimates were in the range of 2, 000 t (Figure 7).

4 - Size composition

Little sampling of the size composition of commercial catches is available as this species is usually not targeted by commercial sampling programs. Lumpfish are sexually dimorphic, with females growing faster and to a larger size than males. Males are generally discarded at sea. Length frequencies were collected in Divisions 3K, 3L and 3Ps in 1988 and 1989 (Figure 8). The length frequencies are for females since they are targeted by the fishery. The length frequencies suggest that generally larger fish are caught in area 3Ps. Information from Icelandic studies (Thorsteinsson 1981) indicate that female lumpfish attain sexual maturity at about 40 cm (5-6 years of age).

5 - Discussion

There is not enough information on the biological characters or on abundance of the species in Atlantic Canada to calculate safe catch levels. The fishery is highly dependent upon markets and this has tended to diminish the level of effort exerted on the species in recent years. Depending on prices, this fishery can be very valuable, however, as with many other fisheries, this resource could become overexploited if a high level of effort is sustained over a long period. Monitoring length frequencies of the removals would be one way of detecting signs of overexploitation.

Good fishing practices such as culling at sea (many fish can remain alive in the nets) is an additional measure that could protect the resource.

6 - References

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Table 1: Lumpfish roe and round lumpfish landings in Atlantic Canada 1970-1991.

Year	Lumpfish Roe (t)	Lumpfish Round (t)
1970	21	-
1971	156	-
1972	204	-
1973	153	-
1974	60	-
1975	94	-
1976	320	2
1977	503	13
1978	941	234
1979	931	204
1980	578	66
1981	846	190
1982	796	22
1983	1068	-
1984	942	8
1985	1226	-
1986	2082	4
1987	3725	2
1988	2672	-
1989	2759	-
1990	1320	3
1991	2329	2
1992[1]	918	-

[1] 1992 figures are preliminary

Table 2: Lumpfish roe landings (t) by NAFO Divisions for the period 1977-1991.

Year	3K	3L	3PS	3PN	4R	4S	4T	Total
1977	146	252			105			503
1978	334	376	100		131			941
1979	237	348	243		103			931
1980	57	50	412	29	30			578
1981	112	52	433	156	93			846
1982	77	23	456	132	108			796
1983	105	46	469	266	182			1068
1984	114	117	330	181	197		3	942
1985	207	343	426	88	162			1226
1986	435	462	651	131	369	34		2082
1987	1257	924	825	134	470	115		3725
1988	806	838	644	95	250	39		2672
1989	766	901	659	140	257	36		2759
1990	423	439	301	20	131	6		1320
1991	291	857	964	111	104	2		2329
1992[1]	149	363	153	150	103			918

[1] 1992 figures are preliminary

Table 3: Landings (t) of lumpfish roe by month and year for areas 3K, 3L and 3Ps (1992 data are preliminary).

NAFO Div.	Year	Jan.-Mar.	Apr.	May	June	July	Aug.	Sept.-Dec.	Totals
3K	1977			65	73	8	+		146
	1978			206	121	7	+		334
	1979			173	63	1			237
	1980		1	36	19	2			58
	1981	+	7	91	14	1			113
	1982		+	36	40	1			77
	1983			48	55	2	1		106
	1984			35	75	4	+		114
	1985			71	123	8	4		206
	1986		+	240	173	21	+		434
	1987		+	511	621	116	9	+	1257
	1988		+	490	248	65	3	+	806
	1989			579	182	5	+		766
	1990			86	305	34			425
	1991			1	37	244	10		292
	1992			81	67	1			149
	Totals	0	8	2749	2216	520	27	0	5520
	%	0.0	0.1	49.8	40.1	9.4	0.5	0.0	100.0

NAFO Div.	YEAR	Jan.-Mar.	Apr.	May	June	July	Aug.	Sept.-Dec.	Totals
3L	1977		+	108	128	15	+		251
	1978		1	232	118	19	6	+	376
	1979		+	257	84	5	1		347
	1980		2	34	13	1			50
	1981		1	45	5	+	+		51
	1982		2	14	6	+			22
	1983			33	12	+			45
	1984			44	71	2	+		117
	1985		+	69	219	46	9	+	343
	1986	+	5	200	171	74	11	1	462
	1987		1	422	342	134	19	6	924
	1988		4	393	295	122	21	3	838
	1989		3	707	184	6	+	+	900
	1990			163	234	41			438
	1991	+		119	357	347	3		826
	1992			233	130	+			363
	Totals	0	19	3073	2369	812	70	10	6353
	%	0.0	0.3	48.4	37.3	12.8	1.1	0.2	100.0

Table 3: Continued.

NAFO Div.	YEAR	Jan.-Mar.	Apr.	May	June	July	Aug.	Sept.-Dec.	Totals
3Ps	1977								0
	1978			32	63	5	+		100
	1979		3	143	96	1			243
	1980		33	208	156	15			412
	1981		73	282	78	+			433
	1982		30	237	165	23			455
	1983		75	280	112	2			469
	1984		28	180	115	8			331
	1985		5	233	145	42	+		425
	1986		31	338	202	79	1		651
	1987		6	366	340	107	5	+	824
	1988		3	308	254	75	1	1	642
	1989		2	433	209	18	1		663
	1990		1	141	165	+			307
	1991	+	26	429	421	95			971
	1992		5	113	40	2			160
	Totals	0	321	3723	2561	472	8	1	7086
	%	0.0	4.5	52.5	36.1	6.7	0.1	0.0	100.0

Table 4: Landings of lumpfish roe (t) by month and year for area 3Pn and 4RS.

NAFO Div.	YEAR	Jan.-Mar.	Apr.	May	June	July	Aug.	Sept.-Dec.	Totals
3Pn / 4RS	1984	1.2	51.5	203.5	105.5	11.7	2.4	1.3	377.1
	1985	0.6	3.4	105.2	109.8	31.4	0.0	0	250.4
	1986	0.1	6.7	281.4	191.1	19.5	0.3	0	499.1
	1987	0	30.7	229.6	304.0	38.4	0.9	0.2	603.8
	1988	0	12.2	192.9	116.9	22.7	0.7	0	345.4
	1989	0	25.1	302.7	67.7	2.2	0.0	0	397.7
	1990	0	0.0	39.0	110.3	1.5	0.0	0	150.8
	1991	0	12.6	125.3	66.7	9.8	0.1	0.2	214.7

Table 5: Estimated biomass (kg) of lumpfish from research vessel surveys conducted in winter in Divisions 3Pn, 4R and 4S.

Trip Years		GADUS 73 1983	GADUS 89 1984	GADUS 104 1985	GADUS 119 1986	GADUS 134 1987	GADUS 148 1988	GADUS 162 1989	GADUS 177 1990	GADUS 194 1991	GADUS 211 1992
Strata	Depth (ftm)										
Div.4R											
801	150-200	8858	13286	41631	97433	39859	48717			13951	18158
802	>200	0	62896	0	30806	29951	0	11980	83063	32021	78371
809	150-200	23698	16927	2116	15960	3385	95920	17773	113411	39355	8463
810	150-200	335	29294	0	26544	2511	108806	0	18134	17457	7700
811	100-150	91327	51784	42368	33777	93367	296579	61787	102390	80117	57668
812	100-150	28479	248629	61027	103746	171780	109536	68656	144940	171215	47805
813	100-150	50737	199235	34650	238216	23822	368152	133618	8662	0	142930
820	50-100	2008589	338870	481552	24523	172407	113947	587573	31212	117415	72456
821	50-100	260188	568116	197727	96543	444034	1141802	1041546	197727	483774	13228
822	50-100	1201502	210301	146282	157802	355054	971959	1199194	245875	381091	0
823	50-100	44385	41041	0	10134			29185	203		2736
824	50-100	82420	103789	0	1832		0				0
835	30-50						624234	0	193628		
836	30-50						0				
	Total 4R	3800518	1884168	1007353	837316	1336170	3879652	3151312	1139245	1336396	449515
Div.4S											
803	>200	6940	47600	63108	39376	85883	87791	10906	104150	63617	
804	>200	33788	5450	1817		10899					
805	150-200	0									
806	150-200	0									
807	150-200	59131	12967	0	20748	11671	103739	12967	14696		
808	150-200	16608	0	70949	27104	41757	53145	21524	77393		18601
814	100-150	129110	93830	56298	11260	22519	7506			51044	
815	100-150	445083	0	59804	14469	66448	70151	241217	22507		
816	100-150	22024	41295	0			28800	0			
817	100-150	162246									
818	100-150	7882									
819	100-150	0	23645	39634	1261	525	21018	72512	4729		21018
825	50-100	815678									
826	50-100	0									
827	50-100	153795	7071	1414	0		74953				
828	50-100	53296									
829	50-100	0	0			4910	8418	60399			
830	50-100	52451	8392	4196	20980	13987	50353	37765	0		
832	50-100	20230									
833	<50	30589	9177	6118			18353				
	Total 4S	2008851	249427	303338	135198	258599	524227	457290	223475	114661	39619
Div.4T											
401	100-150	17903	0		0		2984			5769	
402	100-150	0	13261								
404	150-200	0	0		11560		19507			1084	
405	150-200	0	0			0	8088				
407	>200	0	0		26411		32862		30671	0	
408	>200	74783	2564			4273	0	19942			
	Total 4T	92686	15825	0	37971	4273	63441	19942	30671	6853	0
Div.3Pn											
302	51-100	996646	390221	56248	406627		217961		1087135	158901	1102955
303	101-150	187400	37232	27924	306129	65156	41886	163820	2780155	602535	719692
304	151-200	43395	64563	17640	35280	5292	31752	62446	33693	27254	36938
305	>200	40141	14867	4460	104571	2660	22300	34789	35458	45493	58715
	Total 3Pn	1267582	506883	106272	852607	73108	313899	261055	3936441	834183	1918300
	Total 4RST3Pn	7169637	2656303	1416963	1863092	1672150	4781219	3889599	5329832	2292093	2407434

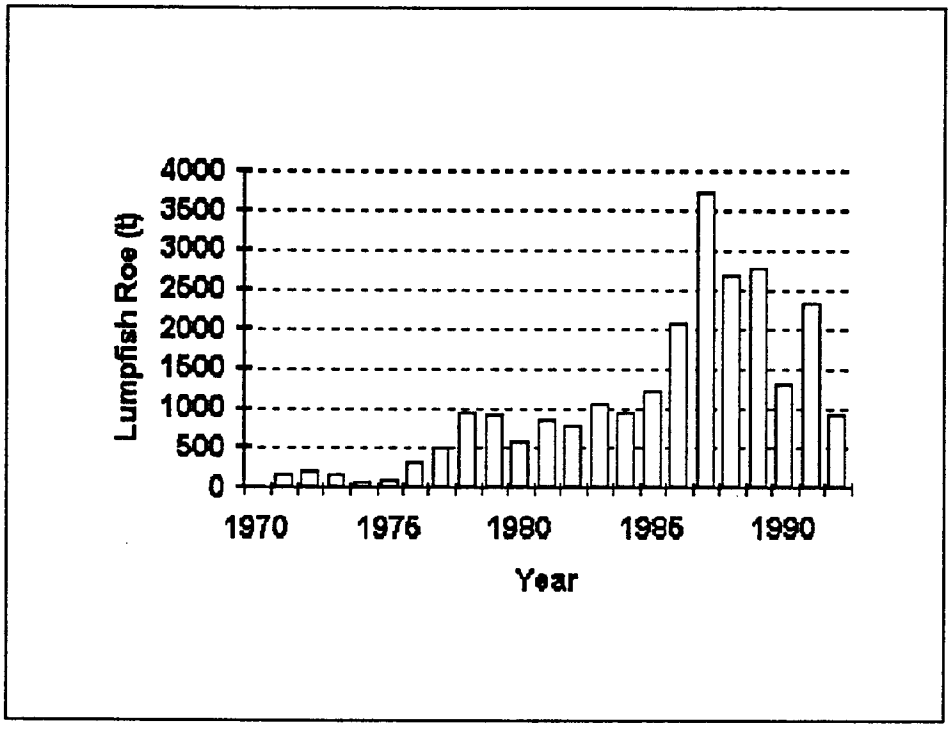


Figure 1: Nominal landings (tonnes) of lumpfish roe in Atlantic Canada from 1970 to 1992 (Note: 1992 figures are preliminary).

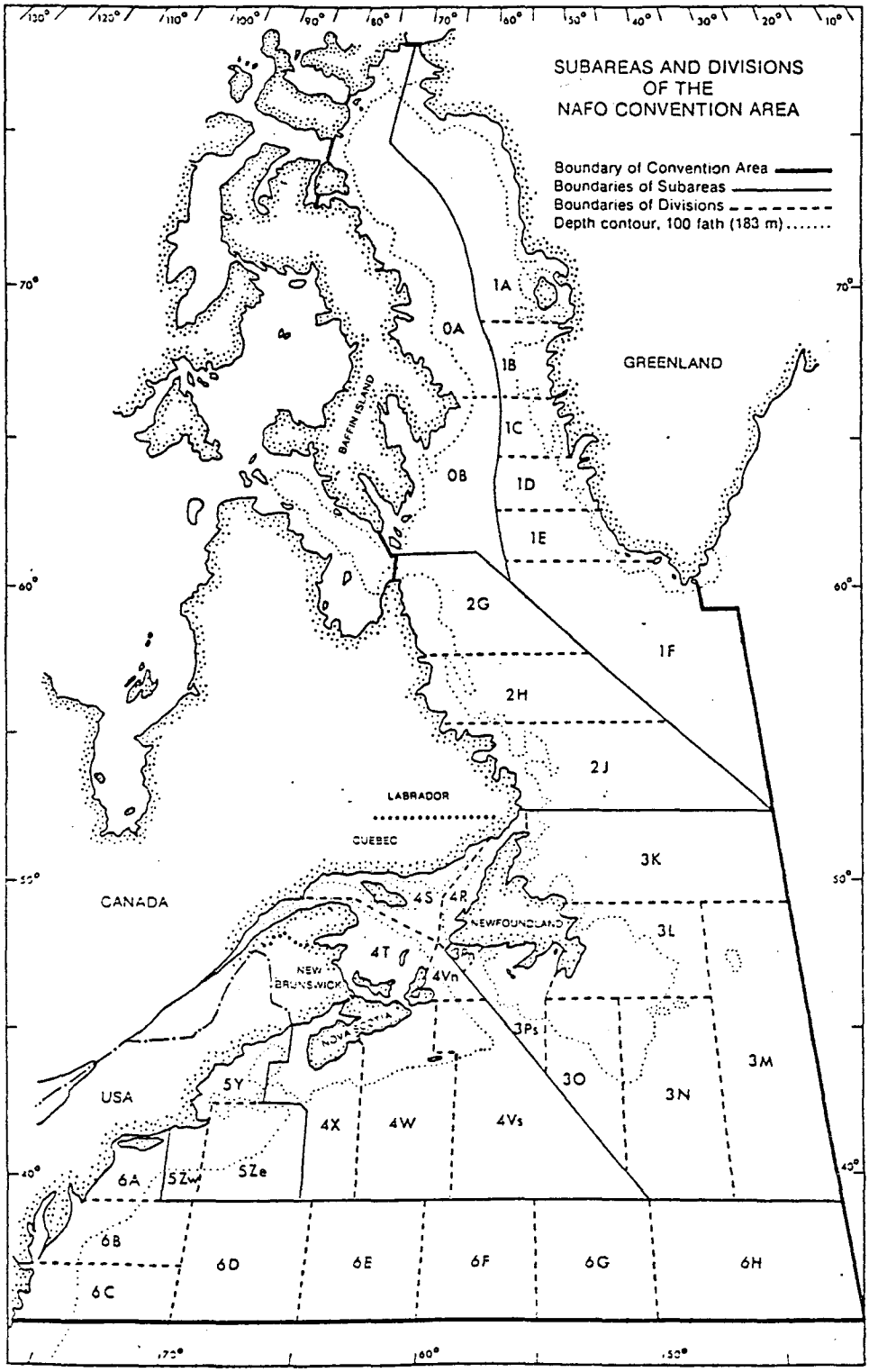


Figure 2: Map showing the Divisions of the Northwest Atlantic Fisheries Organization (NAFO) Convention Area.

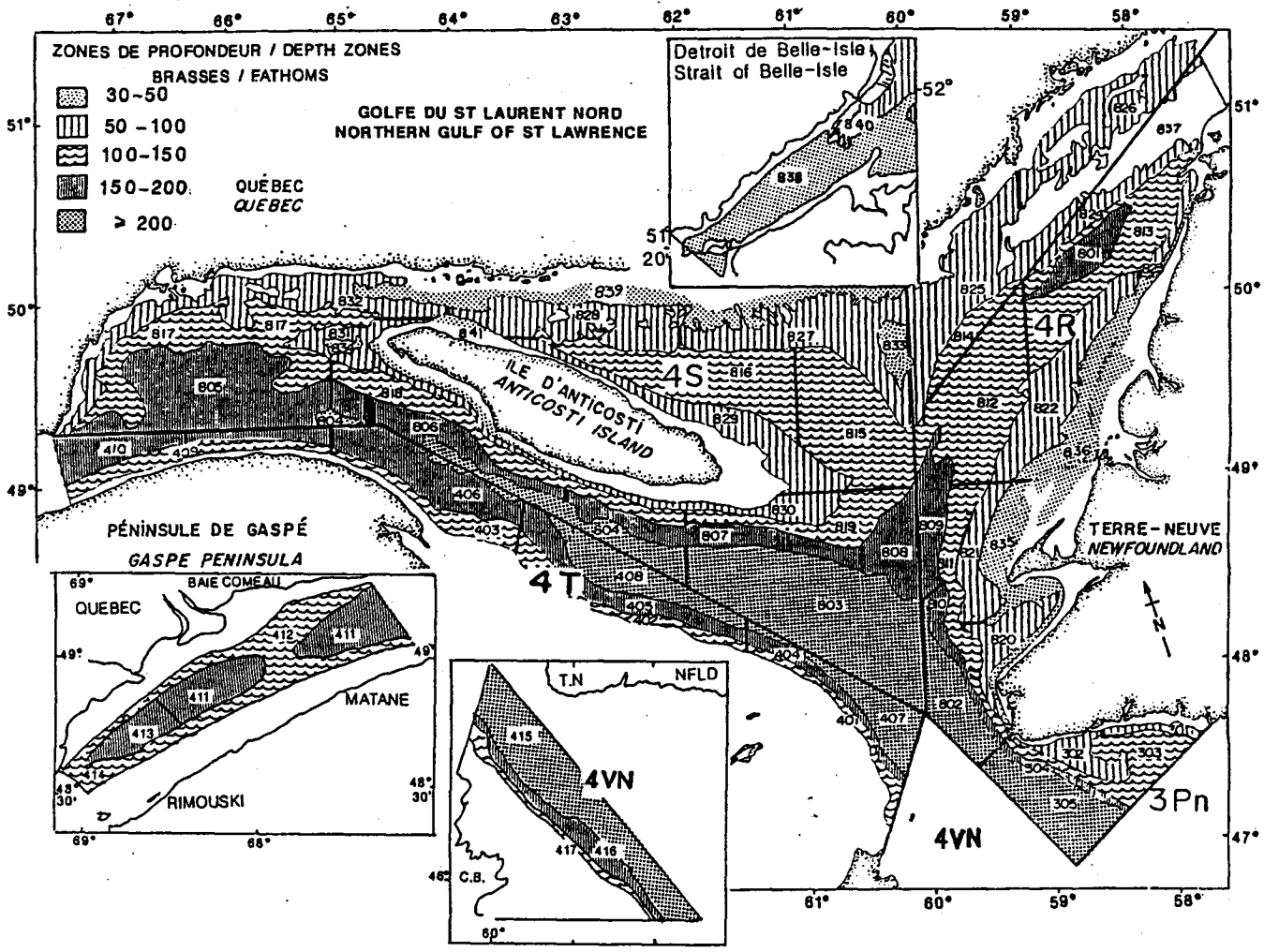
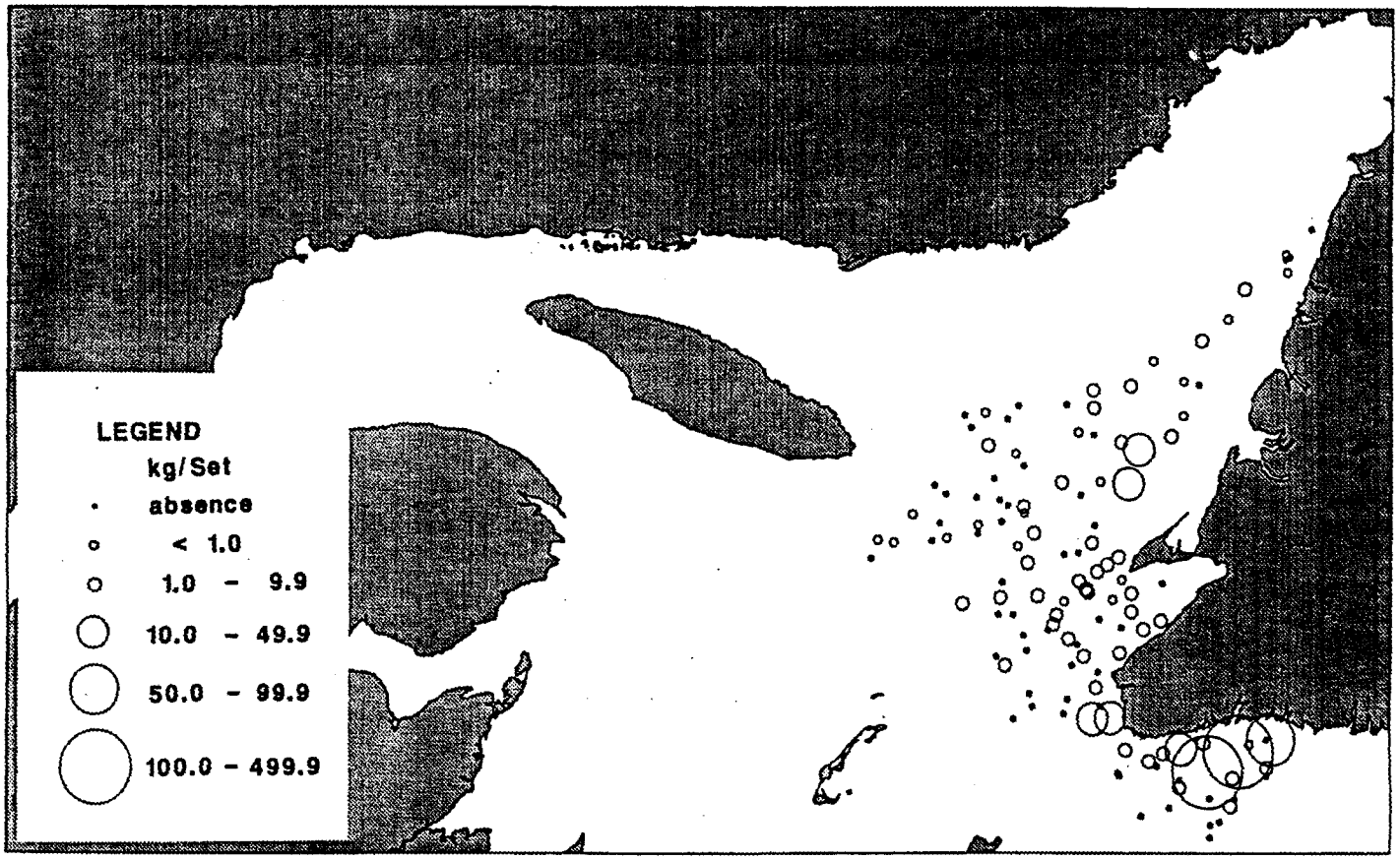


Figure 3: Stratification scheme used in the winter groundfish abundance surveys in 3Pn, 4R and 4S.



igure 4: Catch rate (kg/tow) of lumpfish in the 1990 winter goundfish survey in 3Pn, 4RS.

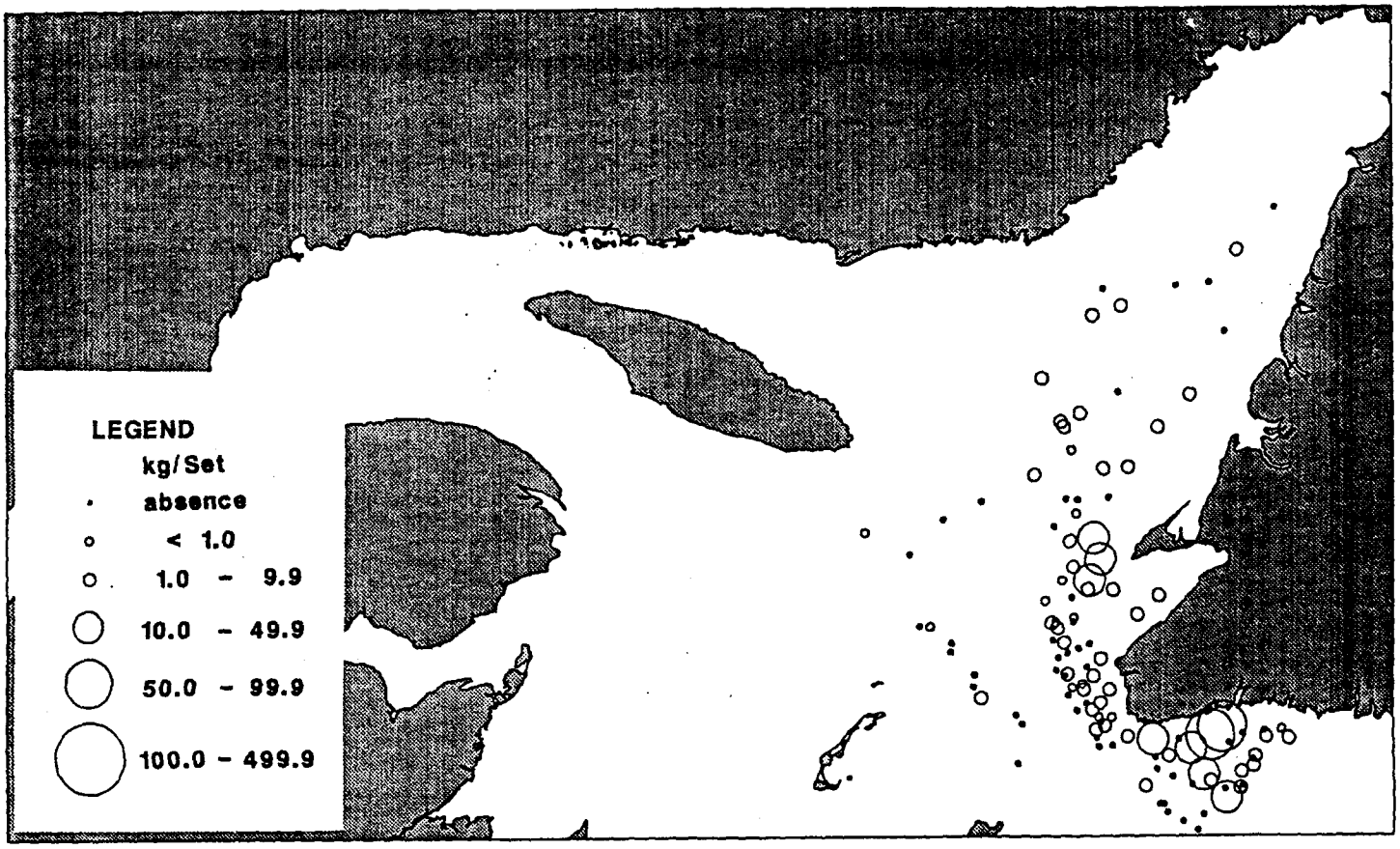


Figure 5: Catch rate (kg/tow) of lumpfish in the 1991 winter goundfish survey in 3Pn, 4RS.

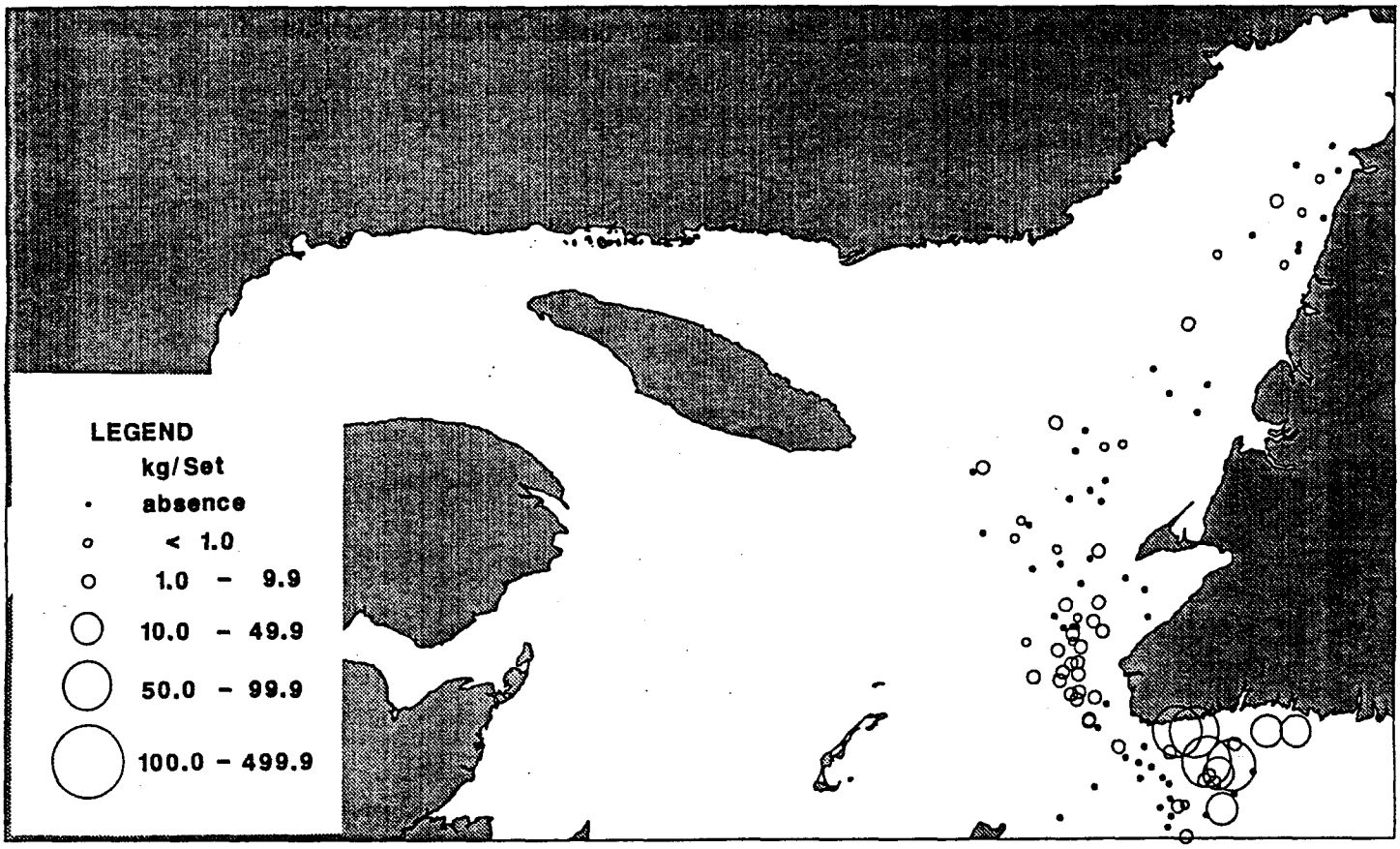


Figure 6: Catch rate (kg/tow) of lumpfish in the 1992 winter goundfish survey in 3Pn, 4RS.

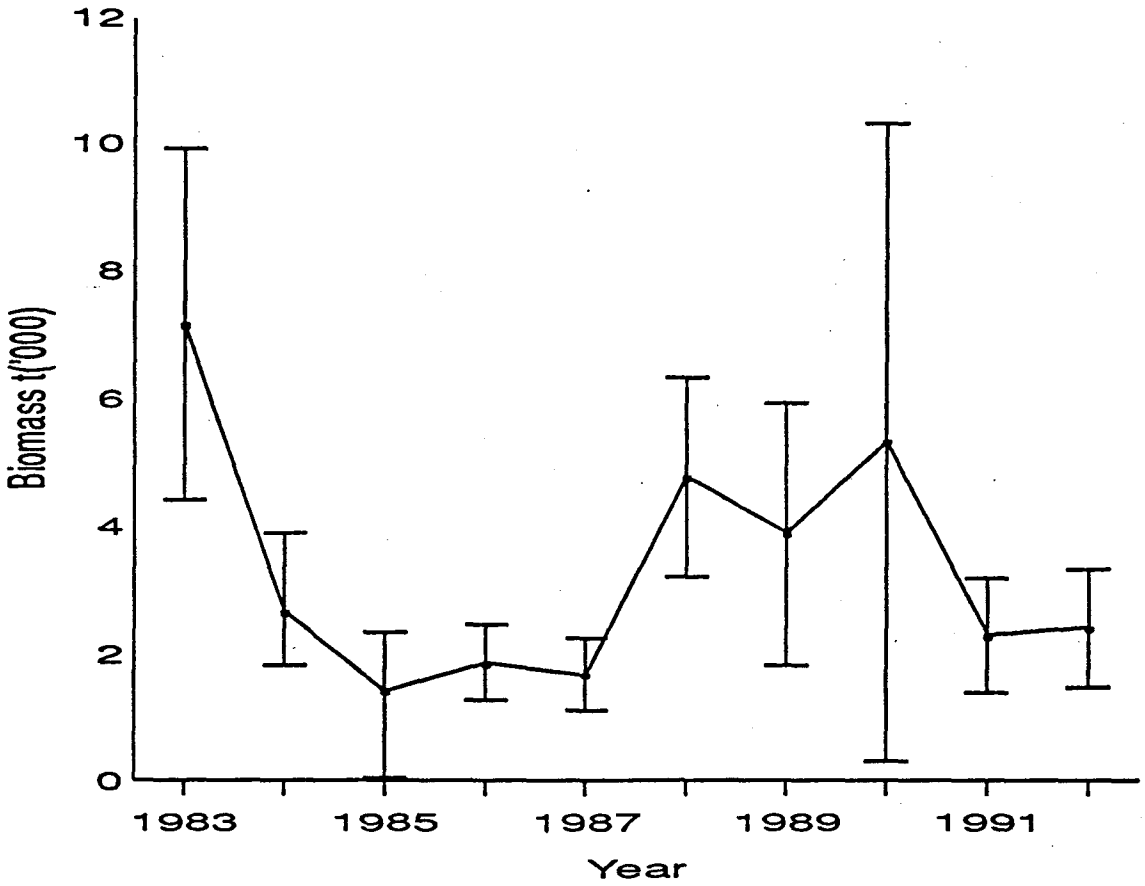


Figure 7: Biomass estimates and 95% confidence intervals for lumpfish from the winter groundfish abundance surveys in 3Pn, 4RS.

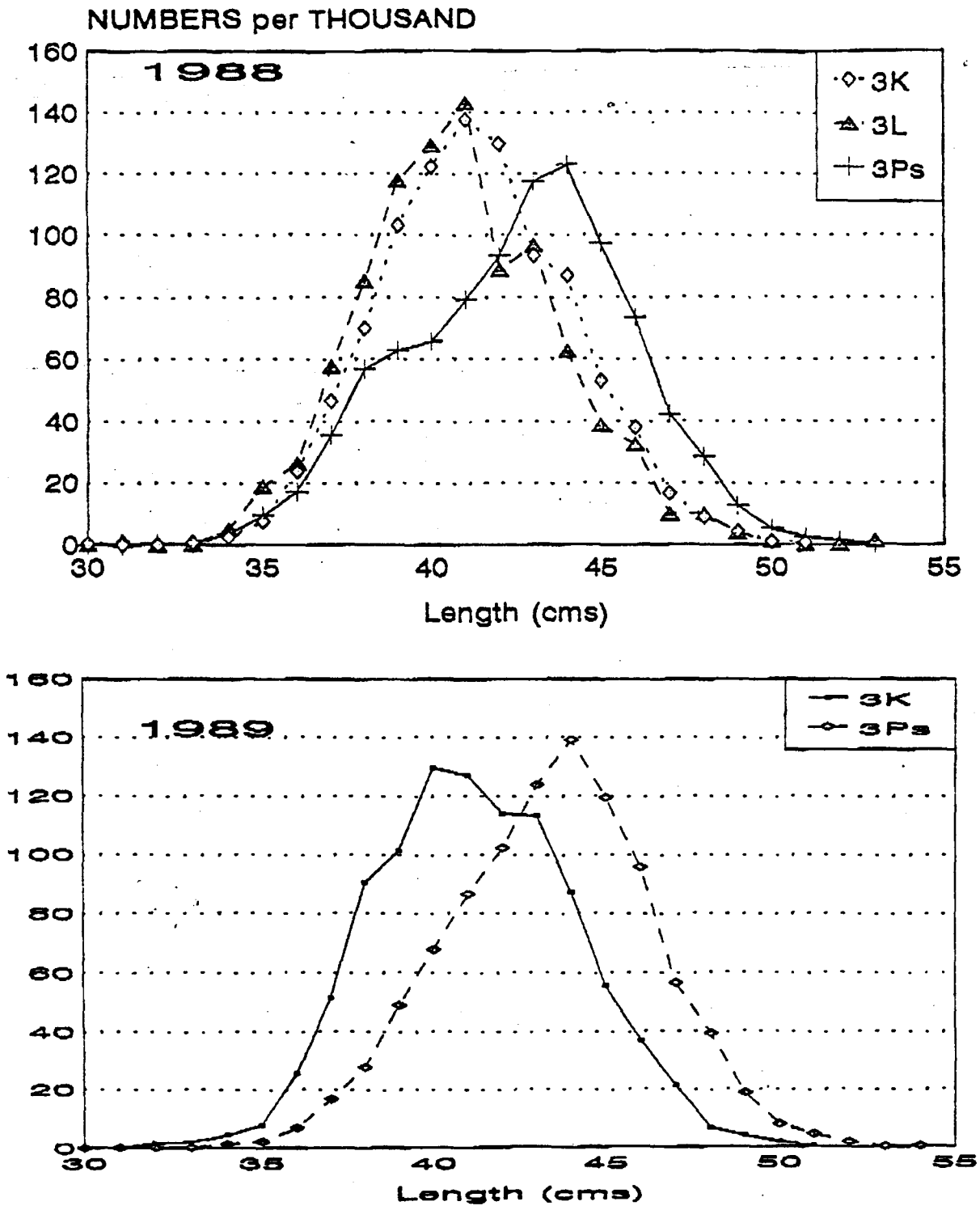


Figure 8: Length frequencies of commercial lumpfish samples (females) for 1988 and 1989.