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Sentinel Surveys 1995-2000: Catch Per Unit Effort In NAFO Divisions 2J3KL

Pêches de contrôle 1995-2000: Captures par unité d'effort dans les divisions 2J3KL de l'OPANO

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Abstract

Sentinel enterprises continued to provide catch rate and biological information on inshore cod resources in 2J3KL for 2000. Data are presented as weekly average catch rates and annual relative length frequencies: number of fish at length divided by amount of gear for each set and averaged by year and gear type, grouped by division. With few exceptions, average catch rates were lower in 2000 than in 1999 in all gears fished. Catches in 2J have remained very low since 1995 with only the 3 ¼" gill net showing catches comparable to other areas. 3K catches from gill net, line trawl and hand line have declined in 2000. Line trawl catches in 3L for 2000 are similar to 1999 results, but gill net catches are down for 5 ½" mesh. The small mesh gear in 3L shows an increased catch of small fish compared to 1999.

Résumé

Des pêches de contrôle ont continué de fournir des données biologiques et des taux de capture de la morue côtière dans les divisions 2J3KL pour l'année 2000. Les données sont présentées sous forme de taux de capture hebdomadaires moyens et de fréquences annuelles de longueurs relatives : moyenne annuelle, par type d'engin et par division, du nombre de poissons selon leur longueur divisé par le nombre d'engins pour chaque mouillage. Sauf quelques exceptions, les taux de capture moyens pour tous les types d'engins utilisés étaient plus bas en 2000 qu'en 1999. Les taux de capture dans la division 2J demeurent très faibles depuis 1995; seul le taux de capture au filet maillant de 3¼ po était comparable à celui dans les autres secteurs. Dans la division 3K, les taux de capture au filet maillant, à la palangre et à la ligne à main ont diminué en 2000. Dans la division 3L, le taux de capture à la ligne à main en 2000 était semblable au résultat de 1999, mais le taux de capture au filet maillant de 5½ po a baissé. Par contre, dans la division 3L, plus de petits poissons ont été capturés par les engins à petites mailles qu'en 1999.

Introduction

Sentinel survey projects were formally announced by the Minister of Fisheries and Oceans in October 1994. The surveys in the DFO Newfoundland Region are an extension of the index fishermen's project from the Northern Cod Science Project with modifications to allow for science activities achievable only under a fishing moratorium. Sentinel data collection has continued during the index fishery of 1998 and commercial fisheries in 1999-2000.

The sentinel survey has the following objectives:

1. To develop a catch rate series for use in resource assessments.

2. To incorporate the knowledge of inshore fishers in the resource assessment process.

3. To describe the temporal-spatial distribution of cod in the inshore area over a number of years through, for example, the use of catch rate information, tagging studies, by-catch information and fishers' observations.

4. To gather length frequencies, sex and maturity data and sample ages for use in resource assessment.

5. To establish a long-term physical oceanographic and environmental monitoring program of the inshore areas.

6. To provide a source of biological material for other researchers. For example, tissue for genetic, physiological and toxicological analyses, cod stomachs for food and feeding studies and by-catch information.

Participants

The primary collectors of data in the sentinel survey are inshore fishers. Through consultation with inshore fishers and fisheries organizations, traditional inshore fishing grounds have been identified and mapped.

Fishers from communities within the boundaries of the identified coastal areas and who met eligibility criteria were invited to apply to participate in the survey. Where more than one application was received from an area, the project partner conducted a draw or lottery to select the participant. While there was considerable interest in the project in most areas, there were many sites from which only one application was received and others where additional canvassing was required to enlist participants. Selected participants were required to complete a six-week course designed by the Marine Institute of Memorial University in consultation with DFO. Topics covered included scientific sampling methods and equipment, computer use, resource assessment basics and presentation skills.

In order to minimize interannual enterprise effects on data collection, participants are expected to remain with the survey over a number of years. It is also expected that most of the sampling activities will continue once commercial fishing operations resume and the sentinel participants will form a core of index fishers.

Sites

Sampling was conducted at 64 sites in NAFO Divisions 2J3KL. The specific location of each site was chosen after consultation between DFO scientists, fishermen, the Fish, Food and Allied Workers Union (FFAW) and the Fogo Island and Petty Harbour Cooperatives (for Fogo Island and Petty Harbour). Site selection was based on the need to survey throughout inshore areas and targeted historical fishing areas and historical gear use patterns.

For 2000 there were changes to Sentinel locations as some enterprises withdrew from the program. The sites in Jackson's Arm, Cape Charles, Great Brehat, Fogo, and one site in Bay Bulls will no longer collect information. The site in Point Lance will be surveyed by a new enterprise, and to maintain spatial coverage in 2J3KL, replacement sites were chosen as outlined above. The new sites include Wesport, Sopp's Arm, Mary's Harbour and Glover's Harbour.

Sampling Strategy

In 2000, sampling ran for a minimum of ten weeks. Many sites were allocated extra time as resources permitted. In 1996, 1997 and 1998 the survey covered a twelve-week period, in 1999 a minimum of 8 weeks were allocated. In 1995, sampling was conducted over fifteen weeks. The timing of sampling was determined after discussions with fishers but was targeted for seasonally appropriate times based on historical fishing patterns.

The number of trap sites in 2J3KL had been reduced from 35 in 1998 to 12 in 1999, and in 2000, 14 traps were fished. Participants used either baited trawl lines or gill nets for the remaining weeks of the survey. Non-trap sites fished either baited trawls or gill nets for the full survey. While traps are in the water continuously, they were hauled three days per week. Two sites at Petty Harbour fished baited hand lines exclusively. Hook and line, hand line and gill net crews fished up to three days per week. Fishing days in the week were selected at the discretion of the crew and depend primarily on weather conditions.

When a cod trap was hauled prior to 2000, the crew estimated how much fish by weight had been caught, removed a random sample for biological sampling and released the remaining catch. Meshed and/or dead, floating fish were retained and brought ashore. Fishers were instructed to release as much live fish as possible. For 2000, traps were used primarily as a source of biological data (length frequencies, otolith samples and frozen samples).

Hook and line crews fished two tubs of baited line trawl. Each tub consisted of approximately 500 hooks for a total of 1000 hooks per fishing day. Gill net crews fished a maximum of six fifty fathom 5 ½ inch monofilament gill nets. Nets were rigged 2-3 to a fleet and up to three fleets were fished per fishing day. In addition, selected sites fished one 3-¼ inch monofilament gill net one day per week. All fish caught in gill nets and on hooks were landed and measured. If catches exceeded 500 kg per week, the numbers of nets in a fleet were cut back. However, some consideration was given to bottom topography and net performance when reducing the number of nets in a fleet. Similarly, the number of hooks per tub was reduced if landings exceeded 500 kg per week. Other measures were considered if fish are particularly abundant in an area and catches appear to be excessive even with the minimal amounts of gear possible.

Hand lines were used mostly in conjunction with gill nets or trawls as a means of determining presence of cod for tagging purposes or when nets were not catching fish. The exception to this was the Petty Harbour area where only hand lines and traps are permitted. In that area, participants used hand lines for the entire survey period. Sites were fished with hand line similar to other gear types, with a control location and experimental locations. The time fished on each ground was recorded, as was number of hooks on each line and number of lines fished. Problems with using these data to calculate a catch rate include drifting off the grounds (which depends on tide conditions, weather conditions and size of the ground), time required to get back on the ground is not accounted for in the time fished, and the effect of fishing more hooks per line is not likely multiplicative to the catch rate. For example, fishing 4 hooks per line does not necessarily mean the catch rate would be 4 times greater than fishing one hook per line if the density of fish on the grounds was equal. Once a fish was hooked, a line is generally pulled up before more than one fish could be caught.

Prior to the start of sampling in 1995, a fixed (control) location on the fishing grounds was established for each site and will remain fixed for the duration of the project. Each fishing day, up to half of the gear was set at the control site. The remainder of the gear (experimental) was set at one or two other locations on the fishing grounds at the discretion of the crew. The location of each fishing set was plotted on a nautical chart. The time of the set and the soak time for the gear were recorded. Other environmental observations were recorded, including wind direction and speed, percent cloud cover, tide conditions, presence of invertebrates (bait) and other fish species in the area, marine mammals, sea birds and any other variables which might have influenced fishing behavior. Selected sites were equipped with a CTD (measuring temperature and salinity at depth). At these locations, casts were conducted in the vicinity of fishing sets each fishing day. CTD locations were fished for subsequent years if possible.

When the gear was retrieved, catches from the control and experimental gear were kept separate and sampled on shore. All fish from gill net, hand line and line trawl, and a sample of the catch from traps, were measured for length and sex. Otoliths were sampled on a length-stratified basis and stored in manila envelopes with relevant information recorded on the outside. Every other week, selected sites collected a sample of up to 100 frozen fish. These were transported to St. John’s for detailed biological sampling. All information was recorded on forms similar to those used by the Port Sampling Section and on DFO Research Vessels.

Other biological samples were collected as needed.

Data Presentation

The data were summarized for each NAFO division and presented by gear type. The relative length frequency plot depicts the number of fish at length scaled by total amount of gear fished so that changes in length frequency distribution may be compared across years. Lengths, in 1cm intervals, are from both control and experimental gear, and for gill net and line trawl represent every fish measured, as the total catch is measured. For hand line and trap data, total number measured are given in the length frequency summary graph. For gill net and line trawl, data are shown as an average of the relative length frequencies for each fisher in the division. The CPUE figures show control and experimental catches separately, in number of fish per net or 1000 hooks by week and are constructed by calculating a daily catch rate for each set and averaging all the CPUEs for all sets in a given week. The tables give catch details broken down by year, including number of fish measured (Nmeas), amount of gear fished (Ngear), total number of sets (Nhauls) and number of sets in which no fish were caught (Nzero). The first table contains data for control sets only and the second table on each sheet combines the data for all experimental sets.

Results

Sixty-four inshore fishing enterprises representing communities from Black Tickle to St. Mary's Bay participated in the 2J3KL Sentinel Survey for 2000. Survey activity covered mostly summer and fall periods in all years, traditional fishing times for the areas involved. A total of 3 101 sets of 5 ½" gill net and 339 sets of 3 ¼" gill net resulted in total measurements of roughly 70 000 fish. One hundred thirty-five sets of line trawl resulted in 3081 measurements. Otoliths from 3 125 fish were collected for aging purposes in 2000. A total of 10 512 fish were sampled from 77 trap hauls. Hand lining resulted in 3 678 measurements from 202 sets.

Figure 1 shows the control sites and trap berths that were surveyed in 2000 plotted by gear type. Control sites were generally consistent from year to year but shifts in location may have resulted due to weather or tide conditions or competition for sites by commercial activity.

3 ¼" Gill net

Data for 3 ¼" gill net are summarized in figures 2-14 and tables 1-8. Figure 2 summarizes the annual relative length frequencies for gill net and line trawl by year and for each division. All plots for each gear are shown on the same scale to facilitate comparisons between divisions. Relative length frequencies shown on subsequent pages are given with years plotted on the same chart for each group. Bimodal selection is shown with 3 ¼" mesh as smaller fish are meshed and larger fish are caught by the lips and entangle as they struggle. In 2000 catches of smaller fish increased in 2J and 3L and were similar in 3K compared to 1999. The second peak in the distribution showed little change from the previous year and remained lower than that seen in 1996-1998.

Weekly catch rates are given in the second two figures on each summary page. For 3 ¼" gill net, most sets were conducted in experimental locations.

5 ½" Gill net

The summary data for 5 ½" gill net in 2J3KL, in Figures 15-26 and tables 9-16 give an indication of catch rate change since inception of the Sentinel Survey in 1995. Gill nets show the narrowest range of selectivity of Sentinel Survey gears, generally targeting fish in the 50cm to 80cm range. Comparing between divisions (Figure 2), 2J shows very poor catches in this gear in all years. 3K catches are highest in 1996 and 1998. Consistently higher catches are seen in 3L than 2J or 3K and 1998 was the best in the series. The relative length frequency plot for all of 2J3KL (figure 15) shows 2000 to have declined to 1995 level. The widest and strongest distribution in 1998 declined and narrowed in 1999, with even more decline in 2000. Weekly catch rate series indicate a bimodal distribution in catch rates, with best catch rates in weeks 25-34 and a second mode in late fall. The enterprises which survey in the fall (primarily Summerford, Miles Cove, Ming's Bight, & Petley) may be fishing on aggregations preparing to over-winter in inshore areas, which may partially explain the higher catch rates during this time frame.

Catches in 2J 5 ½" gill nets were poor in all years. Of 438 sets in 2000, 68% contained no fish (tables 11 and 12) compared to 40% in the previous two years. The relative length frequency plot reflects the scarcity of data in its jagged appearance. The period of time covered by the gill net survey in 2J is the most condensed of all division, likely because all fishers have their gear in the water in the same weeks because of the shorter season in 2J.

In 3K catches from 5 ½" gill net were best in 1996 and 1998. Catch rates in 2000 were comparable to 1995 which showed the lowest catch rate in the series. Fall catch rates were stronger than the summer peak in previous years, but in 2000 this fall increase was not observed.

The best catch rates in 5 ½" gill net were seen in 3L for all years, 1995 to 2000. The relative length frequency plot (Fig. 24) shows 1998 as the strongest peak, probably reflecting the relative strength of the 1992 year-class. Peaks for 1996, 1997 and 1999 are comparable and 1995 again shows the lowest in the series. 2000 catch rates are down from 1999.

Line trawl

Figures 27-38 and tables 17-24 summarize the data from the line trawl portion of the 2J3KL Sentinel Survey. The line trawl survey generally takes place from weeks 34 to 48. Line trawl shows a much wider selectivity curve than gill net and catches mainly fish between 29cm and 83cm. Overall, 1997 shows the broadest range of fish sizes caught and the highest weekly catch rates in the series.

The comparisons between divisions (Figure 2) shows 2J to again have very low catches compared to 3K and 3L. No line trawl was fished in 2J in 2000. 3K and 3L showed comparable catch rates in 1996 and 1997 (the highest in the series) and both divisions declined in 1998 and 1999.Catches in 3K declined further in 2000 while 3L showed improved catches in 2000.

Very few line trawl sets were conducted in 2J. Only 52 sets were conducted over the course of the Sentinel Survey (1995-1999) and in 1999 of 3 sets fished, none caught fish (tables 21 and 22).

In 3K, the line trawl survey had the best catch rates in all weeks fished in 1997. The relative length frequency plot for 1997 shows the widest size ranges of fish caught as well. In 1999 and 2000 there is a noticeable absence of smaller fish in the relative frequency plot and in 2000 the dip in the relative frequency at 45 to 59 cm is particularly dramatic.

The relative length frequency for 3L (Figure 36) shows 2000 to have catch rates similar to other years, in contrast with 3K data. The frequency distribution is wider in 2000 with both smaller and larger fish better represented than in 1999.

Hand line

Hand line data is also given as total number at length with no attempt to scale to effort. Because of the nature of hand line grounds and methods (drifting, tide effects, number of hooks on each line) calculating a CPUE has not been attempted. Looking at total length frequencies, though, still gives an indication of fishing success with this gear. Figures 39-42 and tables 25-32 summarize hand line data for 2J3KL. Overall, catches are lower in 2000 than in previous years (Figure 39), despite an effort similar to 1999 (202 sets compared to 195 sets). The percentage of zero catch sets (Nzero) is similar in 2000 to 1999 at around 45%. Most hand line activity occurs in 3L.

Trap

Trap has the broadest range of selectivity of all gears used in the Sentinel Survey. Fish from 34 to 86cm were well represented in the frequency distributions. Trap data is presented in figures 42-45 and tables 33-36. The total length frequency for all traps fished in 2J3KL (fig. 42) track the movement of a size range of fish from 1996 through 1998, which seem to correspond to the 1992 year-class. In 1999 the absence of larger fish available to the trap is noticeable. The pattern in size progression is driven mainly by the 3L trap data. 2J had very little catch in 1995-1998 and no data for 1999 or 2000. Catches in 3K were less than half those for 3L in most years. There is a peak of relatively small fish indicated in the 1999 and 2000 frequency plot for 3K, while 3L shows very poor trap catches compared to previous years. It should be noted that these frequency plots are not scaled to effort and that effort had been reduced in all divisions in 1999 and 2000. In addition, the method of sampling was modified in 2000. As a rough guide to scaling the plots for comparisons between years, the number of times the trap was hauled can be considered (Tables 33-36, Nhauls).

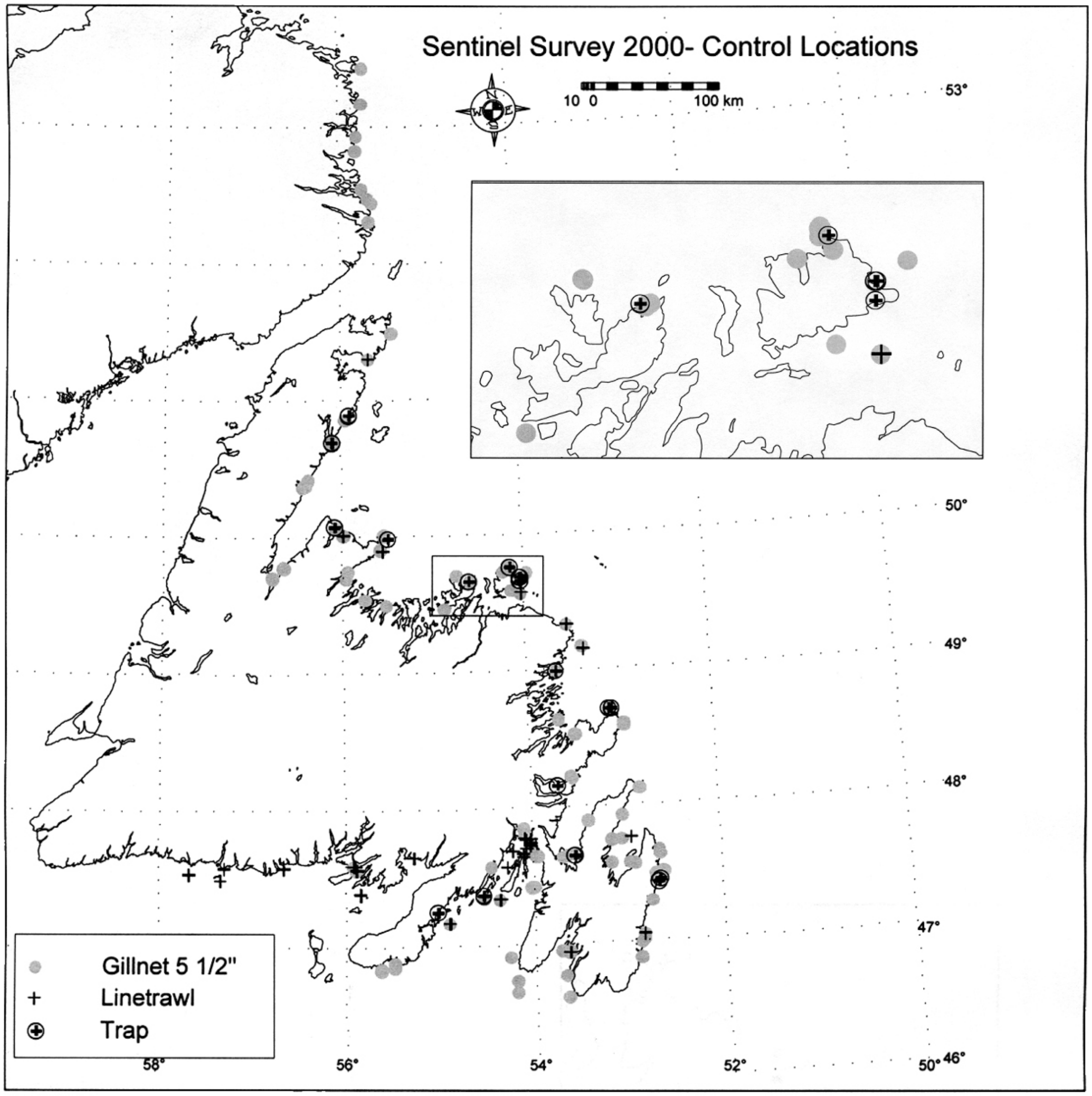

Figure 1. Sentinel Control Locations for 2000.

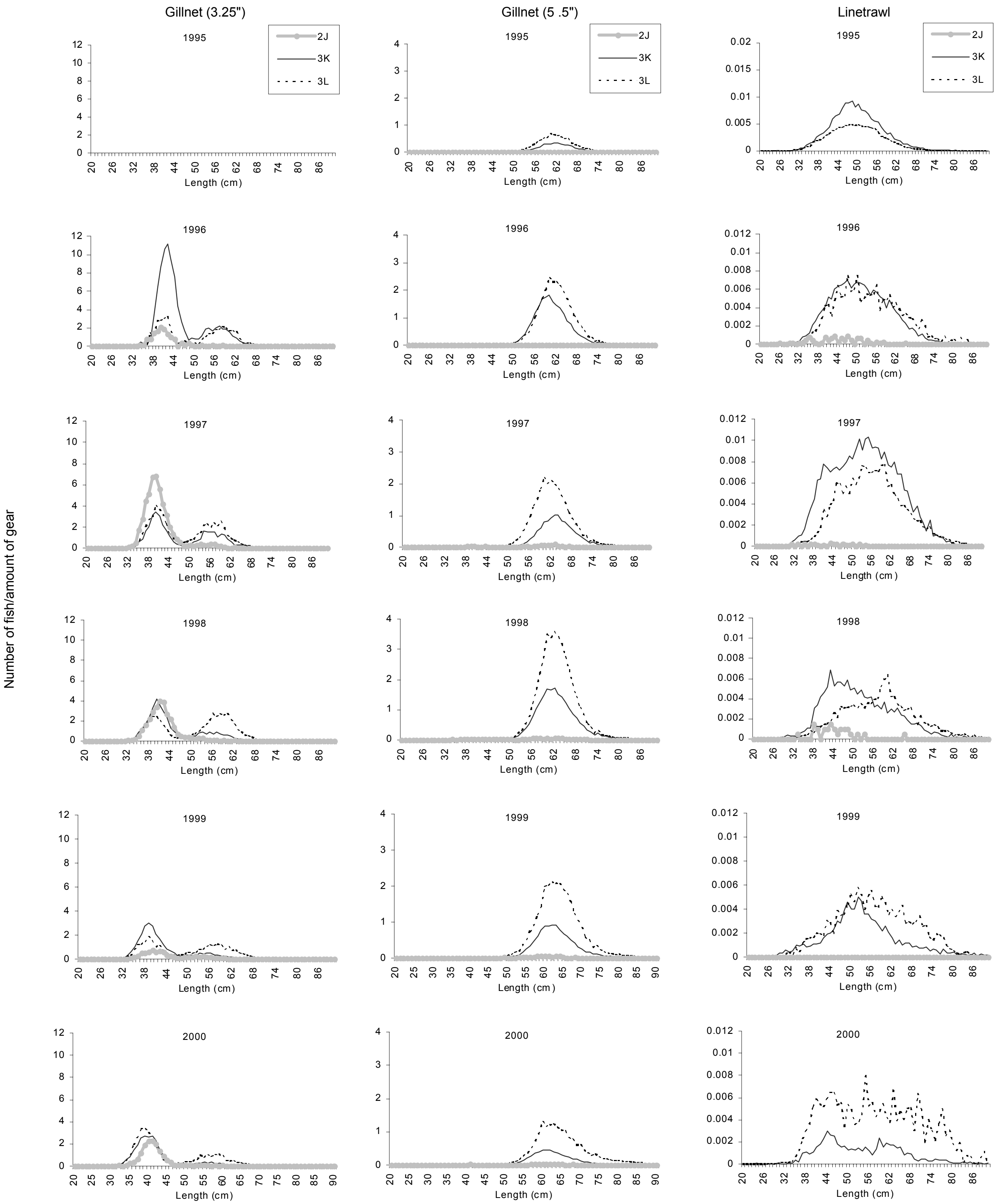
Gillnet (3.25")
Gillnet (5 .5")
Linetrawl
1995
1996
1997
1998
1999
2000
2J
3K
3L
Number of fish/amount of gear
Length (cm)

Figure 2.

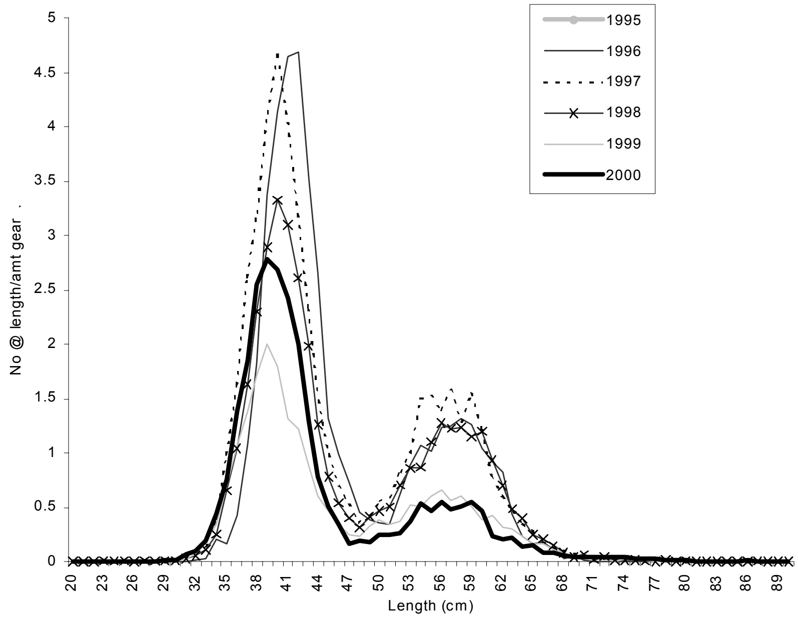

Table 1. Summary data for 2J3KL Control Sets Gillnet 3 1/4 in.

Division	(All)
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		11	212	178		22
Sum of Ngear		1	3	7		1
Sum of Nhauls		1	3	7		1
Sum of Nzero		0	0	2		0

Table 2. Summary data for 2J3KL Exp sets Gillnet 3 1/4 in.

Division	(All)
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		2417	10968	11819	6409	8693
Sum of Ngear		31	225	316	298	339
Sum of Nhauls		31	224	316	297	338
Sum of Nzero		0	16	20	40	36

Figure 3 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J3KL, Gillnet 3 1/4 in.

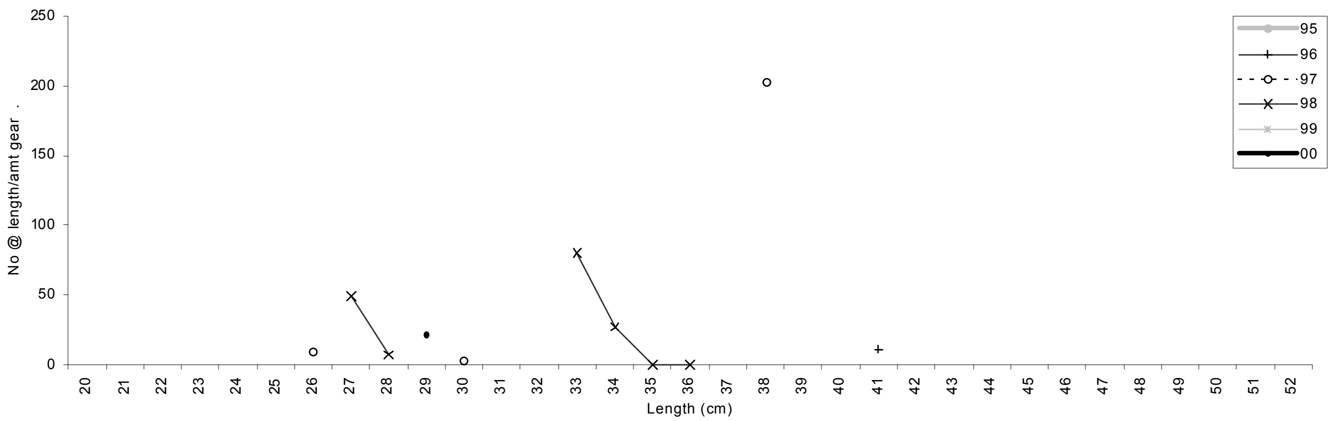

Figure 4 . Average Catch per Unit Effort for Control Sites, 2J3KL, Gillnet 3 1/4 in. (Number of Fish per Net)

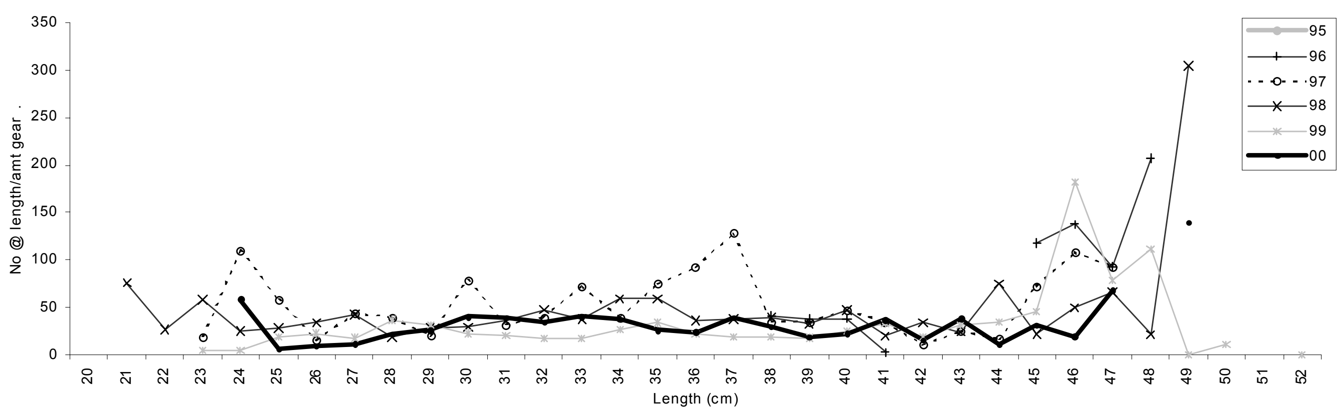

Figure 5 . Average Catch per Unit Effort for Experimental Sites, 2J3KL, Gillnet 3 1/4 in. (Number of Fish per Net)

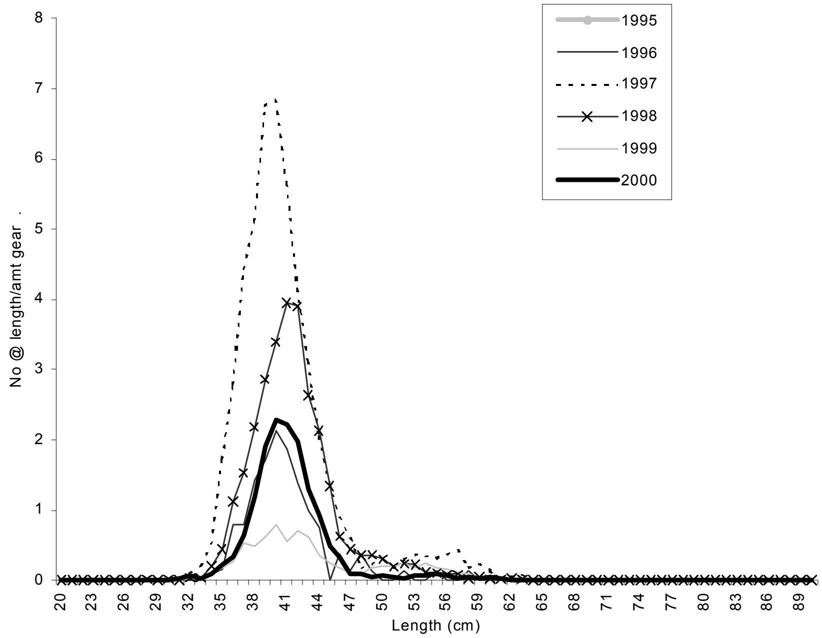

Table 3. Summary data for 2J Control Sets Gillnet 3 1/4 in.

Division	2J
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		11	203			
Sum of Ngear		1	2			
Sum of Nhauls		1	2			
Sum of Nzero		0	0			

Table 4. Summary data for 2J Exp sets Gillnet 3 1/4 in.

Division	2J
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		96	2773	2265	854	1707
Sum of Ngear		7	67	89	109	120
Sum of Nhauls		7	66	89	109	119
Sum of Nzero		0	7	12	27	17

Figure 6. Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J, Gillnet 3 1/4 in.

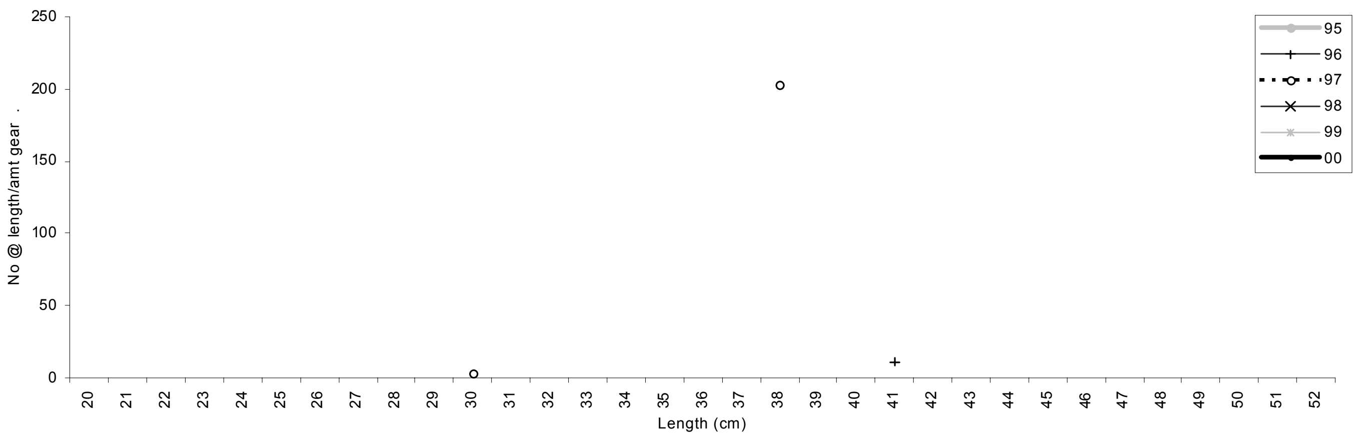

Figure 7. Average Catch per Unit Effort for Control Sites, 2J, Gillnet 3 1/4 in. (Number of Fish per Net)

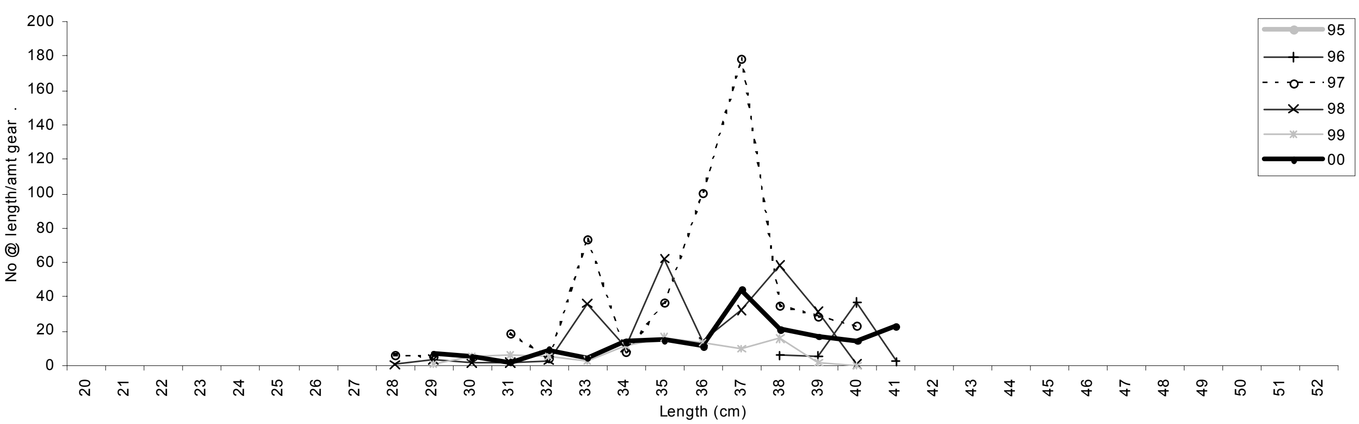

Figure 8. Average Catch per Unit Effort for Experimental Sites, 2J, Gillnet 3 1/4 in. (Number of Fish per Net)

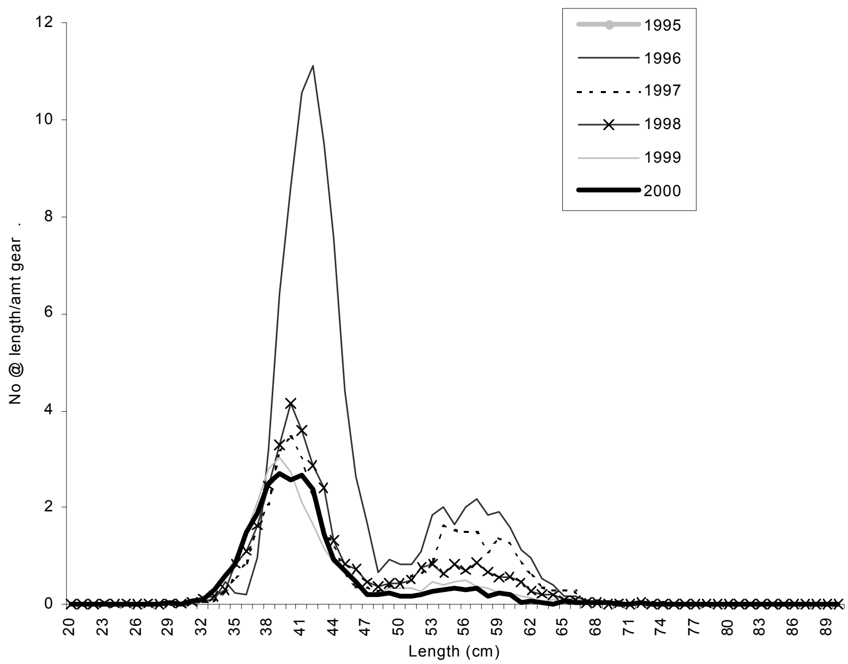

Table 5. Summary data for 3K Control Sets Gillnet 3 1/4 in.

Division	3K
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas			9	87		22
Sum of Ngear			1	2		1
Sum of Nhauls			1	2		1
Sum of Nzero			0	0		0

Table 6. Summary data for 3K Exp sets Gillnet 3 1/4 in.

Division	3K
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		1822	2526	3830	2762	2143
Sum of Ngear		15	52	107	93	80
Sum of Nhauls		15	52	107	92	80
Sum of Nzero		0	2	6	6	11

Figure 9. Relative length frequency (number at length / amount of gear) for control and experimental gears, 3K, Gillnet 3 1/4 in.

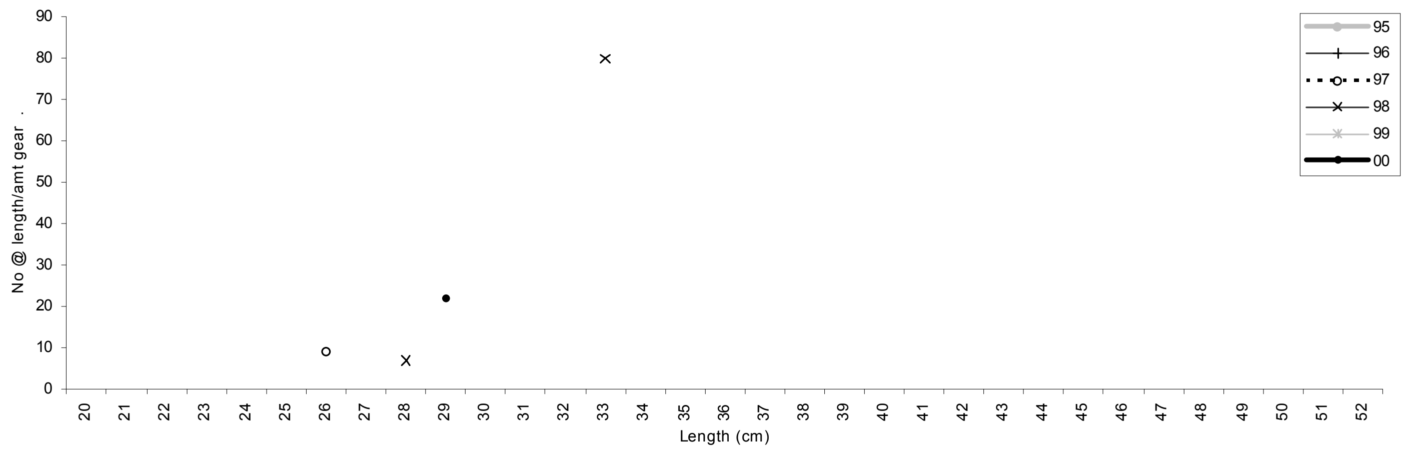

Figure 10. Average Catch per Unit Effort for Control Sites, 3K, Gillnet 3 1/4 in. (Number of Fish per Net)

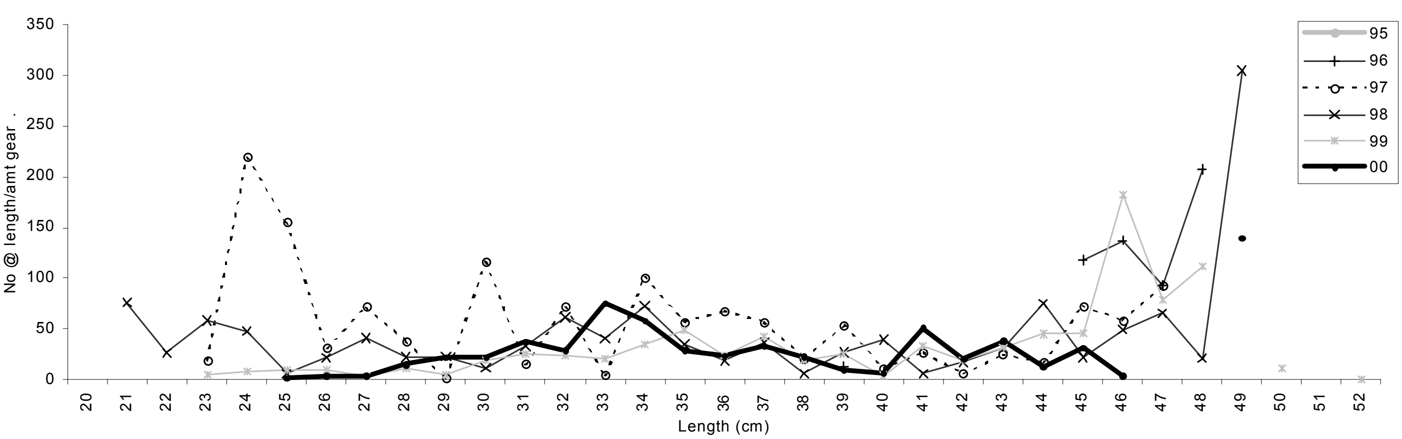

Figure 11. Average Catch per Unit Effort for Experimental Sites, 3K, Gillnet 3 1/4 in. (Number of Fish per Net)

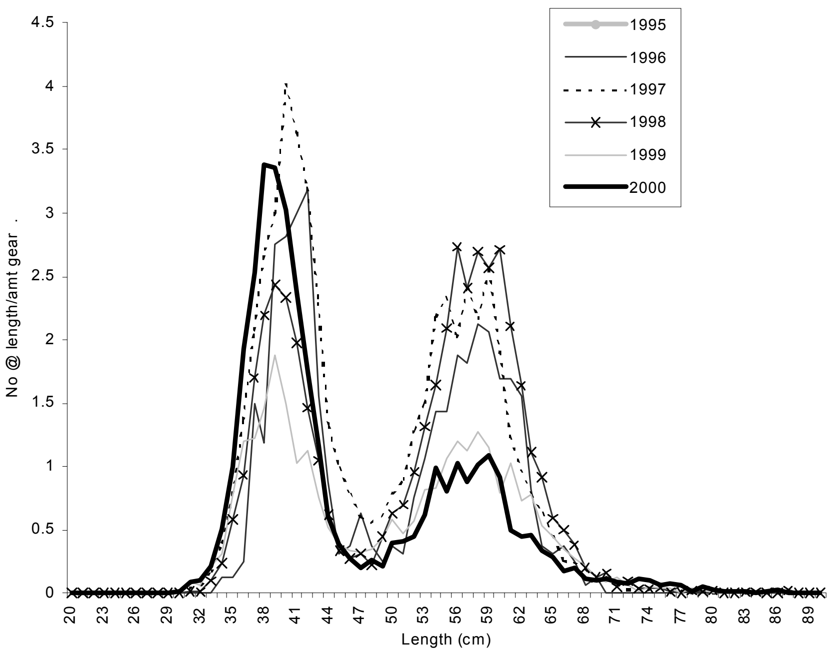

Table 7. Summary data for 3L Control Sets Gillnet 3 1/4 in.

Division	3L
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas				91		
Sum of Ngear				5		
Sum of Nhauls				5		
Sum of Nzero				2		

Table 8. Summary data for 3L Exp sets Gillnet 3 1/4 in.

Division	3L
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	3.25

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		499	5669	5724	2793	4843
Sum of Ngear		9	106	120	96	139
Sum of Nhauls		9	106	120	96	139
Sum of Nzero		0	7	2	7	8

Figure 12 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 3L, Gillnet 3 1/4 in.

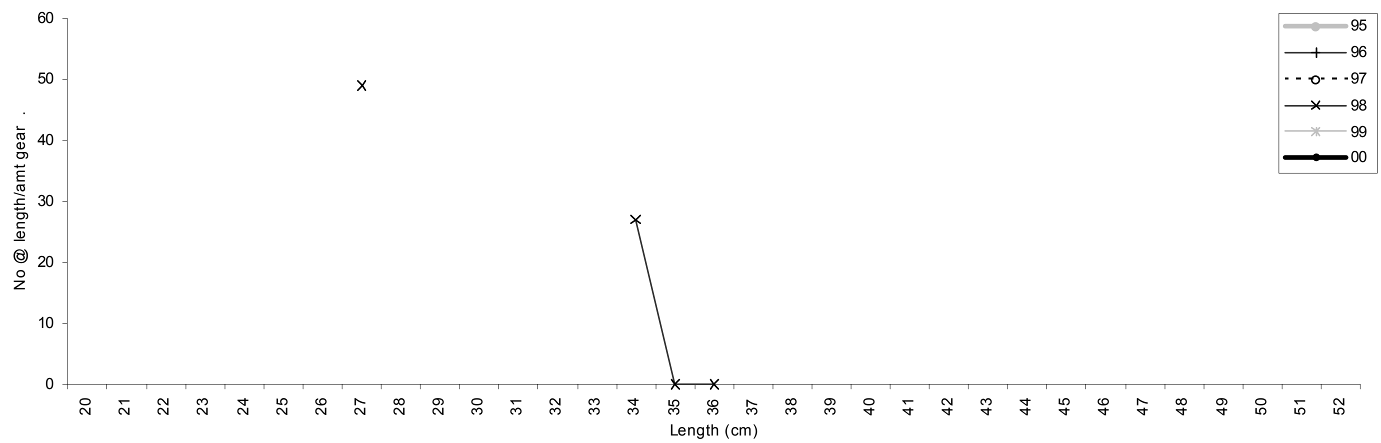

Figure 13 . Average Catch per Unit Effort for Control Sites, 3L, Gillnet 3 1/4 in. (Number of Fish per Net)

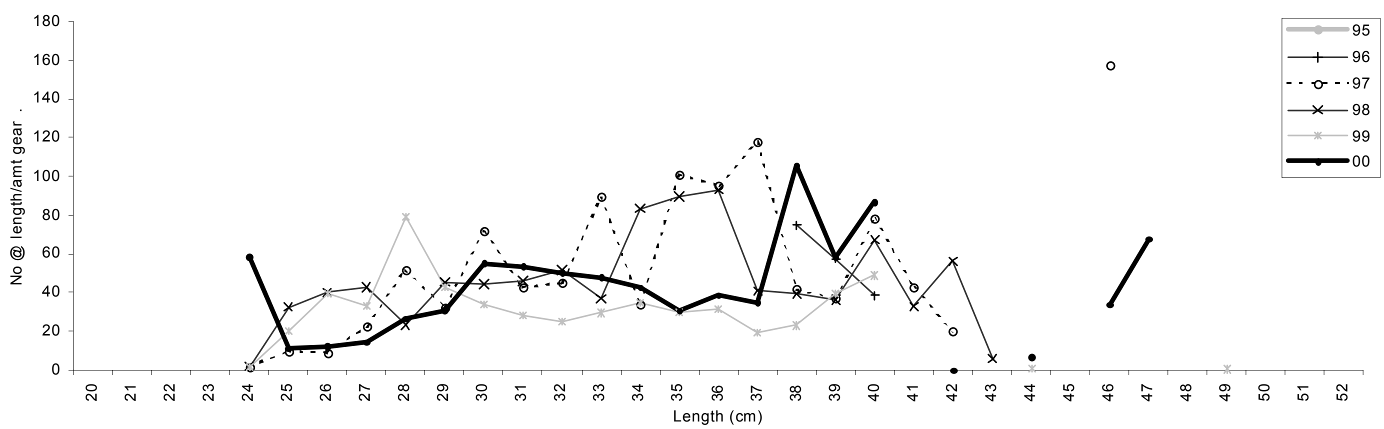

Figure 14 . Average Catch per Unit Effort for Experimental Sites, 3L, Gillnet 3 1/4 in. (Number of Fish per Net)

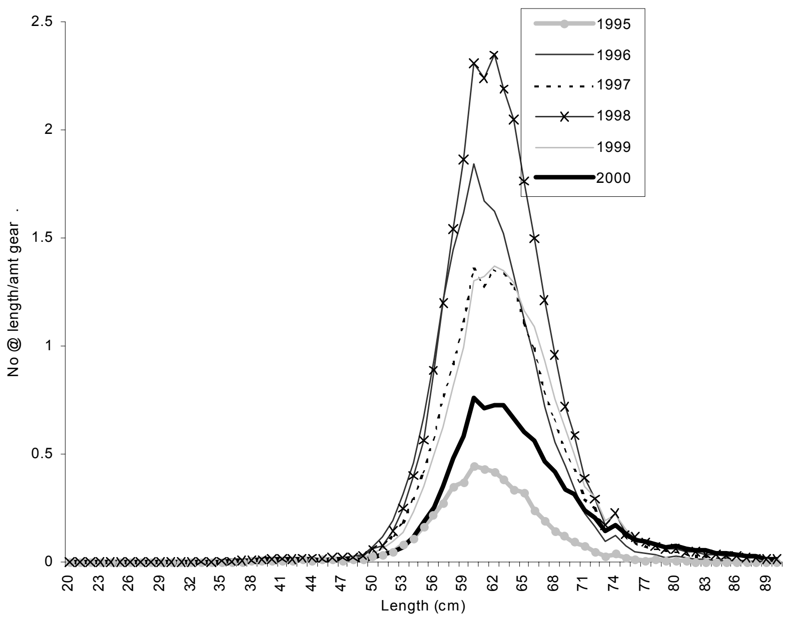

Table 9. Summary data for 2J3KL Control Sets Gillnet 5 1/2 in.

Division	(All)
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	12913	36693	36208	50816	30938	22163
Sum of Ngear	2624	2001	2026	2046	1967	2381
Sum of Nhauls	891	849	866	893	883	1088
Sum of Nzero	182	151	97	90	103	215

Table 10. Summary data for 2J3KL Exp sets Gillnet 5 1/2 in.

Division	(All)
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	15873	61324	50734	73531	52666	38459
Sum of Ngear	2664	3086	2924	2943	3037	3924
Sum of Nhauls	896	1409	1427	1515	1576	2013
Sum of Nzero	180	238	208	217	243	445

Figure 15 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J3KL, Gillnet 5 1/2 in.

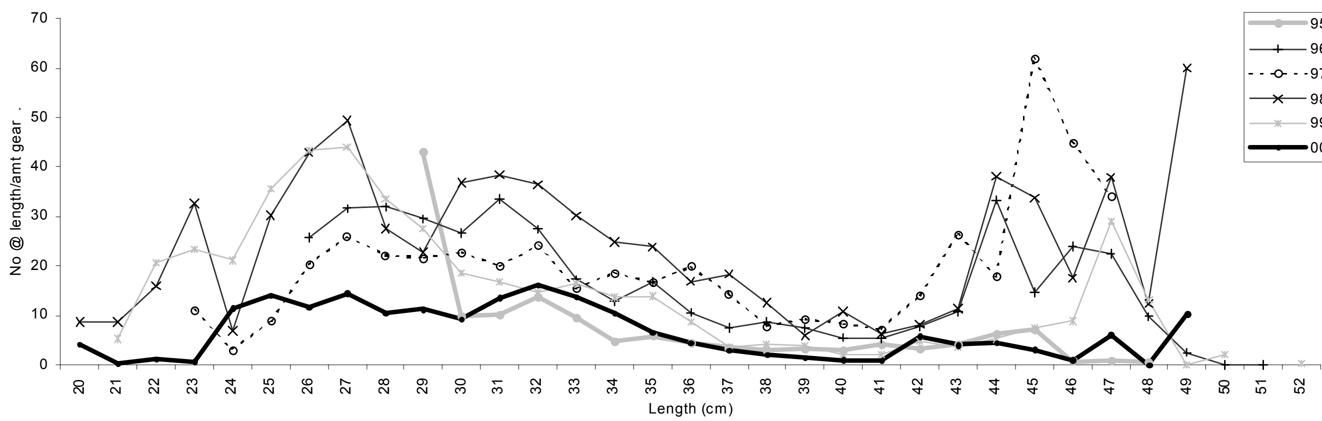

Figure 16 . Average Catch per Unit Effort for Control Sites, 2J3KL, Gillnet 5 1/2 in. (Number of Fish per Net)

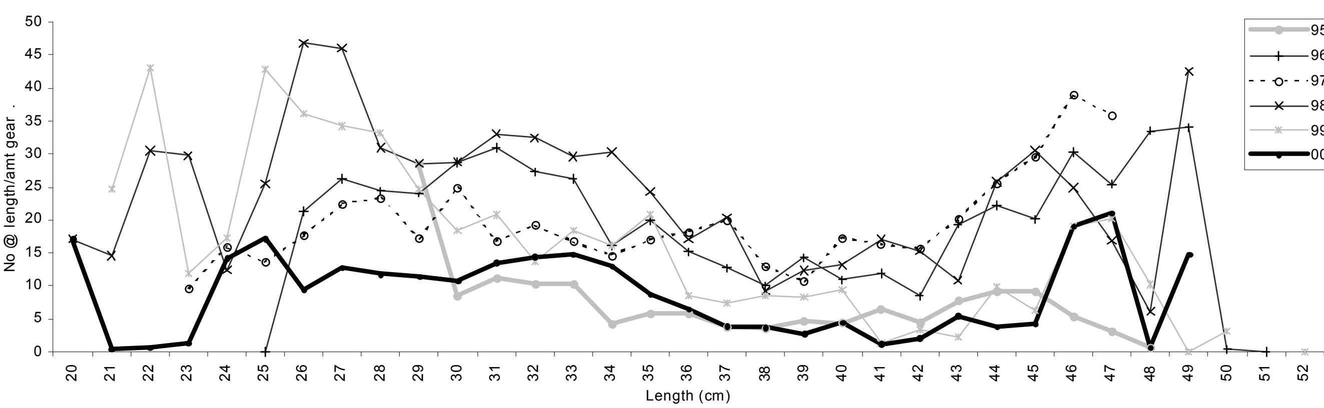

Figure 17 . Average Catch per Unit Effort for Experimental Sites, 2J3KL, Gillnet 5 1/2 in. (Number of Fish per Net)

Table 11. Summary data for 2J Control Sets Gillnet 5 1/2 in.

Division	2J
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	75	21	320	237	135	105
Sum of Ngear	323	250	249	204	240	299
Sum of Nhauls	110	115	117	96	115	144
Sum of Nzero	76	98	71	55	68	92

Table 12. Summary data for 2J Exp sets Gillnet 5 1/2 in.

Division	2J
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	47	84	284	227	321	175
Sum of Ngear	323	482	380	323	359	492
Sum of Nhauls	110	227	213	198	227	294
Sum of Nzero	85	189	162	143	160	208

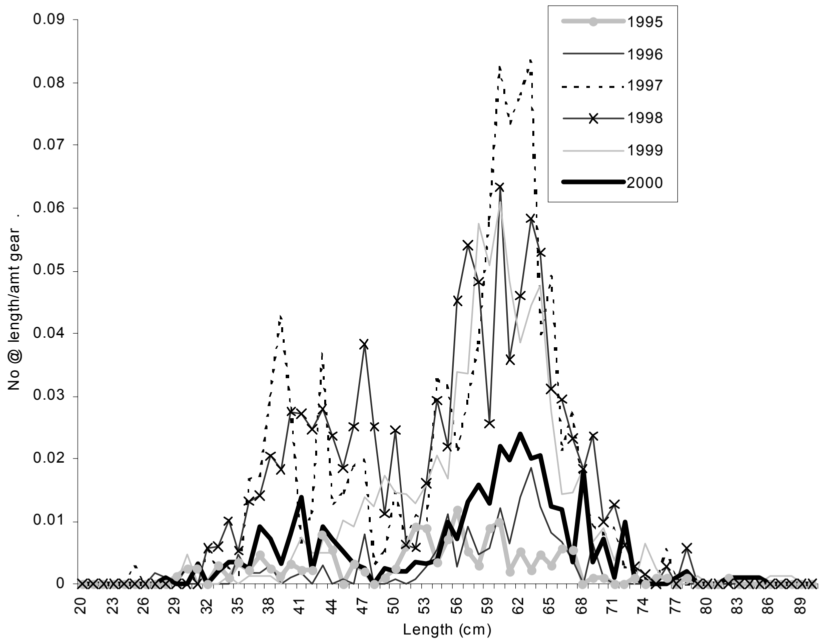

Figure 18 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J, Gillnet 5 1/2 in.

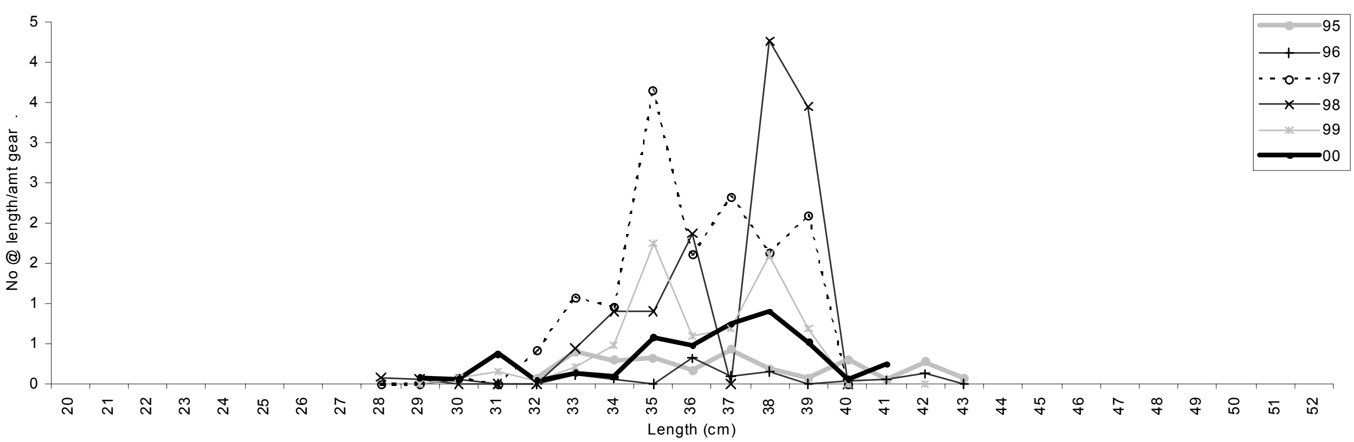

Figure 19 . Average Catch per Unit Effort for Control Sites, 2J, Gillnet 5 1/2 in. (Number of Fish per Net)

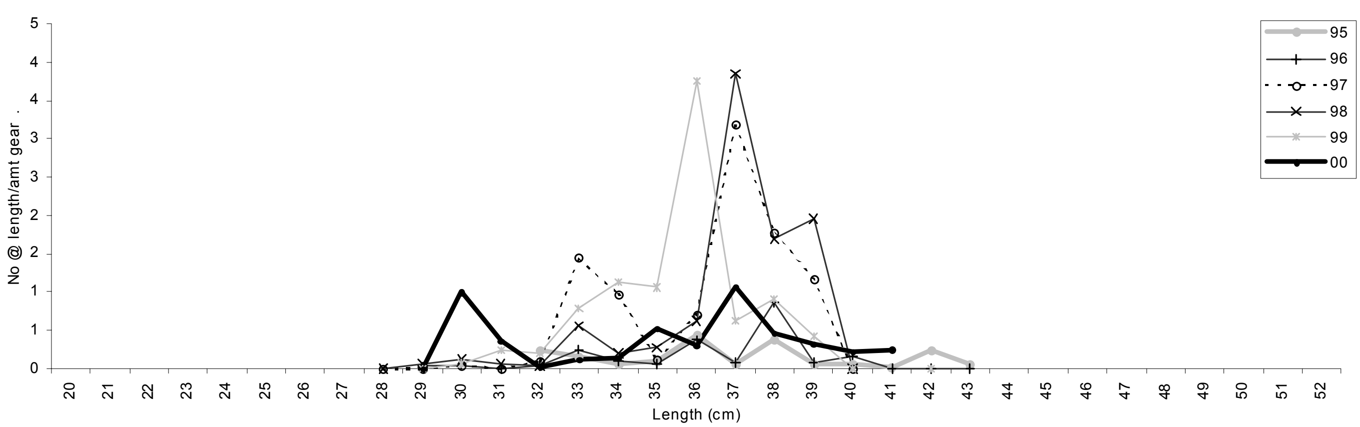

Figure 20 . Average Catch per Unit Effort for Experimental Sites, 2J, Gillnet 5 1/2 in. (Number of Fish per Net)

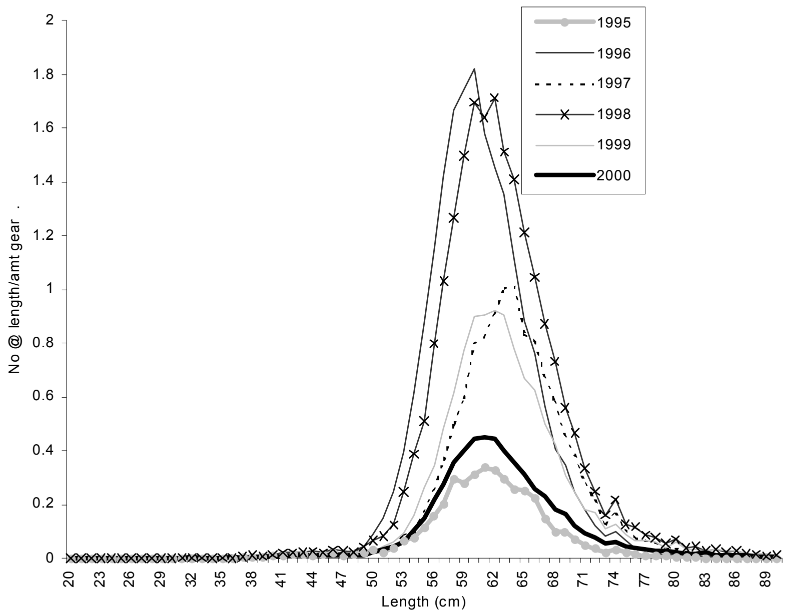

Table 13. Summary data for 3K Control Sets Gillnet 5 1/2 in.

Division	3K
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	3724	11684	9245	13644	7811	3999
Sum of Ngear	990	704	633	696	773	909
Sum of Nhauls	334	317	298	327	367	445
Sum of Nzero	84	38	24	19	25	95

Table 14. Summary data for 3K Exp sets Gillnet 5 1/2 in.

Division	3K
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	5436	23145	14680	23347	17611	12147
Sum of Ngear	1017	1185	1143	1242	1422	1806
Sum of Nhauls	335	586	572	667	748	908
Sum of Nzero	67	33	31	57	63	158

Figure 21 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 3K, Gillnet 5 1/2 in.

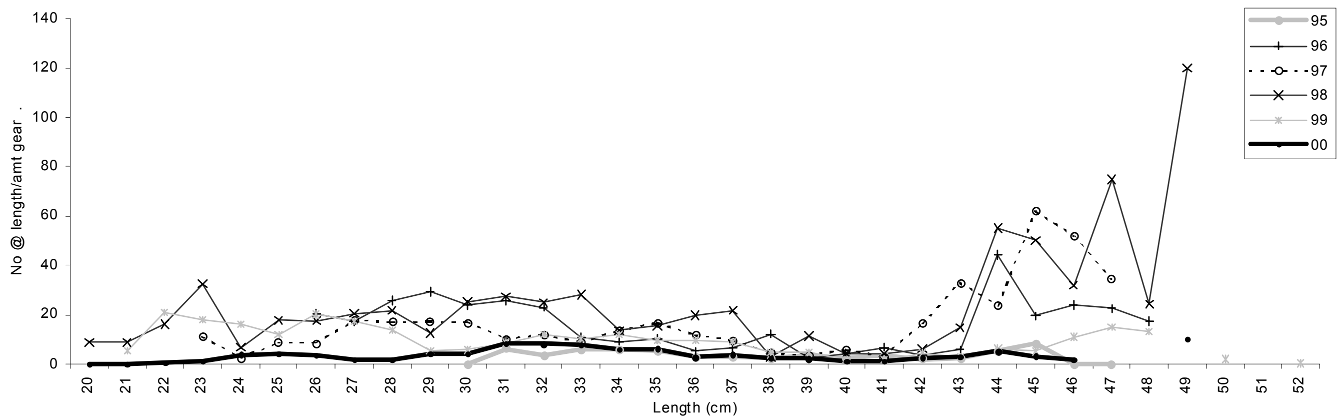

Figure 22 . Average Catch per Unit Effort for Control Sites, 3K, Gillnet 5 1/2 in. (Number of Fish per Net)

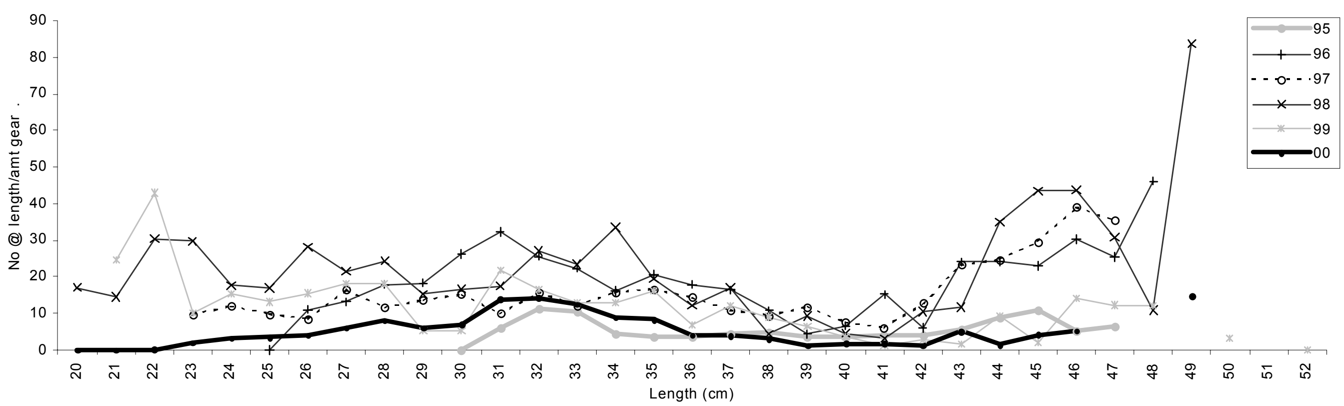

Figure 23 . Average Catch per Unit Effort for Experimental Sites, 3K, Gillnet 5 1/2 in. (Number of Fish per Net)

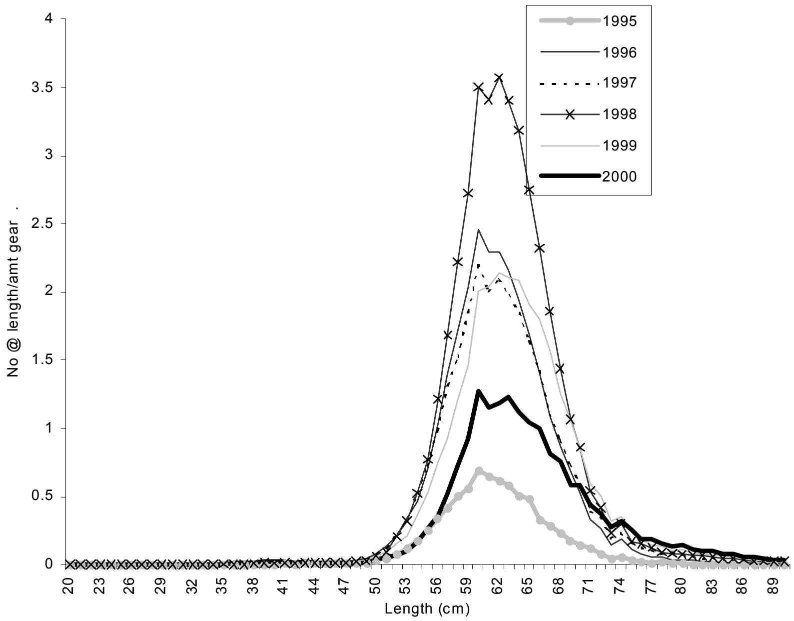

Table 15. Summary data for 3L Control Sets Gillnet 5 1/2 in.

Division	3L
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	9114	24988	26643	36935	22992	18059
Sum of Ngear	1311	1047	1144	1146	954	1173
Sum of Nhauls	447	417	451	470	401	499
Sum of Nzero	22	15	2	16	10	28

Table 16. Summary data for 3L Exp sets Gillnet 5 1/2 in.

Division	3L
LB Area	(All)
Type	(All)
Gear	5
Mesh Size	5.5

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	10390	38095	35770	49957	34734	26137
Sum of Ngear	1324	1419	1401	1378	1256	1626
Sum of Nhauls	451	596	642	650	601	811
Sum of Nzero	28	16	15	17	20	79

Figure 24 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 3L, Gillnet 5 1/2 in.

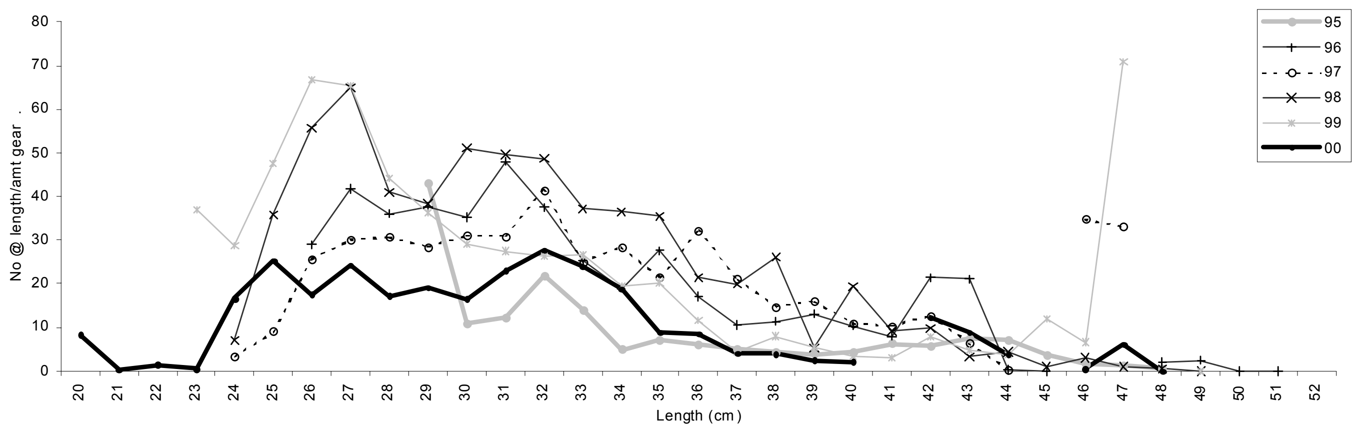

Figure 25 . Average Catch per Unit Effort for Control Sites, 3L, Gillnet 5 1/2 in. (Number of Fish per Net)

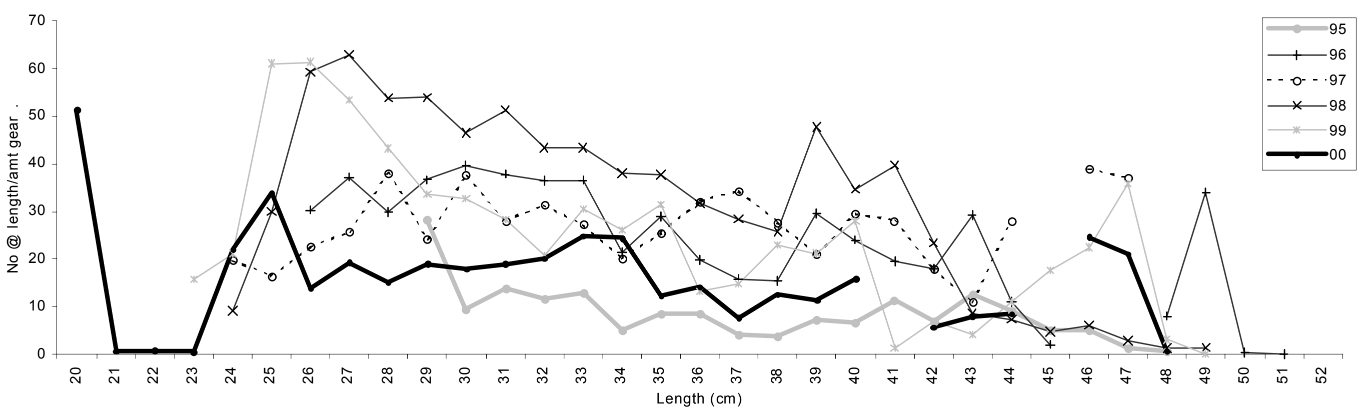

Figure 26 . Average Catch per Unit Effort for Experimental Sites, 3L, Gillnet 5 1/2 in. (Number of Fish per Net)

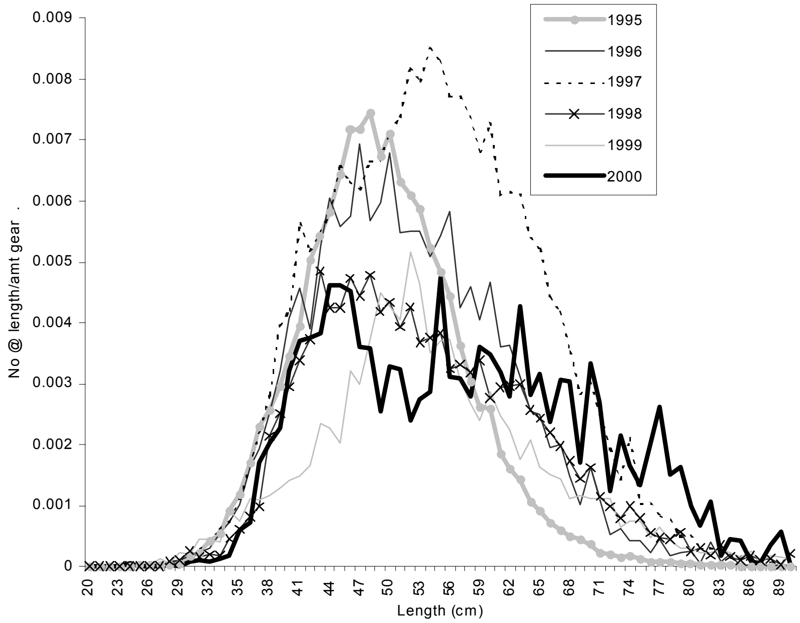

Table 17. Summary data for 2J3KL Control Sets Linetrawl

Division	(All)
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	15746	9123	14653	4879	2293	1259
Sum of Ngear	134250	77422	66400	42952	20450	13800
Sum of Nhauls	386	230	203	134	71	50
Sum of Nzero	50	19	10	12	5	13

Table 18. Summary data for 2J3KL Exp sets Linetrawl

Division	(All)
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	19195	13598	18050	6500	2419	1822
Sum of Ngear	134475	86200	75200	53114	24875	24040
Sum of Nhauls	404	286	237	171	89	85
Sum of Nzero	32	23	11	11	4	14

Figure 27 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J3KL, Linetrawl

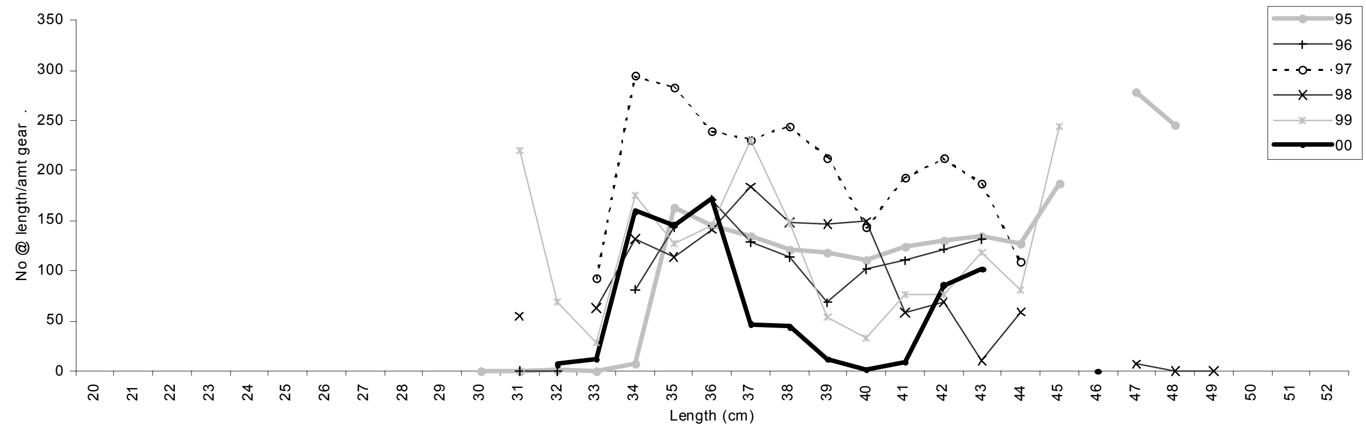

Figure 28 . Average Catch per Unit Effort for Control Sites, 2J3KL, Linetrawl (Number of Fish per 1000 hooks)

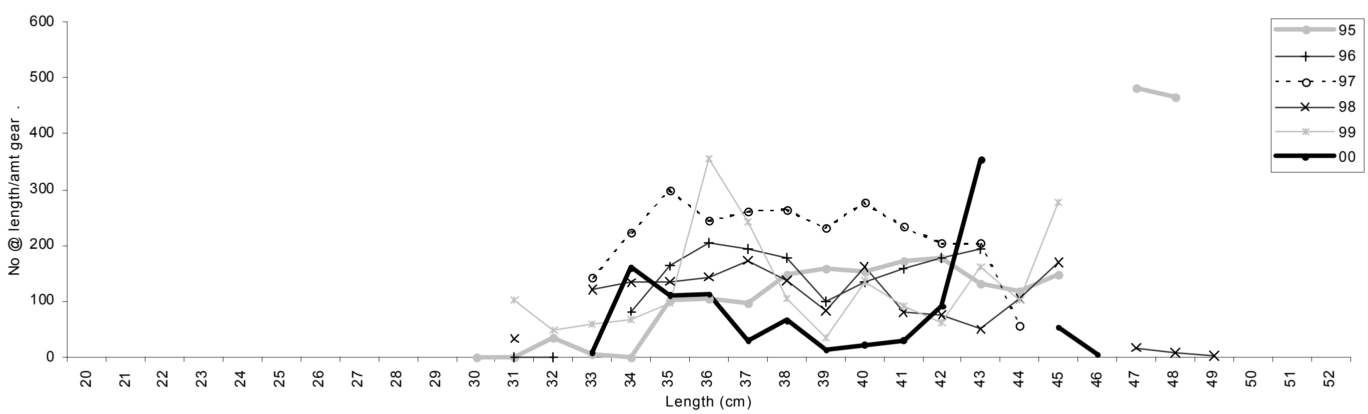

Figure 29 . Average Catch per Unit Effort for Experimental Sites, 2J3KL, Linetrawl (Number of Fish per 1000 hooks)

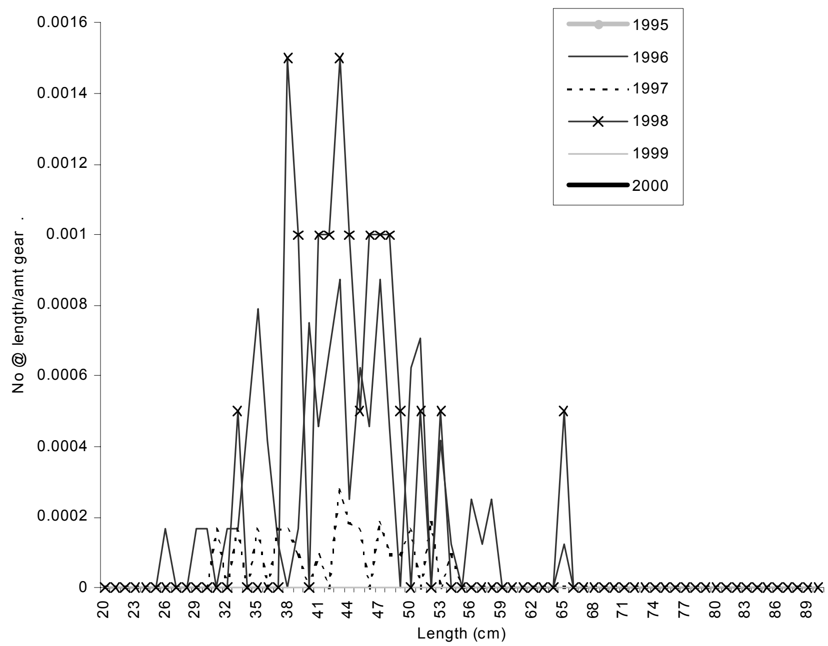

Table 19. Summary data for 2J Control Sets Linetrawl

Division	2J
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		38	16	15		
Sum of Ngear		3000	4200	1000		
Sum of Nhauls		9	12	4		
Sum of Nzero		2	6	0		

Table 20. Summary data for 2J Exp sets Linetrawl

Division	2J
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		37	5	11	0	
Sum of Ngear		4000	4950	1000	750	
Sum of Nhauls		11	12	4	3	
Sum of Nzero		3	9	1	3	

Figure 30 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J, Linetrawl

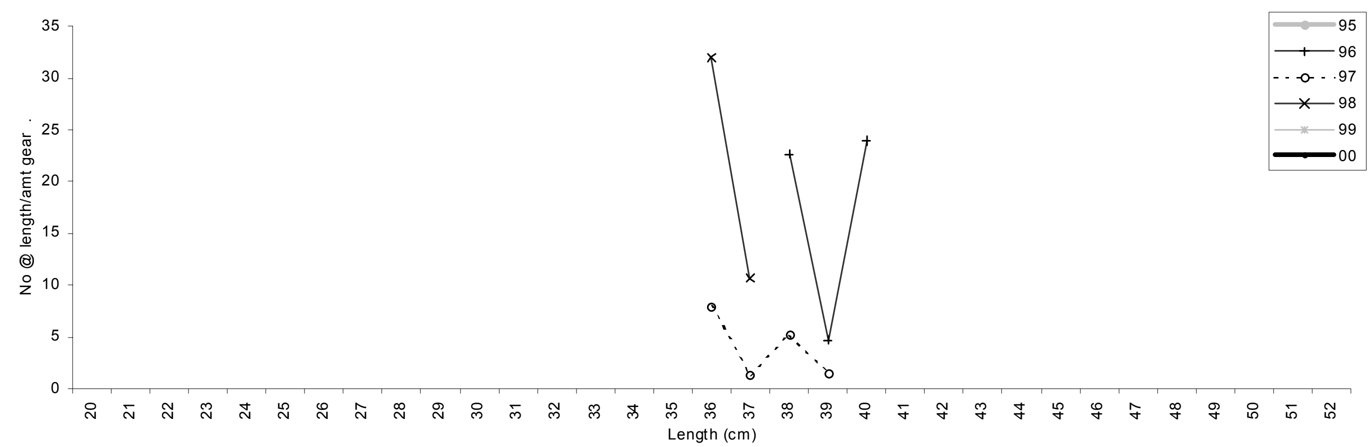

Figure 31 . Average Catch per Unit Effort for Control Sites, 2J, Linetrawl (Number of Fish per 1000 hooks)

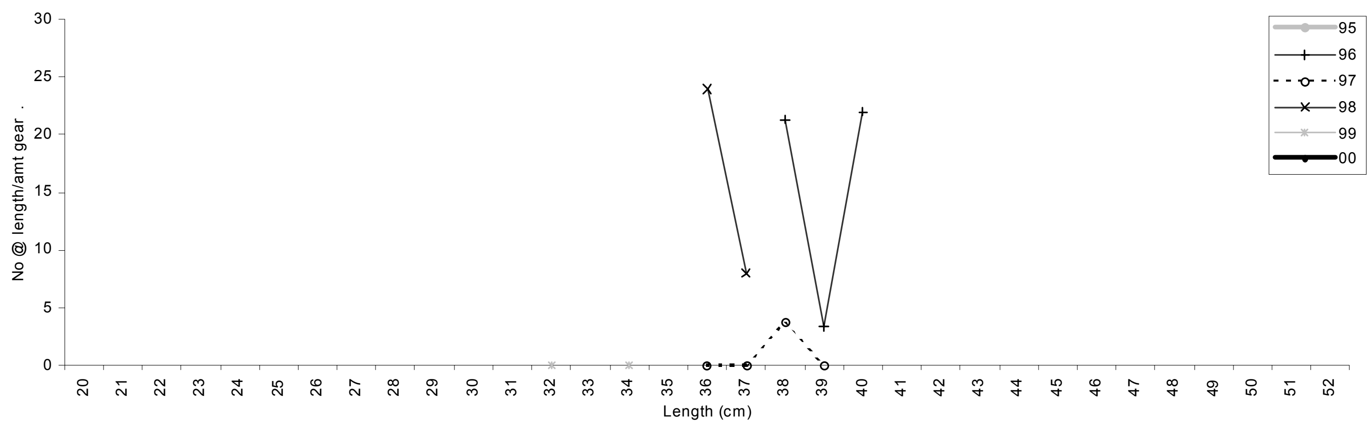

Figure 32 . Average Catch per Unit Effort for Experimental Sites, 2J, Linetrawl (Number of Fish per 1000 hooks)

Table 19. Summary data for 2J Control Sets Linetrawl

Division	2J
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		38	16	15		
Sum of Ngear		3000	4200	1000		
Sum of Nhauls		9	12	4		
Sum of Nzero		2	6	0		

Table 20. Summary data for 2J Exp sets Linetrawl

Division	2J
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas		37	5	11	0	
Sum of Ngear		4000	4950	1000	750	
Sum of Nhauls		11	12	4	3	
Sum of Nzero		3	9	1	3	

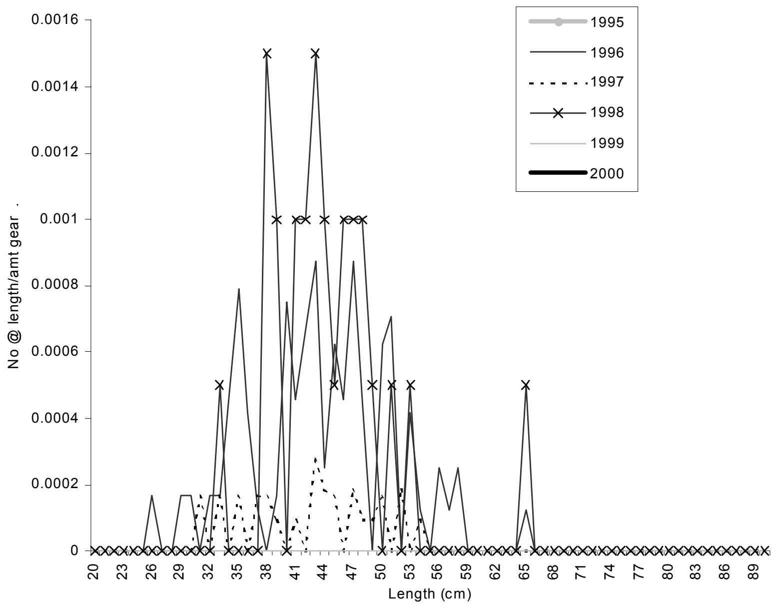

Figure 30 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 2J, Linetrawl

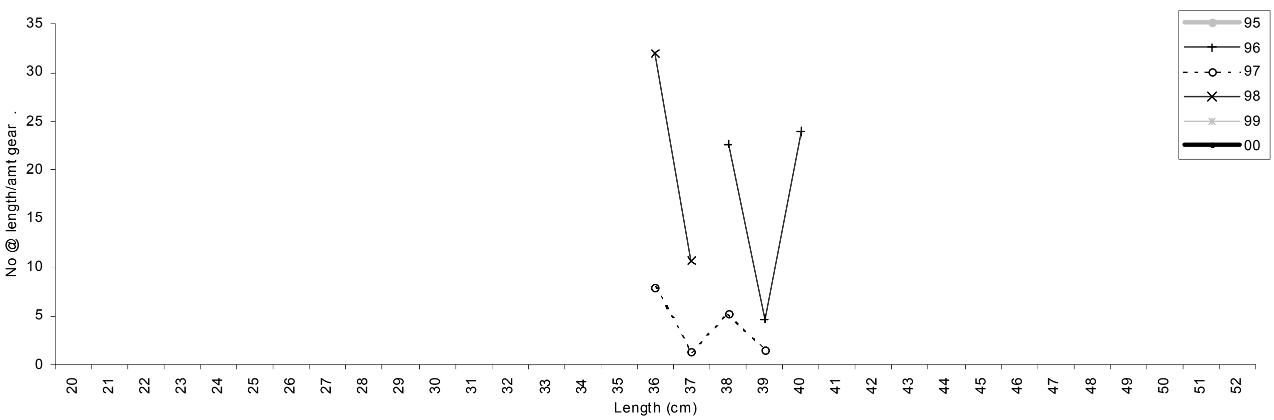

Figure 31 . Average Catch per Unit Effort for Control Sites, 2J, Linetrawl (Number of Fish per 1000 hooks)

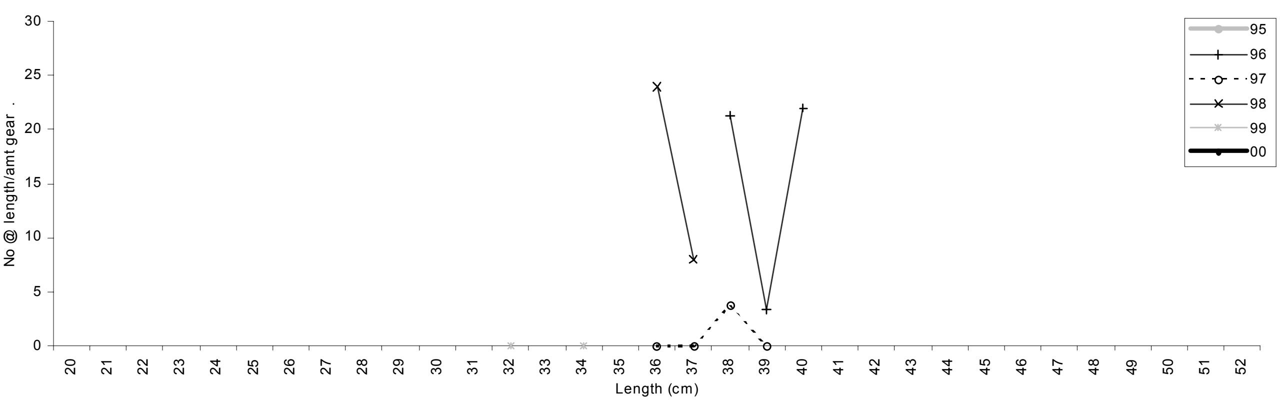

Figure 32 . Average Catch per Unit Effort for Experimental Sites, 2J, Linetrawl (Number of Fish per 1000 hooks)

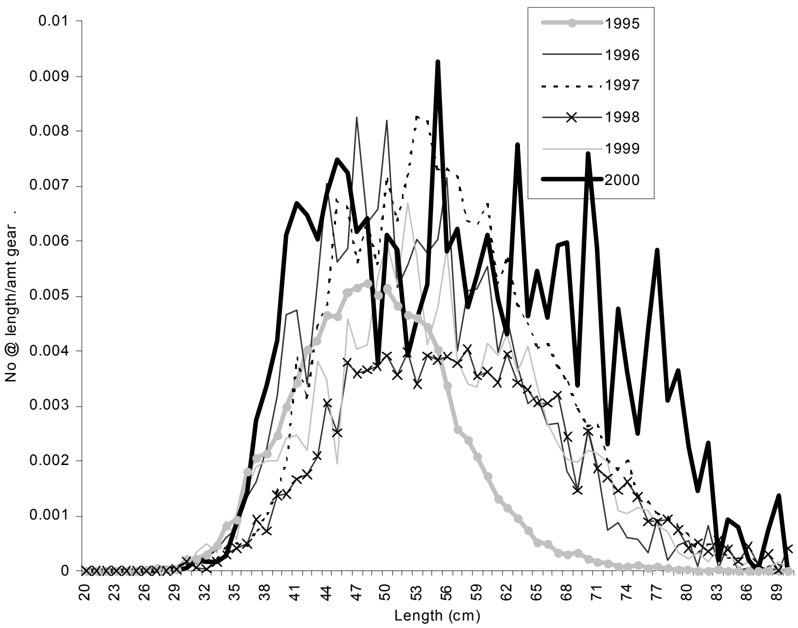

Table 23. Summary data for 3L Control Sets Linetrawl

Division	3L
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	5542	3191	5135	1870	784	945
Sum of Ngear	68100	36122	26200	16482	5300	4750
Sum of Nhauls	164	92	68	47	17	15
Sum of Nzero	28	11	0	6	2	1

Table 24. Summary data for 3L Exp sets Linetrawl

Division	3L
LB Area	(All)
Type	(All)
Gear	7
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	6718	5875	5146	2466	834	1169
Sum of Ngear	62000	36010	29750	21674	7300	9790
Sum of Nhauls	161	102	80	66	24	29
Sum of Nzero	20	11	0	7	1	2

Figure 36 . Relative length frequency (number at length / amount of gear) for control and experimental gears, 3L, Linetrawl

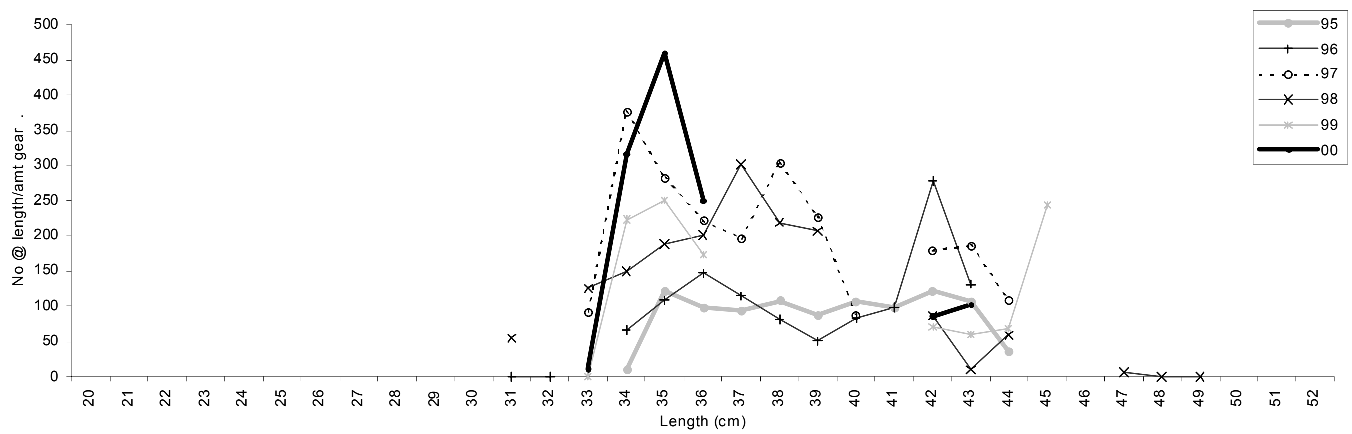

Figure 37 . Average Catch per Unit Effort for Control Sites, 3L, Linetrawl (Number of Fish per 1000 hooks)

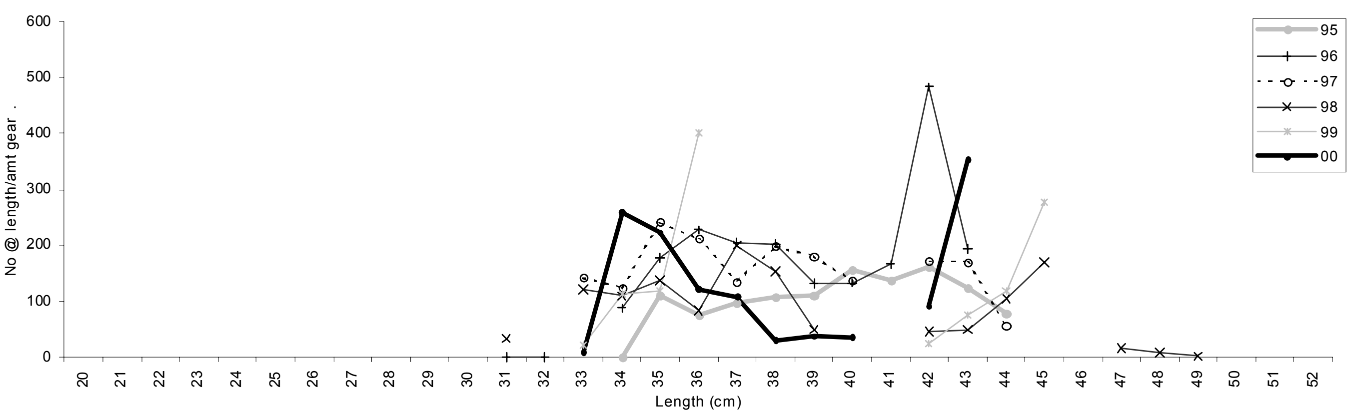

Figure 38 . Average Catch per Unit Effort for Experimental Sites, 3L, Linetrawl (Number of Fish per 1000 hooks)

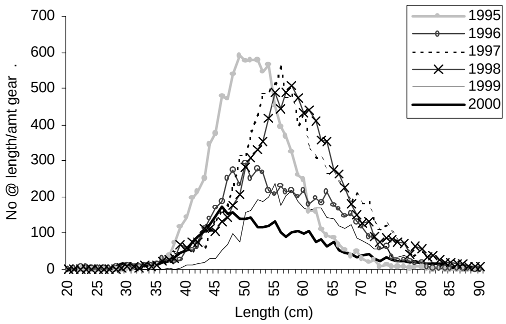

Figure 39. Total Number of Fish at Length for (All) Handline.

Table 25. Summary data for 2J3KL Control Sets Handline

Division	(All)
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas	3593	2801	4022	3662	1940	873
Sum of Ngear	490	773	676	783	427	436
Sum of Nhauls	75	114	125	140	89	73
Sum of Nzero	11	30	24	64	46	49

Table 26. Summary data for Exp Sets (All) Handline

Division	(All)
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas	6164	4754	6972	7102	2418	2805
Sum of Ngear	579	1305	1078	1314	479	666
Sum of Nhauls	89	186	207	238	106	129
Sum of Nzero	0	49	40	92	45	50

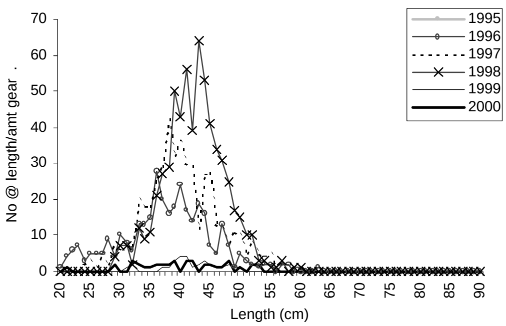

Figure 40. Total Number of Fish at Length for 2J Handline.

Table 27. Summary data for 2J Control Sets Handline

Division	2J
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas		63	208	326	0	
Sum of Ngear		381	276	314		
Sum of Nhauls		40	42	50	12	
Sum of Nzero		17	16	37	12	

Table 28. Summary data for Exp Sets 2J Handline

Division	2J
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas		276	264	304	30	39
Sum of Ngear		678	444	595	40	18
Sum of Nhauls		73	75	96	28	3
Sum of Nzero		36	39	67	22	0

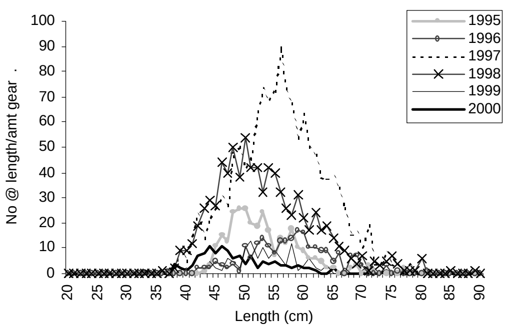

Figure 41. Total Number of Fish at Length for 3K Handline.

Table 29. Summary data for 3K Control Sets Handline

Division	3K
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas	131	11	418	531	128	
Sum of Ngear	18	4	18	30	2	
Sum of Nhauls	3	3	9	9	1	
Sum of Nzero	0	1	0	2	0	

Table 30. Summary data for Exp Sets 3K Handline

Division	3K
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas	170	218	876	326		124
Sum of Ngear	18	4	53	28		6
Sum of Nhauls	3	3	21	14		3
Sum of Nzero	0	0	0	7		0

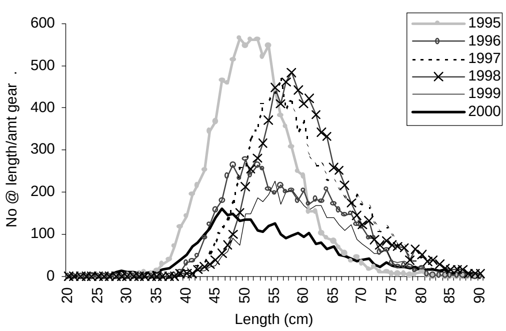

Figure 42. Total Number of Fish at Length for 3L Handline.

Table 31. Summary data for 3L Control Sets Handline

Division	3L
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas	3462	2727	3396	2805	1812	873
Sum of Ngear	472	388	382	439	425	436
Sum of Nhauls	72	71	74	81	76	73
Sum of Nzero	11	12	8	25	34	49

Table 32. Summary data for Exp Sets 3L Handline

Division	3L
Trip	(All)
Type	(All)
Gear	8
Mesh Size	0

Data	Year 1995	1996	1997	1998	1999	2000
Sum of Nmeas	5994	4260	5832	6472	2388	2642
Sum of Ngear	561	623	581	691	439	642
Sum of Nhauls	86	110	111	128	78	123
Sum of Nzero	0	13	1	18	23	50

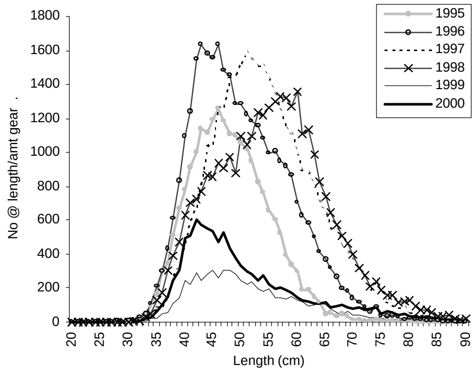

Figure 42. Total Number of Fish Measured in Trap for (All).

Table 33. Summary data for 2J3KL Trap

Division	(All)
Trip	(All)
Type	(All)
Gear	4
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	21310	32511	34217	33183	6270	10512
Sum of Ngear	362	385	362	396	59	77
Sum of Nhauls	362	385	362	396	59	77
Sum of Nzero	1	5	1	0	0	0

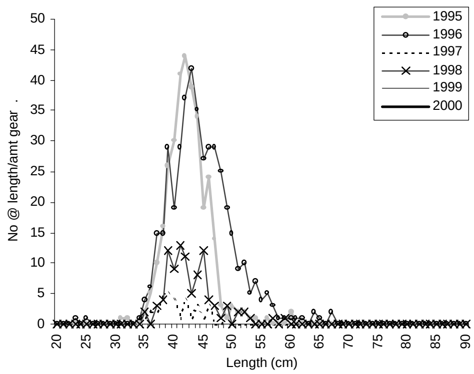

Figure 43. Total Number of Fish Measured in Trap for 2J.

Table 34. Summary data for 2J Trap

Division	2J
Trip	(All)
Type	(All)
Gear	4
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	322	431	11	97		
Sum of Ngear	11	18	5	23		
Sum of Nhauls	11	18	5	23		
Sum of Nzero	0	0	1	0		

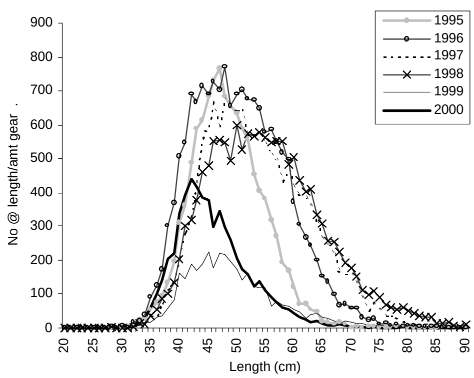

Figure 44. Total Number of Fish Measured in Trap for 3K.

Table 35. Summary data for 3K Trap

Division	3K
Trip	(All)
Type	(All)
Gear	4
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	10935	16042	14572	14869	3732	5752
Sum of Ngear	190	185	177	176	33	41
Sum of Nhauls	190	185	177	176	33	41
Sum of Nzero	0	1	0	0	0	0

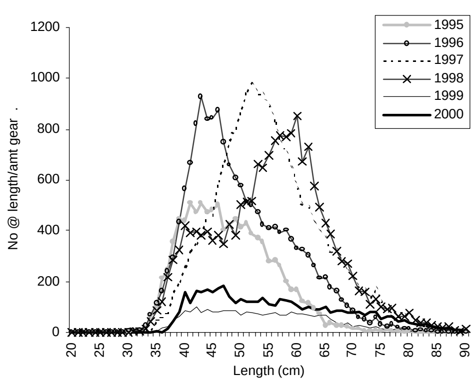

Figure 45. Total Number of Fish Measured in Trap for 3L.

Table 36. Summary data for 3L Trap

Division	3L
Trip	(All)
Type	(All)
Gear	4
Mesh Size	0

	Year					
Data	1995	1996	1997	1998	1999	2000
Sum of Nmeas	10053	16038	19634	18217	2538	4760
Sum of Ngear	161	182	180	197	26	36
Sum of Nhauls	161	182	180	197	26	36
Sum of Nzero	1	4	0	0	0	0