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The 1995 Inshore Sentinel Survey for Cod in NAFO Divisions 2J3KL

by

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Introduction

Canadian research vessel (RV) surveys for cod have historically sampled in waters beyond the 100 m contour in the inshore areas. While capable of surveying in shallow water, rough bottom and inshore fishing gear conflicts prevent the RV from coming inshore.

Inshore fish harvesters perceived that results of the RV surveys did always reflect what they were observing in the inshore fishery with respect to catches and catch rates. Under the Northern Cod Science Program (NCSP), a specific initiative was established in 1990 to gather quantitative data from the inshore fishery to supplement stock assessment information and attempt to address the concerns of the inshore fish harvesters. The NCSP initiative intended to use fish harvesters to collect quantitative data and provide a qualitative interpretation of the information based on their professional fishing experience. However, the 1992 moratorium on cod fishing in Divisions 2J3KL effectively halted data collection from the inshore.

From 1992 to 1994, attempts were made to establish an inshore sampling program which would provide useful data for assessment purposes. A formal sampling program, known as Sentinel Survey projects, were announced by the Minister of Fisheries and Oceans in October 1994 and included all of Atlantic Canada. The survey in Newfoundland and Labrador is an extension of the original Northern Cod Science Project with modifications which allow for science activities achievable only under a fishing moratorium.

The sentinel survey has the following objectives:

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

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

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 fish harvesters' observations.

4. To gather length frequencies, sex and maturity data and otoliths 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 fish harvesters. The process of participant selection is as follows: Through consultation with fish harvesters and fisheries organizations, traditional inshore fishing grounds were identified and mapped. This resulted in the identification of fifty-eight areas in NAFO Divisions 2J3KL, (6 in 2J, 23 in 3K and 29 in 3L) (Figure 1).

In the spring and early summer of 1995, the communities within the boundaries of the identified coastal areas were advised via the media and word-of-mouth of sentinel information meetings. The objective of the meetings was to present both the scientific and administrative rationale and structure for the project. A representative from one or both of the project sponsoring organization and the Department of Fisheries and Oceans (DFO) Science Branch attended the meetings.

Fish harvesters who met an eligibility criteria were invited to apply to participate in the survey. The criteria included five years as head of a fishing enterprise and a willingness to participate in a six week science training program.

Where more than one application was received from an area, the project sponsor 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 in order to enlist participants.

In order to minimize inter-annual 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 activities resume and the sentinel participants will form a core of index fish harvesters.

Training

In order to establish a standardized data collection routine, provide a rationale for the data collection methods and establish an initial and thorough point of contact, a science training program was developed jointly by DFO and the Marine Institute of Memorial University of Newfoundland in the eighteen months prior to the start of the sentinel survey.

Originally, one person from each sentinel survey crew was to participate in a six week training course prior to commencing survey activities. The training course provides an introduction to data collection, sampling methods and tools, use of computers and electronic oceanographic monitoring instruments. Participants also receive overviews of the ocean environment, resource management and presentation/communication skills. However, due to the late approval of funding for the project in 1995, a two day introduction to sampling and record keeping was delivered and the six week training program was post-poned to the fall and winter of 1995-96.

Sampling

In 1995, sampling ran for a maximum of fifteen weeks. The timing of sampling was determined after discussions with fish harvesters but was targeted for seasonally appropriate times based on historical fishing patterns. Due to the late resolution of funding and administrative issues, sampling started late relative to the traditional timing of the inshore fishery. The cod trap season was particularly affected by the late start.

Cod Traps

Forty-two of the sites were designated for use with cod trap sites. The specific location of each trap site was chosen after consultation between DFO scientists, fish harvesters, the Fishermen, Food and Allied Workers Union (FFAW) and the Fogo Island and Petty Harbour Cooperatives (for the Fogo Island and Petty Harbour projects). Site selection was based on the need to survey throughout inshore areas and targeted historical fishing areas and historical gear use patterns.

Designated trap crews fished cod traps for a maximum period of five weeks and then switched to either baited trawl lines or gill nets for an additional period of ten weeks. Non-trap sites fished either baited hooks or gill nets for the full fifteen weeks.

Trap crews fished five days per week for five weeks. Fishing days in the week were selected at the discretion of the crew and depend primarily on weather conditions. All berths selected for traps were considered prime trap locations.

When a trap was hauled, the crew noted the soak time since the previous haul, estimated how much fish had been caught, removed a sample of approximately 100 fish for biological sampling and released the remaining catch. Meshed fish and dead or floating fish were retained and brought ashore. While it is acknowledged that Japanese style cod traps could have higher mortalities of fish than modified Newfoundland traps, fish harvesters were asked to release as much live fish as possible.

Both gill net and trawl crews fished up to three days per week. Hook and line crews fished two tubs of baited line trawl. Each tub consisted of up to 500 hooks for a total of 1000 hooks per fishing day. Gill net crews fished 2-6 fifty fathom 140 mm monofilament gill nets. The nets were rigged 2-3 to a fleet but only two fleets were fished per fishing day. All fish caught in gill nets and on hooks were landed. If catches exceeded 500-750 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 were reduced if landings exceeded 500-750 kg per week. Other measures to reduce mortality were available if fish were particularly abundant in an area and catches appeared to be excessive even with the minimal amounts of gear possible.

Sampling Strategy

Prior to the start of sampling with gill nets and trawl lines, a fixed (control) location on the fishing grounds was established for each site for the duration of the project. The control site was a location that was chosen to reflect average fishing activity over a fishing season. It is expected that the same control site will be occupied over years. Since fishing grounds can change depending on season, there may be more than one control site per sentinel community.

Each fishing day, half of the gear was set at the control site. The other half of the gear (experimental) was set anywhere 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 was recorded down to the quarter hour. If high catch rates were experienced at one experimental location on a particular day, set locations were moved for the following fishing day. Environmental observations were recorded and included 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 variable which may have influenced fishing behaviour.

When the gear was retrieved, any catches from the control and experimental gear were kept separate and sampled on shore. All fish were counted, length measured, sexed, and examined for parasites. Observations were made on stomach contents and fullness. Otoliths were sampled based on length frequency requirements.

Every other week, a sample of up to 100 fish was frozen and transported to St. John's for weight analysis. All information was recorded on forms similar to those used by the Port Sampling Section and on the Research Vessels. Otoliths were stored in manila envelopes with relevant information recorded on the outside. Fin clips were stored on blotter paper in the envelopes.

Other biological samples were collected on an "as needed" basis. These included fin clips and/or blood samples, liver samples for toxicological studies, etc.

DFO Fisheries Evaluation Section and Commercial Sampling section staff provided field support through weekly visits to sites and regular phone contact. Project sponsors maintained regular contact with participants for administrative support and scientific liaison.

Public Consultations

In addition to the organizing meetings in the spring and summer of 1995, a series of twenty-five public meetings were conducted between January and April 1996 to present the 1995 results of the survey and solicit feedback on the information and ways of improving the survey.

Results

Distribution of Fish

Participants throughout the survey identified fish in their respective areas before, during and after survey activities although there were differences observed in the abundance depending on location. All sites noted that fish were located in shallower or shoaler water than expected. This observation generated considerable debate between scientists and participants and at public meetings conducted over the winter. There were no clear causative factors identified although there were a number of hypotheses generated. These included predator-prey interactions, changed behaviour as a result of relaxed fishing pressure and changed behaviour due to changes in stock structure to name a few. Most sites noted that the shallow water distribution of fish formed a coastal band but did not extend to any great distance from shore (a function of a few kilometres). However, information from long liners fishing offshore indicated that cod patches were present in traditional areas (e.g.) the Virgin Rocks and the Forty Fathom Edge.

All areas throughout the survey area reported that fish were in good physical condition and had been feeding well.

Catch Rate Information

While it has been possible to derive catch rate information for each of the sentinel sites on a fine temporal scale, the lack of a time series renders the data difficult to interpret with respect to the overall state of the cod stock. However, through the observations of the sentinel participants, it has been possible to put the information in some perspective relative to the last years of the commercial fishery. Participants throughout the survey area cautioned that the observed catch rates may be higher than those observed in a commercial fishery due to the competitive nature of the fishing gear on the grounds. A summary of sentinel catch rates relative to the last years of the commercial fishery are presented in Table 1.

During the public meetings and throughout the sentinel survey with participants, the question of what constituted a "good catch" rate for gill nets and trawl was posed. A benchmark averaged over a season of 100 lbs or 45 kg for gill nets and 0.5 lb or 0.23 kg per baited hook was established. The translates into approximately 20 fish per gill net and 65 fish per tub of 500 baited hooks.

In general, gill net performance was considered by participants to be poorer than trawl lines. The exception to this observation was in St. Mary's Bay and the Bonavista headland area where gill net catches were considered good. Poor gill net performance may be a result of the age structure of the population. For a number of years, the research vessel surveys have not found any abundance of older fish in the population. This appears to be reflected in the sentinel survey as well with the noted exceptions. On the other hand, baited hooks select for younger ages of fish than gill nets and appeared to make up the bulk of the trawl catches. It is acknowledged that if older larger fish are in the area of trawl lines, they may out-compete smaller fish for the bait.

3L Gill Net Catch Rates

Using the 20 fish/net benchmark, only St. Mary's Bay experienced good catch rates at different times in the survey (Figure 2). With the exception of St. Mary's Bay (SMB), most participants indicated that the timing of the gill net survey missed periods of traditionally good catches. SMB also indicated that there was a strong contribution of NAFO Subdivision 3Ps cod in their catches. The catch rates and age structure of the St. Mary's Bay catches were more like those of Placentia Bay (3Ps) than southern shore catches.

The headland areas of Bonavista Bay experienced the second highest catch rates during the survey. Participants indicated that some of the catch likely originated from the Random Island body of cod that was observed in the spring of 1995.

Both Conception Bay and the Southern Shore of the Avalon Peninsula experienced low gill net catch rates.

3K Gill Net Catch Rates

The 20 fish/net benchmark was never met in the 3K gill net component of the sentinel survey. The Baie Verte Peninsula and New World Island areas had the best catch rates for nets (Figure 3). Catch rates in White Bay and the Northern Peninsula were low.

3L Trawl Catch Rates

Trawl catches in Bonavista Bay and along the southern shore exceeded the benchmark 65 fish/tub for a number of weeks during the late summer and autumn of 1995 (Figure 4). The southern shore of the Avalon Peninsula which had experienced poor gill nets catch rates did experience better trawl catches although not all sites saw the same trends. In mid October, Conception Bay catch rates exceeded the benchmark catch rate.

3K Trawl Catch Rates

Most locations around Notre Dame Bay, Fogo Island and the Baie Verte Peninsula experienced good catch rates. Catch rates on the Northern Peninsula were low over the duration of the survey.

2J Gill Net Catch Rates

Only gill nets were fished and traps were used in Division 2J and catch rates were extremely low at all six sites. However, while it is likely a function of the catchability of the gear and the low numbers caught, it is interesting to note that the age structure of the fish caught is shifted toward older fish.

Cod Trap Catches

Since the cod trap component of the survey was late in starting and missed much of the traditional timing of the fishery, it is difficult to derive much more than presence or absence of fish in the area for the 1995 survey (Tables 2-4). In addition, most fish harvesters agreed that the low numbers of traps throughout 2J3KL should not be used to derive any indices of abundance due to the highly variable and patchy distribution of fish in and around trap berths. Consequently, many trap crews have advised that traps might be more appropriately used in applied activities like cod tagging.

Age Distribution

The numbers at age are derived from all gear types combined (Figures 6-9). In Division 3K age 5 fish were the dominant age in the catch while in Division 3L, age 5 and 6 year old fish were present. However, in 3L there may be a contribution of 3Ps fish in the catches were there is known to be a strong 1989 year class which were 6 years old in 1995. Unit 3LQ or St. Mary's Bay had large numbers of six year old fish in the catches. In Division 2J where only gill nets were used, age 7 and 8 year old fish were dominant in the catch. However, with a small age sample (N=20) for the entire gill net portion of the survey, this age structure should be treated with caution. In deed, fish harvesters in 2J observed that fish from all sites were small and often tangled in nets rather than meshed.

Enterprise owners were asked to compare their catch rates during the survey with those of the last year of the commercial fishery. Below are the results of this comparison.

	Worst	Same	Better		Worst	Same	Better
2J				3L			
Penny's Harbour		×		Wesleyville		×	
Tub Harbour	×			Centreville			×
Triangle	×			Eastport	×		
William's Harbour	×			Plate Cove West		×	
Spear Harbour	×			Bonavista	×		
Cape Charles	×			Little Catalina			×
3K				Petley			×
St. Lunaire	×			Thornlea		×	
Great Brehat	×			Hopeall		×	
Goose Cove	×			Hearts Content	×		
Conche	×			Northern Bay		×	
Englee	×			Carbonear		×	
Harbour Deep		×		Port De Grave		×	
Jacksons Arm		×		Foxtrap	×		
Coachmans Cove		×		Pouch Cove	×		
Ming's Bight			×	Petty Harbour	×		
La Scie		×		Bay Bulls(Puddister)	×		
Shoe Cove		×		Bay Bulls(Williams)	×		
Smith's Harbour			×	Calvert			×
Jackson's Cove			×	Ferryland			×
Miles Cove			×	Renews	×		
Summerford			×	Trepassey	×		
Durrells			×	Riverhead(Corcoran)			×
Too Good Arm			×	Riverhead(Whalen)		×	
Aspen Cove	×			Point Lance			×
Lumsden			×				
3Ps							
St. Brides			×	Red Harbour			×
Fox Harbour			×	Lord's Cove			×
Red Island			×	Rencontre East			×
Little Harbour East			×	Harbour Breton			×
Arnolds Cove			×	Seal Cove			×
North Harbour			×	Francois			×
Monkstown			×	Ramea			×
Little Paradise			×				

Table 1. Comparison of catch rates between the sentinel survey and the last years of the commercial fishery.

2J Sentinel Trap Summary
Totals to Date

Community	Gear	Amt. Gear	Hrs. Fished	No. Meas.	Est. Weight (Lbs.)
Triangle	Trap	1	756.75	312	979
Tub Harbour	Trap	1	802.25	0	25
Cape Charles	Trap	1	705.25	8	12
Total			2264.25	320	1016

Table 2. Cod trap catches in Division 2J

3L Sentinel Trap Summary
Totals to Date

BAY	Community	Gear	Amt. Gear	Hrs. Fished	No. Meas.	No. Caught	Est. Wt.	Ave. Wk	
BB	Plate Cove	Trap	1	764.5	645	0	57040	8953	1
	Centreville	Trap	1	725	525	0	1662	261	10
	Bonavista	Trap	1	353	820	0	7966	1250	7
TB	Hopeall	Trap	1	677.5	721	0	11600	1821	5
	Petley	Trap	1	738.5	553	0	4480	703	8
	Heart's Con	Trap	1	767	692	0	10188	1599	6
CB	Porte de Gr	Trap	1	669.5	714	0	3478	546	9
	Ochre Pitt C	Trap	1	771.5	92	0	152	24	11
SS	Renews	Trap	1	599.5	86	0	141	22	12
	Calvert	Trap	1	696	720	0	14072	2209	3
	Pouch Cove	Trap	1	642.75	1497	0	13630	2139	4
SMB	Riverhead	Trap	1	746	688	0	37546	5893	2
	Total			8150.75	7753	0	161955		

Table 3. Cod trap catches in Division 3L

3K Sentinel Trap Summary
Totals to Date

Community	Gear	Amt. Gear	Hrs. Fished	No. Meas.	Est. Weight (Lbs.)
Aspen Cove	Trap	1	454.5	34	64
Too Good Arm	Trap	1	697	1174	7729
Durrells	Trap	1	424.75	41	250
Shoe Cove	Trap	1	652.25	865	4636
LaScie	Trap	1	707	261	834
Ming's Bight	Trap	1	695.5	1376	21211
Coachman's Cove	Trap	1	821.4	751	17573
Harbour Deep	Trap	1	784.25	407	5431
Englee	Trap	1	565	246	581
Conche	Trap	1	753.75	527	1409
St. Lunaire	Trap	1	754	127	165
Joe Batt's Arm	Trap	1	870.75	978	6270
Seldom	Trap	1	934.5	1703	23360
Deep Bay	Trap	1	813.5	644	2661
Tilting	Trap	1	881	1346	21480
Total			10809.15	10480	113654

Table 4. Cod trap catches in Division 3K

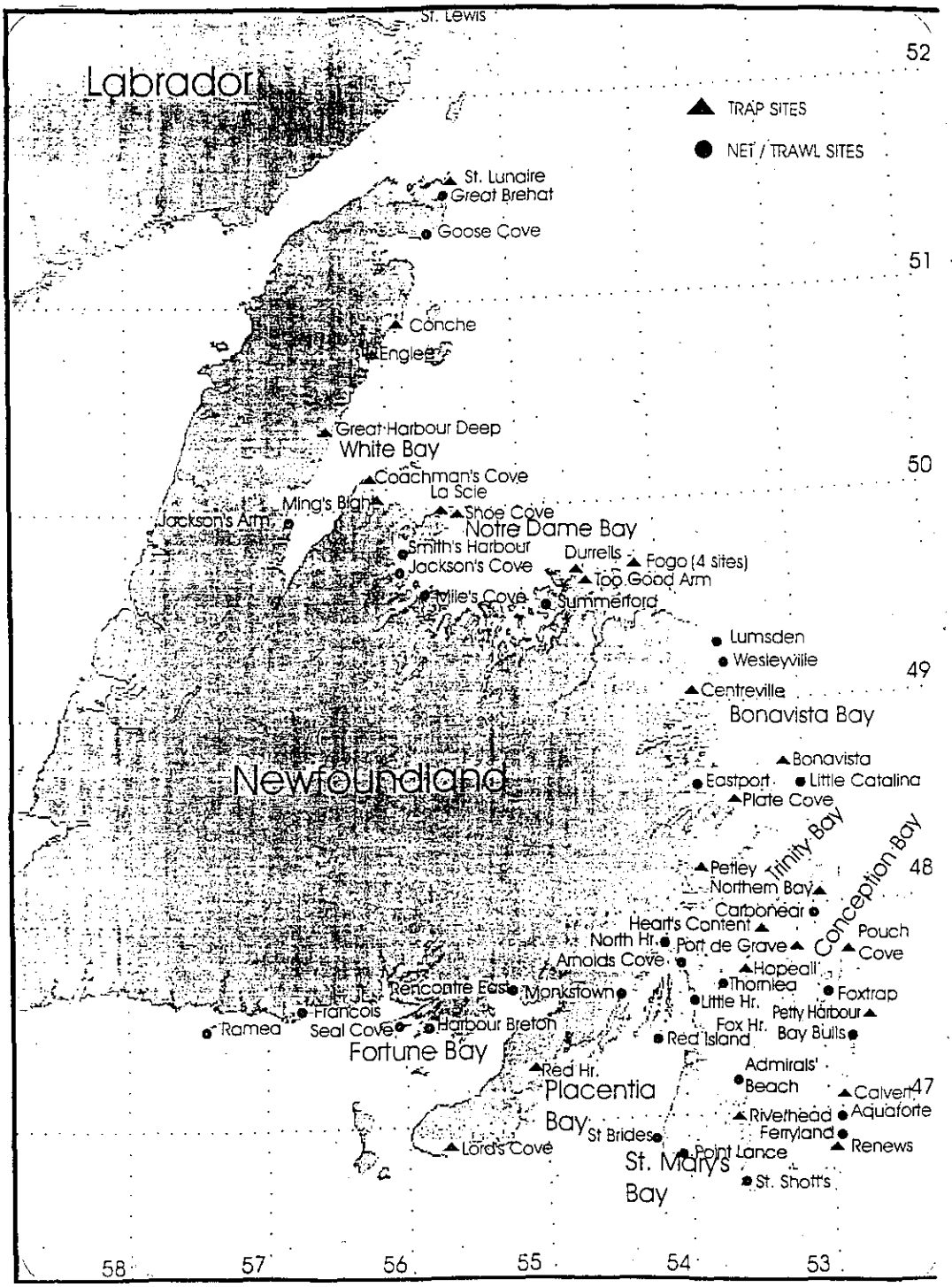

Figure 1. Sentinel Sites in NAFO Divisions 2J3KL

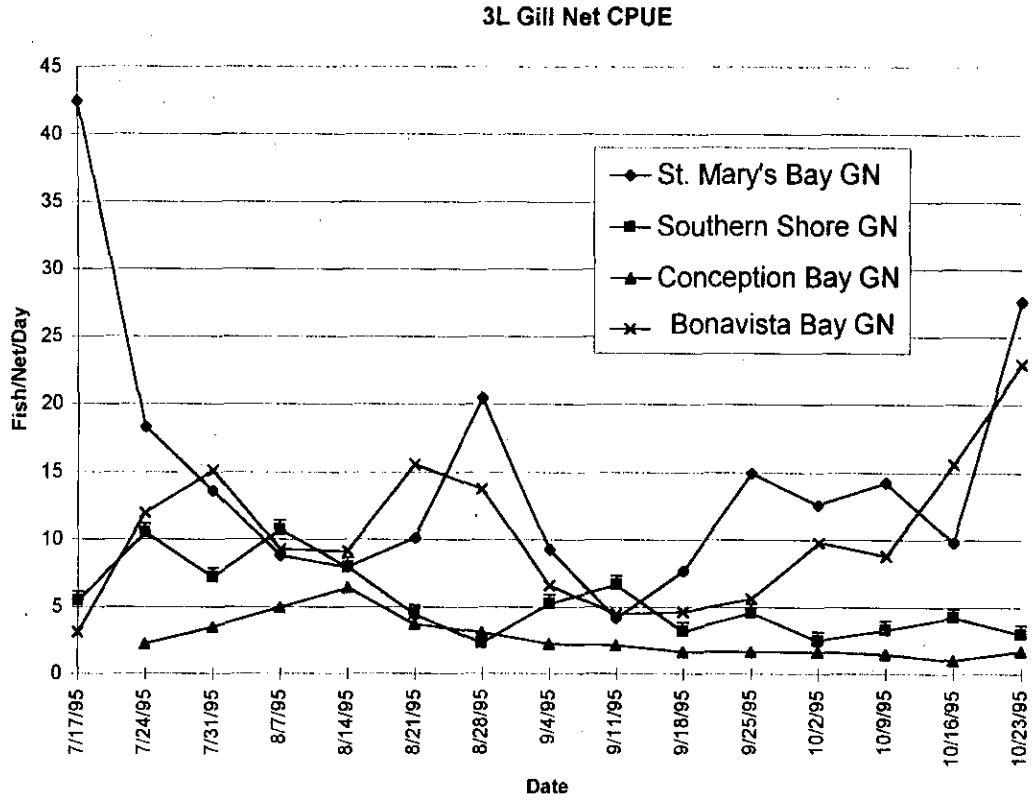

Figure 2. 3L Gill net catch rates

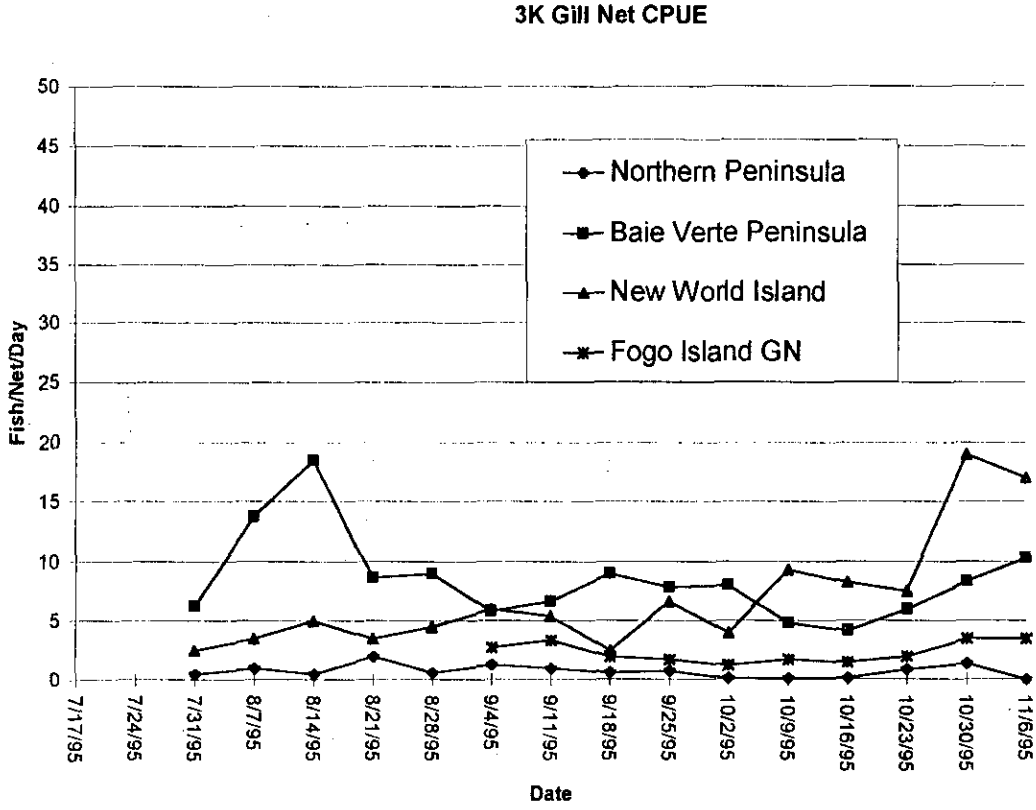

Figure 3. 3K Gill net catch rates

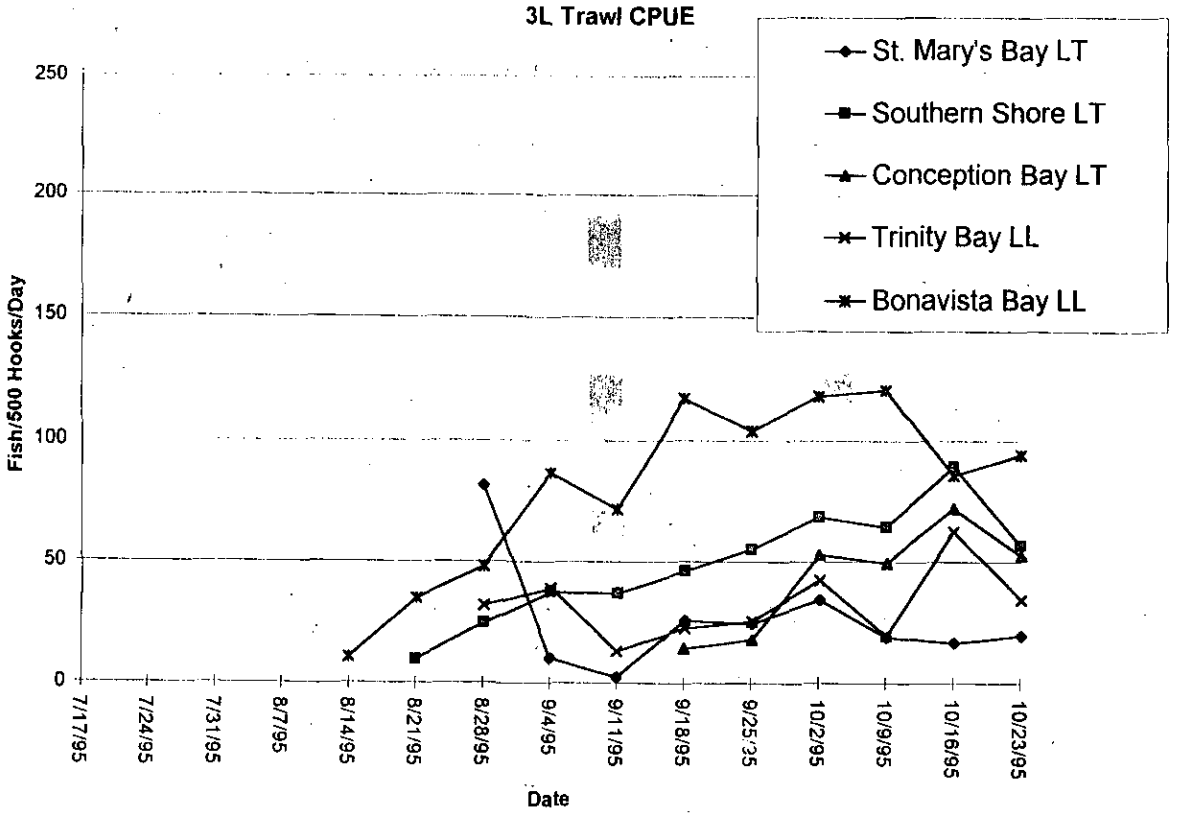

Figure 4. 3L Trawl catch rates

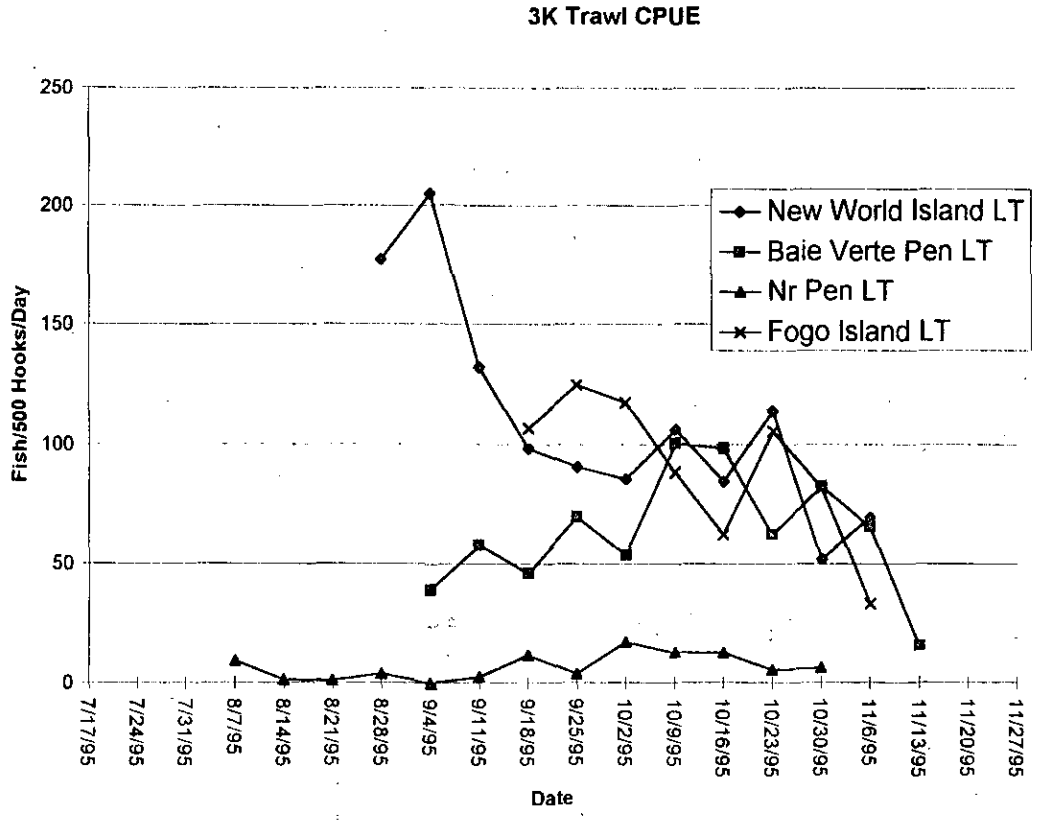

Figure 5. 3K Trawl catch rates

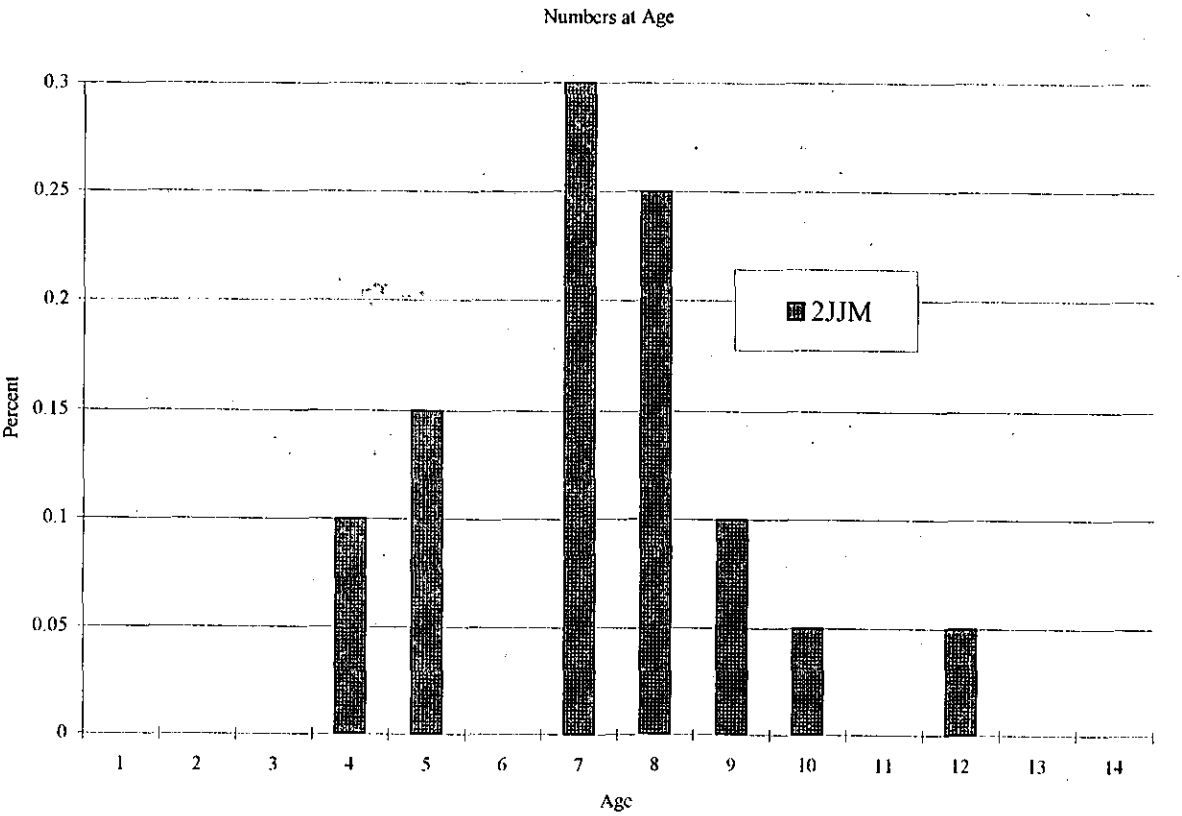

Figure 6. 2J Numbers at Age

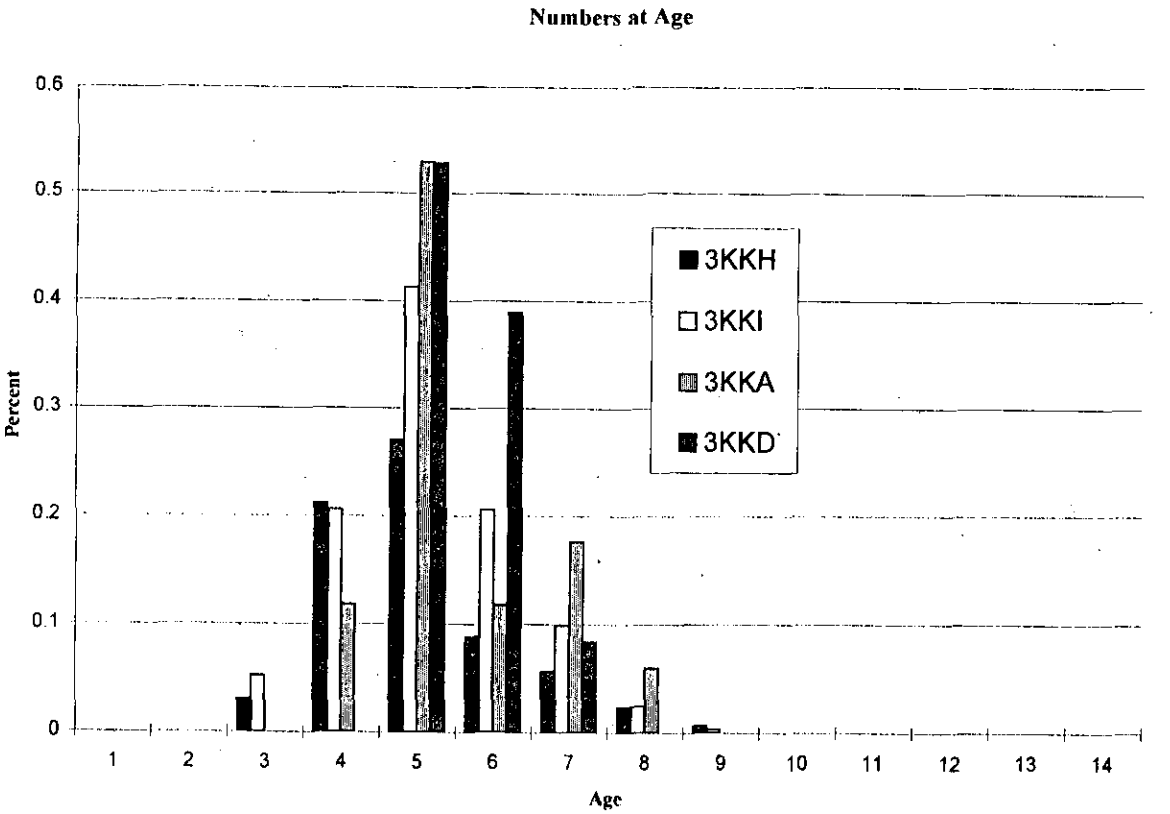

Figure 7. 3K Numbers at age

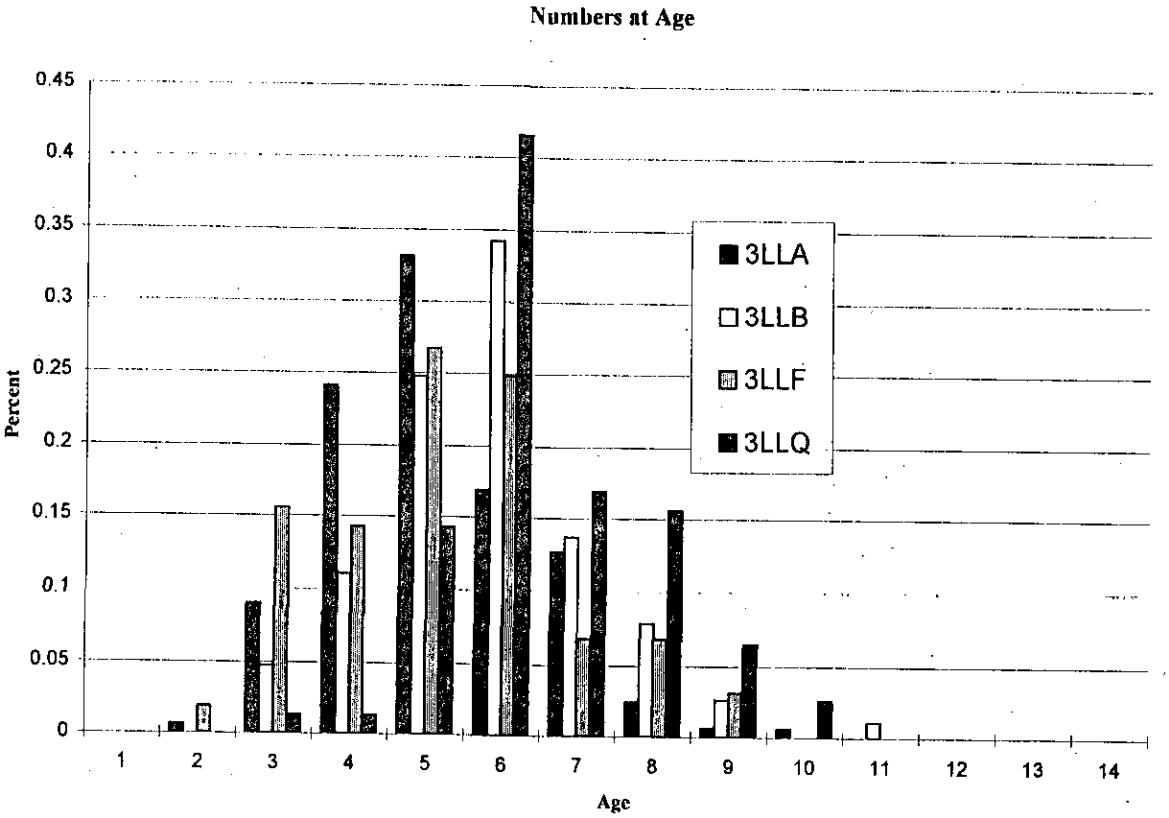

Figure 8. 3L Numbers at age

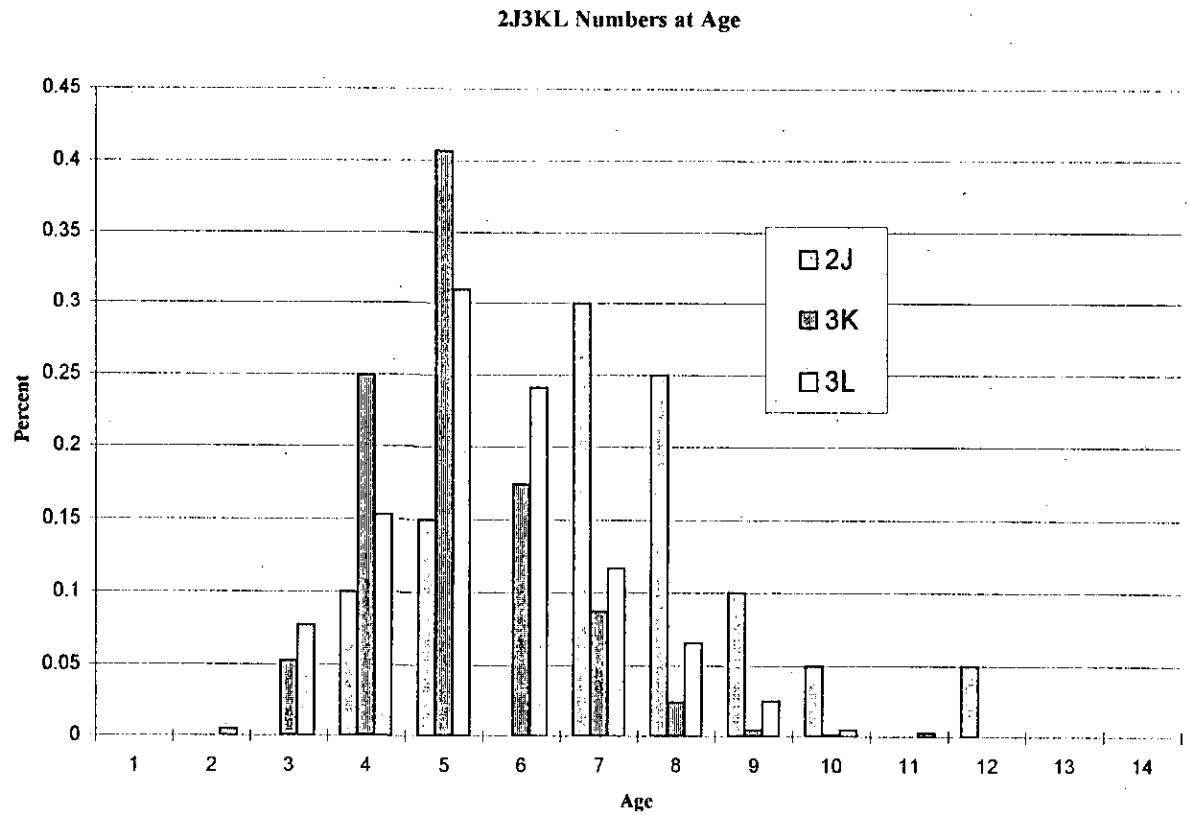

Figure 9. 2J3KL Combined Numbers at age