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Sentinel Surveys 1995-2005: Catch per Unit Effort in NAFO divisions 2J3KL

Relevés sentinelles 1995-2005 – Prises par unité d'effort dans les divisions 2J3KL de l'OPANO

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Abstract

Data from the Sentinel program in NAFO divisions 2J3KL are summarized and updated for 2005. They 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, averaged by year and gear type, and grouped by NAFO division. Catch rates in gillnet and on linetrawl improved in most areas, and in Division 2J were the highest in the time series.

Résumé

Les données recueillies dans le cadre du programme de relevés par pêche sentinelle dans les divisions 2J3KL de l'OPANO sont résumées et mises à jour pour 2005. Elles sont ventilées en fonction du taux de capture hebdomadaire moyen et des fréquences annuelles de longueurs relativisées; du nombre de poissons selon la longueur divisé par le nombre d'engins pour chaque mouillage, avec moyenne par année et par type d'engin, et groupées par division de l'OPANO. Les taux de capture au filet maillant et à la palangre étaient meilleurs dans la plupart des zones et, dans la division 2J, étaient les plus élevées de la série chronologique.

INTRODUCTION

Sentinel survey projects were formally announced by the Minister of Fisheries and Oceans in October 1994. The surveys in the DFO Newfoundland and Labrador Region are an extension of the index fishermen's project from the Northern Cod Science Project Program with modifications to allow for science activities achievable only under a fishing moratorium. Sentinel data collection continued during the commercial/index fisheries that occurred from 1998 to 2002.

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 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 operations resume and the sentinel participants will form a core of index fishers.

Sites

In 2005, forty-four enterprises participated in sentinel activities in NAFO Divisions 2J3KL (down from 57 or 58 prior to 2004). 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.

Sampling Strategy

Table 1 gives the homeport of the participants in the sentinel surveys; showing the number of sets completed in each year, the number of weeks allocated for sentinel activity, and the number of enterprises participating in the survey. 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. In 2001 and 2002, only a few traps were used, primarily to collect biological data and trap fish to tag. Traps have not been used since then. Participants used either baited trawl lines or gillnets for the remaining weeks of the survey. Non-trap sites fished either baited trawls or gillnets 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 gillnet 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 2000-2002, traps were used primarily as a source of biological data (length frequencies, otolith samples and frozen samples) and as a means to tag fish.

Hook and line crews fished two tubs of baited linetrawl. Each tub consisted of approximately 500 hooks for a total of 1000 hooks per fishing day. Gillnet crews fished a maximum of six fifty fathom 5 ½ inch monofilament gillnets. 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 gillnet at least one day per week. All fish caught in gillnets 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 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 gillnet, hand line and linetrawl, 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 are here 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 gillnet and linetrawl represent every fish measured, as the total catch is measured. Data are shown as an average of the relative length frequencies for each fisher in the division. The second figure on each summary page gives catch details broken down by year, including number of fish measured (Nmeas), total number of sets (Nhauls) and number of sets in which no fish were caught (Nzero). The CPUE figures (bottom figure on each summary page) give average weekly catch rates, in number of fish per net or 1000 hooks, and are constructed by calculating a daily catch rate for each set and averaging all the CPUEs for all sets (control and experimental) in a given week.

RESULTS

Fourty-four inshore fishing enterprises representing communities from Black Tickle to St. Mary's Bay participated in the 2J3KL Sentinel Survey for 2005 (45 in 2004). Survey activity covered mostly summer and fall periods in all years, traditional fishing times for the areas involved.

Figures 1 to 3 shows the catches (in scaled symbols) from every set in 2005 of 5 ½" gillnet and linetrawl. 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.

Figure 4 shows overall average CPUE by division from 1995-2005 for the three main gear types used in sentinel activity. 3L had the highest catch rates in gillnet over the time series. Gillnet (5 ½") catch rates in all divisions declined from 1998 to 2002 and then increased from 2002 to 2005. When compared to division 3L, linetrawl catches were generally higher in 3K until 1998, and once again from 2003-2005. The 2005 value was the second highest observed. Catch rates in 2J were very low compared to 3K and 3L in all gears in all years. In 2005, however, catch rates in 5 ½" gillnets increased substantially in 2J and were triple those seen in other years.

Figures 5-7 give mean CPUE by community for gillnet and linetrawl organized from north to south. Catch rates in 5 ½" gillnet were very low in northern areas and were highest around the Bonavista area in most years (figure 5). In 2005, many communities had substantially higher mean catch rates than previous years. Small mesh gillnet (figure 6) showed more variability in CPUE from year to year and between locations, with high catch rates in 2J and 3K in some years. Catch rates were most consistent from Wesleyville to Petley. Linetrawl was not as widely used in 2J3KL and catch rates were variable (figure 7). There was less change in CPUE in the area around Aspen Cove, Lumsden and Wesleyville then the decline seen in La Scie, Shoe Cove and Durrell.

Tables 2-6 show the change in mean catch rate for each location between subsequent years. Changes greater than 10% are highlighted.

Length frequencies, scaled by amount of gear used, are summarized in figure 8. The same data are given in the length frequency plots on the summary sheets that follow (figures 9-65). The 5 ½" gillnet frequencies (Fig. 8, top plot) show the narrowest range of selectivity (50-80cm). Catch rates in this gear declined from 1998-2002 and then increased from 2003 to 2005. 3L has higher catches than the other divisions.

The small mesh gillnet frequency has two modes (Fig. 8, middle plot), reflecting two size ranges of fish caught in the gear. Catches of smaller fish, caught by meshing in the net, declined in 3K from 1996-1999 and have remained at this level since then with the exception of 2003 and 2005 which showed higher catches of small fish. In 3L, catches of these smaller fish have remained relatively constant over the series with the exceptions of 1999, which had lower catches, and higher catches were observed in 2003 and 2005. In 2J, this smaller mode decreased from 1997-1999, and has been variable since then. The larger modes in the small mesh frequencies are due to larger fish that entangle in the net. The catches of these larger fish in 3 1/4" gear have declined noticeably from 1998 to 2001 in all divisions, but increased in 2003 and 2004, similar to the pattern seen in the 5 ½" gear.

Linetrawl frequencies (Fig. 8, bottom plot) show a wider distribution of fish sizes. In 3K, linetrawl catch rates declined from 1997 through 2000 and then increased in 2003 and have remained high since then. Linetrawl catches in 2J were low in all years and no sampling was done with this gear since 2001.

Figures summarizing the data by gear for the entire stock area and also broken out by division follow on pages 20-38. The bottom figure on each page shows the weekly average catch rate. The decline in catch rate from 1998-2002 is most evident in 5 ½" gillnet plot (figures 9-11). Catch rates in small mesh gillnet (figures 21-23) were lower in the first part of the year from 2001 to 2005, and good catch rates in the latter part of the year (sites surveyed in the fourth quarter in 3K and 3L) bring the average up. Linetrawl catch rates in 3K (figures 39-41) have increased from 2000-2001 to 2005, and in 3L have been variable, but increasing from 2003 (figures 42-44).

Figures 45-62 show the data grouped for comparison to model formulations presented for this assessment. Information for the central inshore area (3Khi+3Lab) is grouped together for each gear type, and data from enterprises in the southern inshore area (3Lf, 3Lj and 3Lq) are grouped together in these summary plots.

Table 1. Total number of sets (gillnet and line trawl) for each participant in 2J3KL. Participant home ports are given.

Comm	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Black Tickle		48	63	54	64	42	80	72	72	80	80
Williams Hr	54	48	58	50	39	49	60	45		49	
Tub Hr	22	25	28	24	39	80	80	80			
Triangle	24	25	29	29	62	70	80	76	78	80	80
Penny's Hr	46	50	51	62	64	81	81	56	80	80	71
Spear Hr	48	73	81	93	64	80	80	88	80	80	80
St. Lewis		72	83	48	60	80	80	79	80	80	80
Mary's Hr						76	80	80	80	79	80
Cape Charles	28	36	38	32	63						
Quirpon							76				
St. Lunaire	38	52	48	55	64	60	71	76	72	77	70
Great Brehat	56	73	68	76	30						
Goose Cove	60	56	68	72	54	60	60	68	80	80	80
Conche	40	48	48	48	60	60	60	60	61	60	60
Englee	40	46	48	57	55	67	70	70	70	70	70
Hr Deep	36	45	45	49	54	59	65	68	70	70	58
Jackson's Arm	50	59	57	84	53						
Sopp's Arm						50	60	70	70	67	62
Westport						58	69	70			
Coachman's Cove	46	58	51	52	63	70	70	70	70	70	70
Ming's Bight	56	46	46	47	44	57	54	60	49	52	52
La Scie	36	48	50	49	38	70	67	65	58	61	61
Shoe Cove	60	54	51	53	52	60	62	60	54	54	54
Smith's Hr	60	64	62	72	48	58	60	60	60	54	60
Jackson's Cove	56	48	48	48	32	42	38	40			
Miles Cove	56	76	83	83	56	55	68	59	64	70	70
Glover's Hr						54	69	68	69	70	69
Summerford	60	78	84	81	91	72	71	70	82	90	70
Durrell	56	60	39	38	36	57	55	58			
Too Good Arm	39	48	53	54	48	77	70	68	70	70	70
Deep Bay	44	41	45	49	49						
Fogo					64	72	108	113	71	70	70
Joe Batt's Arm	48	32	40	41	80	77	71	87			
Tilting	53	49	45	39	82	78	69	83	65	72	67
Seldom	38	41	31	45	69	72	76	74	59	60	58
Aspen Cove	39	42	45	32	47	59	60	55	47	61	59
Lumsden	74	72	74	63	54	56	54	52	53	53	50
Wesleyville	64	68	91	78	62	68	67	68	68	67	68
Centreville	40	30	32	32	20	36	40	40			
St. Chad's	60	60	62	58							
Happy Adventure					59	56	71	72	70	66	70
Plate Cove West	39	46	52	56	48	68	70	70	70	66	70
Bonavista	1	41	29	20	30	27	33	38			
Little Catalina	60	59	67	74	36	59	44	60	60	57	60
Petley	40	52	56	46	59	80	72	68	63	67	70
Thornlea	60	72	72	66	48	77	84	60			
Hopeall	40	32	32	32	32	40	50	50	50	49	50
Heart's Content	57	16	40	66	48	74	60	60	60	60	59
Bay de Verde		32	49	31	46	68	69	69	69	70	68
Ochre Pitt Cove	40	51	48	48	48	60	60	60			
Carbonear	54	75	73	71	46	60	60	60	56	56	56
Port de Grave	40		48	48	48	60	60	60			
Foxtrap	74	62	64	65	41	46	52	52	48	48	47
Pouch Cove	39	32	43	51	53	56	70	69	70	70	70
Petty Hr					47	57	45	32			
Bay Bulls	121	94	102	108	70	48	46	45	31	60	57
Calvert	60	45	45	52	46	64	60	60	56	60	60
Ferryland	59	44	42	39	40	51	65	68			
Aquaforte	60	47	48	47	32	48	40	40			
Renews	33	37	29	28	32	48	60	60	70	54	62
St. Shott's	34	40	49	51	30	47	40	40	36	32	40
Riverhead	118	114	94	88	69	66	91	84	40	42	40
Admiral's Beach	61	52	68	72	47	57	59	60	60	53	54
Point Lance	58	49	48	48	6	24	36	40	36	40	40
Number of weeks	**15**	**12**	**12**	**8**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Number of enterprises	**53**	**55**	**56**	**56**	**58**	**58**	**59**	**58**	**44**	**45**	**44**

* two enterprises

Table 2. Ratio of annual mean cpue (#/ 3 1/4" net, experimental sites) for concurrent years by community.

		Gillnet 3 1/4 in. Experimental									
		96/95	97/96	98/97	99/98	00/99	01/00	02/01	03/02	04/03	05/04
2Jm + 3Kad	Black Tickle			15.841	0.054			1.039	3.534	0.746	1.712
	Williams Hr			0.570	0.625	1.200	1.020	2.983			
	Tub Hr		5.467	1.976	0.156	2.274	0.151	2.655			
	Triangle		5.048	0.434	0.132	2.308	1.481	1.589	0.337	0.883	0.793
	Penny's Hr		1.212	2.330	0.213	1.308	1.269	1.039	0.761	2.736	0.578
	Spear Hr		11.773	0.264	0.820	1.496	0.155	10.691	0.358	2.096	0.496
	St. Lewis			0.593	0.411	3.683	0.435	1.709	1.274	0.637	1.370
	Mary's Hr						0.470	2.179	0.803	1.024	3.865
	Cape Charles			0.938	0.390						
	Quirpon										
	St. Lunaire		1.385	1.765	0.024			0.877	3.543	0.625	2.602
	Great Brehat										
	Goose Cove								1.172	0.891	1.290
	Englee				4.458	0.694	0.348	1.294	1.993	0.541	1.204
	Hr Deep			1.113	1.224	0.838	0.823	2.507	0.849	0.331	
	Jackson's Arm			0.420	0.807						
	Sopp's Arm								0.601	0.646	2.671
	Westport							0.987			
Northern Inshore area (3Khi+3Lab)	Coachman's Cove			0.585	0.718	1.097	1.032	0.205	6.625	0.898	0.534
	La Scie			3.429	0.708	2.147	1.577	0.031	111.667	0.312	0.911
	Miles Cove		0.622	0.414	0.773	0.842	0.931	1.518	2.138	0.271	2.229
	Glover's Hr							0.991	0.797	0.565	1.905
	Summerford		0.237	2.316	1.035	0.266	2.179	1.381	1.375	0.658	0.745
	Too Good Arm			0.980	0.813	0.943	0.567	0.809	2.421	0.818	1.766
	Deep Bay				0.785						
	Fogo								0.298	1.664	1.812
	Joe Batt's Arm				0.496	1.118	0.522	1.414			
	Tilting				0.614	1.085	1.561	1.127	0.526	1.288	1.828
	Seldom										
	Wesleyville			0.580	1.647	1.088	0.626	0.880	1.543	1.191	1.529
	Happy Adventure						0.868	0.799	1.273	0.422	1.047
	Plate Cove West			1.298	0.299	1.501	1.543	0.854	1.780	0.749	1.158
	Little Catalina			1.008	0.373	1.123	1.099	0.612	2.905	0.742	1.629
	Petley		0.757	1.172	0.777	0.944	0.554	2.823	0.645	0.941	0.665
	Hopeall							1.276	1.216	0.512	1.653
	Heart's Content			10.833	0.442	1.123	0.697	1.233	7.243	1.018	1.188
Southern 3L (3Lfjq)	Bay de Verde			0.981	0.384	0.520	0.437	3.836	1.970	0.707	0.746
	Foxtrap		0.894	0.941	0.977	0.734	0.902	1.080	2.245	0.396	1.889
	Pouch Cove			1.719	1.151	0.914	0.658	0.811	1.237	0.814	1.688
	Bay Bulls			0.524	0.132			0.533	2.188		
	Ferryland		1.285	0.100	3.333	1.369	1.174	0.146			
	Renews										
	St. Shott's										
	Admiral's Beach		1.608	0.760	0.611	1.405	0.773	0.585	1.623	0.608	0.464

no survey in one or both years
ratio is >1.10 (10% or greater increase in mean cpue)
ratio is between .9 and 1.1 (mean cpue is within 10% of the previous year)
ratio is <.9 (mean cpue has decreased by greater than 10%)

Table 3. Ratio of annual mean cpue (#/5 1/2" net, control sites) for concurrent years by community.

		Gillnet 5 1/2 in. Control									
		96/95	97/96	98/97	99/98	00/99	01/00	02/01	03/02	04/03	05/04
2Jm + 3Kad	Black Tickle		15.000	5.497	0.121	2.400	0.200	2.407	5.923	0.795	10.926
	Williams Hr	0.219	6.540	0.466	0.225	4.242	0.302	0.289			
	Tub Hr			6.167	0.216	0.575	0.261	4.500			
	Triangle	4.286	11.900	0.790	0.074	1.000	0.900	1.170	0.528	1.440	2.625
	Penny's Hr	0.719	2.000	4.000	0.750	0.381	2.100	0.238	2.800	2.250	2.222
	Spear Hr	0.750	41.530	0.492	1.276	0.294	1.438	7.688	0.238	0.155	3.923
	St. Lewis				5.688	1.083	0.106	15.000	0.467	4.714	1.152
	Mary's Hr						0.086	14.000	0.643	1.667	9.667
	Cape Charles	1.750	1.000	2.000	1.125						
	Quirpon										
	St. Lunaire	3.778	0.331	1.921	2.499	0.560	0.867	0.372	4.396	0.709	3.522
	Great Brehat	4.216	0.821	1.655	1.133						
	Goose Cove		0.424	9.000	0.222	0.286	1.500	2.714	5.453	0.574	7.753
	Conche	7.599	0.883	1.316	1.234	1.080	0.315	0.479	2.178	2.194	1.916
	Englee	9.618	0.552	3.637	0.518	0.433	0.375	0.462	2.111	1.895	6.736
	Hr Deep	6.253	1.469	3.206	0.329	0.872	0.293	0.786	1.790	1.531	3.158
	Jackson's Arm	4.904	1.500	0.697	0.318						
	Sopp's Arm						0.378	1.658	0.719	1.101	1.336
	Westport						1.943	0.578			
Northern Inshore area (3Khi+3Lab)	Coachman's Cove	26.597	0.535	1.180	0.453	0.380	0.679	0.368	4.567	1.555	1.071
	Ming's Bight				0.233	0.200	0.694	1.800	1.111	7.200	0.153
	La Scie		0.380	8.746	0.208	0.042	2.941	0.414	2.000	2.052	4.126
	Shoe Cove		1.254	1.273	1.055	0.121	0.475	1.889	1.988	2.041	1.104
	Smith's Hr	3.407	1.065	1.025	0.392	0.363	0.354	2.443	0.749	1.808	2.253
	Jackson's Cove	1.756	1.354	1.589	0.291	0.039	4.035	0.267			
	Miles Cove	10.583	1.990	0.724	0.280	0.374	1.153	0.397	4.622	0.594	1.000
	Glover's Hr						0.122	2.357	1.576	1.615	0.929
	Summerford	2.300	1.391	1.288	0.269	0.295	0.880	0.382	5.437	2.117	1.103
	Durrell	4.200	1.190	0.793	2.440	0.187	0.565	1.498			
	Too Good Arm	3.992	0.947	1.116	0.354	0.953	1.480	0.656	0.830	2.387	1.177
	Deep Bay	5.537	0.843	2.060	1.145						
	Fogo					0.294	1.565	0.417	0.261	4.950	0.869
	Joe Batt's Arm	8.407	0.159	2.639	0.553	0.675	0.241	0.918			
	Tilting	9.692	0.414	2.526	0.837	0.833	0.136	1.260	0.954	4.383	1.317
	Seldom	4.877	0.631	2.332	0.658	0.401	0.607	1.855	0.805	1.827	0.315
	Aspen Cove		0.139	5.159	0.344	0.686	1.198	0.480	1.552	5.528	0.792
	Lumsden	4.830	0.253	2.542	0.492	0.855	0.507	0.852	1.835	1.511	2.256
	Wesleyville	3.782	0.975	1.247	1.033	0.424	0.638	0.473	1.696	1.308	1.886
	Centreville	1.005	1.413	0.651	0.548	1.124	0.407	0.710			
	St. Chad's	1.835	1.329	1.068							
	Happy Adventure					1.314	0.243	1.466	0.598	1.144	1.559
	Plate Cove West	1.817	2.172	1.234	0.324	0.647	1.118	1.339	0.580	1.482	1.225
	Bonavista		1.855	1.844	0.717	0.780	0.799	0.933			
	Little Catalina	3.017	1.075	1.337	1.117	0.619	0.952	0.571	1.124	0.786	2.663
	Petley	2.353	1.583	1.419	0.651	1.235	1.042	0.650	0.985	0.640	2.013
	Thornlea	4.351	1.154	0.722	0.797	0.636	0.420	0.688			
	Hopeall	13.605	0.538	1.671	0.527	0.995	0.333	0.674	4.000	1.407	0.699
	Heart's Content		1.811	1.287	0.403	1.376	0.239	1.393	2.106	0.970	1.219
Southern 3L (3LFjq)	Bay de Verde		0.584	4.082	0.376	0.402	0.355	1.460	1.516	1.467	1.647
	Ochre Pitt Cove	2.458	1.156	2.453	0.363	0.411	0.655	0.514			
	Carbonear	4.394	0.691	2.149	0.289	1.088	0.357	1.351	1.647	1.211	1.528
	Port de Grave			2.379	0.578	0.197	1.115	0.582			
	Foxtrap	16.267	0.787	2.056	0.599	0.186	1.017	0.983	2.000	1.519	0.702
	Pouch Cove	8.081	0.650	2.032	0.884	0.205	1.024	0.131	8.255	2.708	0.603
	Petty Hr					0.323	0.930	0.432			
	Bay Bulls	2.812	0.989	1.415	0.692	0.111	1.314	1.060	4.289	2.421	0.765
	Calvert		1.495	1.223	0.871	0.070	0.227	2.960	2.179	2.391	0.716
	Ferryland	3.104	1.091	2.652	0.792	0.299	0.191	3.627			
	Aquaforte	5.416	1.334	0.880	0.644	0.227	0.523	1.151			
	Renews			1.043	0.947	0.281	0.319	1.149	5.833	0.582	0.993
	St. Shott's		0.775	1.010	1.167	0.729	0.380	0.789	5.157	0.299	0.546
	Riverhead	1.910	0.616	1.258	0.702	1.417	0.673	0.900	1.100	1.259	1.128
	Admiral's Beach	6.146	0.631	1.266	0.536	1.467	0.259	0.593	1.931	1.847	0.462
	Point Lance	1.307	0.673	1.214			13.188	0.109	13.333	0.770	0.113

no survey in one or both years
ratio is >1.10 (10% or greater increase in mean cpue)
ratio is between .9 and 1.1 (mean cpue is within 10% of the previous year)
ratio is <.9 (mean cpue has decreased by greater than 10%)

Table 4. Ratio of annual mean cpue (#/ 5 1/2" net, experimental sites) for concurrent years by community.

		Gillnet 5 1/2 in. Experimental									
		96/95	97/96	98/97	99/98	00/99	01/00	02/01	03/02	04/03	05/04
2Jm + 3Kad	Black Tickle		1.445	2.624	0.580	4.779	0.230	0.147	19.000	3.316	2.421
	Williams Hr	1.069	1.067	1.579	2.429	0.540	0.579	2.051			
	Tub Hr			1.250	1.956	0.143	1.270	0.675			
	Triangle	2.813	3.543	1.069	0.576	0.174	2.430	1.055	0.935	1.209	1.873
	Penny's Hr	0.431	51.077	0.333	0.969	0.597	0.451	1.286	0.980	3.143	2.803
	Spear Hr	1.558	4.652	1.035	1.188	0.489	0.397	4.509	0.781	0.727	1.906
	St. Lewis		3.647	1.518	0.330	2.813	0.733	1.632	3.900	0.843	3.475
	Mary's Hr						0.658	2.222	1.700	0.498	5.495
	Cape Charles	0.263	2.133								
	Quirpon										
	St. Lunaire	18.721	0.638	0.712	2.209	0.983	0.679	0.345	5.029	0.613	6.739
	Great Brehat	4.504	0.686	2.548	0.246						
	Goose Cove		0.988	2.126	2.394	0.605	0.286	0.705	2.765	0.688	4.715
	Conche	5.309	0.564	1.803	0.758	0.932	0.382	0.302	5.276	1.495	2.772
	Englee	14.395	0.765	0.975	2.511	0.257	0.518	0.287	4.595	1.247	3.387
	Hr Deep	1.887	0.735	1.959	0.361	0.376	0.508	0.472	3.987	0.554	5.792
	Jackson's Arm	8.743	0.594	0.714	0.248						
	Sopp's Arm						0.409	1.039	1.938	0.751	1.972
	Westport						1.475	0.703			
Northern Inshore area (3Khi+3Lab)	Coachman's Cove	11.734	0.627	1.044	0.282	0.448	0.484	1.233	2.511	1.623	1.854
	Ming's Bight				0.569	0.767	0.878	0.484	1.142	2.379	1.777
	La Scie		0.463	6.726	0.251	0.207	0.346	1.766	4.142	0.846	2.321
	Shoe Cove		0.465	2.491	0.690	0.393	0.393	1.775	1.867	1.747	1.793
	Smith's Hr	1.734	1.593	0.942	0.405	0.271	0.597	0.509	4.305	1.111	1.453
	Jackson's Cove	1.546	1.029	1.120	0.461	0.141	1.597	0.757			
	Miles Cove	2.530	0.962	0.846	0.199	0.848	1.025	0.893	3.139	1.114	0.910
	Glover's Hr						0.241	3.431	1.132	1.298	2.882
	Summerford	2.834	1.103	1.199	0.299	0.265	0.999	0.717	3.617	2.668	0.718
	Durrell	2.145	0.679	1.066	1.814	0.241	1.188	1.025			
	Too Good Arm	4.957	0.451	1.576	0.306	1.077	0.468	0.992	1.037	2.938	1.486
	Deep Bay	6.078	0.864	3.128	0.707						
	Fogo					0.635	0.295	0.576	1.642	2.381	2.248
	Joe Batt's Arm	84.150	0.124	2.214	0.527	1.530	0.174	1.340			
	Tilting	9.676	0.369	4.033	0.928	0.914	0.146	0.962	0.570	6.886	0.807
	Seldom	11.368	0.576	4.610	0.450	0.284	0.605	0.391	2.390	1.735	0.555
	Aspen Cove		0.696	2.159	0.350	0.433	0.723	1.366	0.563	9.492	1.309
	Lumsden	3.285	0.605	1.373	0.532	0.899	0.518	0.528	2.240	1.886	1.830
	Wesleyville	1.600	1.504	1.120	1.191	0.511	0.516	0.538	1.707	1.935	0.593
	Centreville	1.275	1.035	0.788	0.443	1.505	0.454	0.589			
	St. Chad's	3.384	1.077	1.286							
	Happy Adventure					1.152	0.540	0.862	1.145	0.851	1.662
	Plate Cove West	3.472	1.093	1.254	0.533	0.785	1.368	0.798	0.650	1.961	0.794
	Bonavista		1.218	2.102	0.628	2.583	0.335	1.263			
	Little Catalina	3.364	0.737	1.617	1.148	0.645	0.589	1.648	0.574	1.003	2.114
	Petley	2.151	1.284	1.411	0.648	0.796	0.728	1.353	1.019	1.139	0.846
	Thornlea	6.722	1.355	0.453	0.564	1.353	0.782	0.886			
	Hopeall	6.000	1.030	1.516	0.422	0.981	0.369	0.930	2.497	1.183	0.570
	Heart's Content		2.577	0.904	0.470	1.096	0.541	1.195	1.578	0.929	2.137
Southern 3L (3Ljfq)	Bay de Verde		1.037	3.510	0.255	0.626	0.362	1.222	1.729	1.435	1.226
	Ochre Pitt Cove	7.318	0.586	3.751	0.340	0.563	0.447	0.722			
	Carbonear	3.876	0.622	2.049	0.427	0.669	0.369	1.746	2.133	1.302	1.674
	Port de Grave			1.646	0.521	0.147	1.039	0.979			
	Foxtrap	13.626	1.246	1.849	0.664	0.330	0.703	1.170	2.236	1.274	1.129
	Pouch Cove	14.414	0.965	2.416	0.878	0.137	0.917	0.252	5.847	3.283	0.370
	Petty Hr					0.332	0.528	0.778			
	Bay Bulls	4.497	0.932	1.384	0.589	0.120	1.648	1.072	2.703	1.197	1.257
	Calvert		0.809	2.384	0.976	0.066	0.827	0.716	6.240	1.801	0.665
	Ferryland	3.043	1.789	1.628	1.248	0.228	0.416	1.444			
	Aquaforte	2.665	2.207	0.849	0.622	0.277	0.607	0.644			
	Renews			0.891	0.921	0.191	0.512	0.950	1.542	3.671	0.903
	St. Shott's		0.517	1.308	0.999	0.408	0.467	0.260	7.107	1.734	0.559
	Riverhead	2.861	0.880	1.511	1.028	0.960	0.574	0.946	1.750	0.684	1.830
	Admiral's Beach	7.861	0.878	1.037	0.946	1.025	0.334	0.399	1.543	1.280	0.559
	Point Lance	1.708	0.570	1.725	0.004	1.688	15.915	0.459	3.745	1.141	0.177

no survey in one or both years
ratio is >1.10 (10% or greater increase in mean cpue)
ratio is between .9 and 1.1 (mean cpue is within 10% of the previous year)
ratio is <.9 (mean cpue has decreased by greater than 10%)

Table 5. Ratio of annual mean cpue (#/1000 hooks, linetrawl control sites) for concurrent years by community.

		Linetrawl Control									
		96/95	97/96	98/97	99/98	00/99	01/00	02/01	03/02	04/03	05/04
2Jm + 3Kad	Tub Hr		0.389	3.429							
	Cape Charles		0.177								
	Goose Cove	1.038	5.420	0.257	0.380	1.941					
Northern Inshore area (3Khi+3Lab)	Coachman's Cove	2.854	1.637	0.464	0.689					2.476	2.337
	Ming's Bight	0.927	1.357	0.429	0.348	0.343	6.042	1.115	0.965	2.364	0.861
	La Scie	1.088	1.547	0.279	0.899			0.606	5.661	0.636	0.839
	Shoe Cove	0.904	1.854	0.511	0.705	0.692	2.088	0.544	2.135	0.916	1.561
	Durrell	0.713	1.891	0.276	0.852			2.400			
	Deep Bay	1.193	2.392								
	Fogo										
	Joe Batt's Arm	0.475	2.668	0.665							
	Tilting	1.354	2.507	0.846							
	Seldom										
	Aspen Cove	0.295	3.524	0.367	1.331	0.326	2.140	1.062	0.713	2.959	0.684
	Lumsden	2.280	1.001	0.737	0.794	0.747	0.841	1.021	2.248	1.010	1.397
	Wesleyville	0.977	1.692	0.734	1.223	1.413	0.638	0.707	1.683	0.668	1.082
	Happy Adventure										
	Bonavista										
	Heart's Content			0.859				1.190			
Southern 3L (3Lfjq)	Carbonear	0.879	2.230	0.273	2.445			2.512	0.269	1.973	1.753
	Foxtrap	2.522	1.330	0.225	2.119	0.811	2.339	0.084	1.778	3.063	1.017
	Bay Bulls										
	Calvert	0.583	2.393	0.794	0.061	2.328	0.954				
	Aquaforte										
	Renews	7.455	3.912								
	St. Shott's	1.776									
	Riverhead	1.064	1.639	0.708	1.710			0.948	1.040	2.346	0.344
	Point Lance									1.128	0.273

Table 6. Ratio of annual mean cpue (#/1000 hooks, linetrawl experimental sites) for concurrent years by community.

		Linetrawl Experimental									
		96/95	97/96	98/97	99/98	00/99	01/00	02/01	03/02	04/03	05/04
2Jm + 3Kad	Black Tickle										
	Williams Hr										
	Tub Hr										
	Triangle										
	Penny's Hr										
	Cape Charles		0.180								
	Goose Cove	1.042	2.000								
	Sopp's Arm										
Northern Inshore area (3Khi+3Lab)	Coachman's Cove	0.758									
	Ming's Bight	0.714	1.977	0.429	0.199	1.608	1.308	1.730	1.392	1.156	1.793
	La Scie	1.278	1.895	0.257	0.907			0.719	4.500	0.842	0.978
	Shoe Cove	1.117	2.006	0.393	0.589	0.874	1.225	1.249	1.879	0.527	1.617
	Durrell	1.138	1.297	0.316	0.703	0.546	0.250				
	Deep Bay	2.318	1.647								
	Fogo										
	Joe Batt's Arm	0.536	3.162	0.553							
	Tilting	0.635	1.558	0.899							
	Seldom										
	Aspen Cove	0.692	2.315	0.360	0.863	0.257	2.368	1.161	2.459	0.764	0.988
	Lumsden	1.699	0.883	0.677	0.879	0.766	0.758	1.142	2.201	0.929	1.212
	Wesleyville	1.952	0.703	0.609	1.487	1.323	0.715	0.669	2.128	1.086	0.993
	Happy Adventure										
	Bonavista	1.135	0.925	0.473				0.491			
	Petley										
	Heart's Content			0.935				1.247			
Southern 3L (3Lfjq)	Carbonear	0.907	0.701	0.238	4.815			2.117	0.653	2.704	0.641
	Foxtrap	1.986	1.024	0.264	2.029	0.621	1.389	0.140	2.000	2.779	1.168
	Bay Bulls										
	Calvert	1.160	0.694	0.880	0.358	1.086	0.597				
	Aquaforte										
	Renews	6.548									
	St. Shott's	1.594									
	Riverhead	1.299	1.689	1.206	2.084	0.162	0.846	0.820	2.648	3.007	0.856
	Point Lance									1.057	0.391

no survey in one or both years
ratio is >1.10 (10% or greater increase in mean cpue)
ratio is between .9 and 1.1 (mean cpue is within 10% of the previous year)
ratio is <.9 (mean cpue has decreased by greater than 10%)