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The Fishery for Short-finned Squid (*Illex illecebrosus*) in NAFO Subareas 3 and 4 1n 1998

by

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Abstract

Landings in Subareas 3+4 declined from about 14,500 tons in 1997 to about 1,900 tons in 1998, primarily due to a large decline in Subarea 3. Indices of abundance and bimass from Subarea 4 bottom trawl surveys on the Scotian Shelf in July and in the southern Gulf of St. Lawrence in September remained low, reflecting low abundance in 1998. Squid sampled from the Newfoundland inshore jig fishery were larger and sexual maturity of males was more advanced in 1998 than in 1997. There was considerable annual variation in size in Subarea 3, which appeared to be related to catch rates from the July Scotian Shelf survey. It was postulated thar this relationship reflects earlier spawning in years of high abundance than in years of low abundance.

Introduction

This paper provides a description of the fishery for short-finned squid on the Nova Scotian Shelf (NAFO Subarea 4) and inshore at Newfoundland (NAFO Subarea 3) during 1998. Landings in both areas are compared to long-term trends and to survey-based abundance indices, toward inferring annual changes in abundance levels. Subarea 3 landings are broken down by month, NAFO Division, and processing category. Length composition and (for males) maturity are described for those biological samples which could be obtained at Newfoundland. Yearly catches and biological characteristics have been described for most years between 1965 and 1997 (Mercer MS 1975; Collins and Ennis MS 1978; Hurley et al. MS 1979; Beck et al. MS 1980, MS 1981, MS 1982, MS 1983, MS 1986, MS 1989; MS 1994; MS 1998; Drew et al. MS 1984, MS 1985).

Materials and Methods

Data on monthly inshore squid landings by NAFO Division were obtained for Subarea 3 from the Fisheries Systems and Statistics Branch, Department of Fisheries and Oceans, Newfoundland Region. Subarea 4 annual landings and indices of abundance (no/tow) and biomass (kg/tow) from the July Scotian Shelf bottom trawl survey were available from NAFO (1998) up to 1997 and were updated for 1998 by M. Showell (personal communication). Abundance and biomass indices for the Southern Gulf of St. Lawrence (Subarea 4), based on September bottom trawl surveys during 1971-1998 (Koeller 1980) were provided by D. Swain (personal communication).

Biological samples were taken from the commercial jig fishery, when available, at New Bonaventure in NAFO Div. 3L (Fig. 1). All squid samples were dissected, sexed, and measured in dorsal mantle length (DML) to the nearest 0.5 cm. Maturity stages for males were assigned according to Mercer (MS 1973a). Samples were pooled over biweekly periods for descriptions of length, sex, and maturity composition.

Results and Discussion

Reported Catches

Subarea 3+4 landings increased gradually from about 100 t in 1986, to 7,000 t in 1989 and 11,000 t in 1990 (Table 1, Fig. 2). They subsequently declined to 2,000 t in 1992, before increasing to 5,970 t in 1994 and then declining to only 1,032 t in 1993 (Beck et al. MS 1994). Throughout 1986-1993 most of the reported catch was derived from the Scotian Shelf, largely as by-catch from the silver hake fishery. SA 3+4 landings increased to 8,233 t in 1996 and 12,616 t in 1997, mostly due to the inshore fishery in SA 3. Landings again declined to only 1,918 t in 1998, with most of that reported catch again from SA 4 (Table 1, Fig. 2).

Largest monthly catches from SA 3 in 1998 occurred in Sept. (Table 2), as has commonly been observed. Historically, most of the Nfld. inshore catch has been derived from Div. 3L (Mercer 1973b), as was also true during 1997 (Beck et al. 1998) and 1998 (Table 2).

Most production was in the form of round (whole) squid, (Table 2). Dried squid represented less than 1% of production during 1998, whereas it represented about 10% during 1996-97 (Beck et al. 1998).

Abundance and Biomass Indices

The two annual Subarea 4 bottom trawl surveys have different limitations with respect to providing reliable squid indices. The July survey on the Scotian Shelf (NAFO Div. 4VWX) is the more suitable with respect to survey area but its timing is early relative to the fishery peak. Conversely, the timing of the September survey in the Southern Gulf of St. Lawrence (Div. 4T) corresponds well with the overall peak in the SA 3+4 fishery, but it is not conducted within the main fishery area.

Survey no/tow and kg/tow (Table 1) were generally higher from the July survey (Fig. 3a) than from the Sept survey (Fig. 3b). However, the Sept survey indices better corresponded to the SA 3+4 catch trend than did the July survey indices. The major peak for the July indices was in 1976, three years before the landings peak, whereas the major peak for the Sept. indices was in 1978, one year before the landings peak. Very low July survey indices were evident for 1978 and 1980, in relation to landings and Sept survey indices for those years. July indices for those two years were also lower than they were during some recent years within the 1983-95 period of very low abundance (Fig. 3a). This likely reflects the early timing of the July survey and relatively late immigration of squid onto the Scotian Shelf in those years.

The July survey abundance and biomass indices respectively declined from 52 squid/tow and 4.8 kg/tow in 1997 to 9.95 squid/tow and 0.94 kg/tow in 1998 (Fig. 3a). The 1998 September survey abundance index remained unchanged from the previous year, at 0.96 squid/tow, whereas the biomass index increased marginally from 0.17 kg/tow in 1997 to 0.21 kg/tow in 1998. This indicates larger mean size in 1998 than in the previous year.

Biological Characteristics

Commercial samples were acquired from the Newfoundland inshore jig fishery at only one site (New Bonaventure, Fig. 1) in 1998. These samples represented three consecutive 2-week periods between Aug. 16 and Sept. 30. Length frequency distributions (Fig 4) were unimodal for all three time periods and both sexes, as is usually the case for inshore Newfoundland jigged samples (Beck et al 1998). Length composition for both sexes remained virtually unchanged between Aug. 16-31 and Sept. 1-15, whereas there was a great increase in mean and modal length for both sexes between the first and second halves of September (Fig. 4). Seasonal change in size frequencies reflect dynamic interchange of individuals within local populations, due to continuous recruitment, emigration and size-related cannibalism. These processes frequently result in a decline in mean and modal length late in the fishing season (Dawe and Hendrickson 1998, Beck et al. 1998).

Beck et al. (1998) reported that mean biweekly mantle lengths throughout 1989-96 were generally smaller than those of any earlier years during 1978-88, but that mean 1997 mantle length was larger than in recent years. To examine such size trends in more detail we compared mean mantle length across years (1976-1998) by sex for the historically most common sampling sites (Fig. 1) and for each of the seasonal periods sampled in 1998 (Fig. 5-6). It appears generally that mean length declined over the period 1976-1992, and has been quite variable in more recent years. Mean length at New Bonaventure in 1998 was considerably greater than in recent years and was comparable to the large mean lengths of the late 1970's. Large sizes during 1976-80 may be related to relatively early spawning in years of high abundance. Length distributions from the fall survey in SA 5+6 (Dawe and Hendrickson 1998) also indicate that modal length of the largest size group was larger during 1975-80 than during 1981-97.

We found that Aug 16-31 mean mantle length at Holyrood Newfoundland appeared to be directly related to July survey catch rates on the Scotian Shelf (Fig. 7). Peaks in Holyrood mean length in 1976 and 1979 correspond with peaks in catch rates. We feel that the very low July survey catch rates in 1978 may be due to relatively late spawning in that year and late immigration of small squid onto the shelf. Such annual variability in timing of peak spawning and July mean size would likely be related to environmental variation (Dawe et al 1998). Koeller (1980) found that both mean size and, to a lesser extent, biomass were directly correlated with mean bottom temperature from 1970-1979 July surveys.

Sexual maturation of males progressed considerably between the fist and second halves of September in 1998 (Fig. 4). A large proportion of males was fully mature during the second half of September. Male maturation was much more advanced in 1998 than in the previous year, when no fully mature males were sampled within comparable time periods (Beck et al. 1998). Such great differences in male maturity between years was related to the great size differences noted earlier.

Acknowledgements

We thank Mark Showell (Department of Fisheries and Oceans, BIO, Dartmouth, NS) for providing 1998 July survey indices and landings estimates for the Scotian Shelf, and Doug Swain (Department of Fisheries and Oceans, Moncton, NB) for providing the September survey series for the southern Gulf of St. Lawrence.

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Table 1. Annual catch and survey indices for NAFO Subareas 3 and 4, 1953-1998.

	Subarea 3 and 4 Catch , t			SA 4 July Survey		SA 4 Sept. Survey	
Year	Subarea 3	Subarea 4	SA 3+4	no./tow	kg/tow	no/tow	kg/tow
53	4460		4460				
54	6700		6700				
55	7019		7019				
56	7779		7779				
57	2634		2634				
58	718		718				
59	2853		2853				
60	5067		5067				
61	8971		8971				
62	482		482				
63	2119	103	2222				
64	10408	369	10777				
65	7831	433	8264				
66	5017	201	5218				
67	6907	126	7033				
68	9	47	56				
69	21	65	86				
70	111	1274	1385	5.6	0.4		
71	1607	7299	8906	28.5	2.8	0.72	0.16
72	26	1842	1868	6.6	0.7	0.05	0.01
73	622	9255	9877	10.9	1.5	0.08	0.02
74	48	389	437	13.4	1.8	0.06	0.00
75	3751	13945	17696	44.8	5	2.47	0.51
76	11257	30510	41767	231.2	42.7	30.76	8.04
77	32754	50726	83480	50.9	9.5	25.73	7.61
78	41376	52688	94064	16.4	2.3	55.95	15.87
79	88833	73259	162092	91.4	14.2	28.47	8.14
80	34780	34826	69606	23.3	2.2	18.04	4.58
81	18061	14801	32862	35.5	4.9	5.76	1.67
82	11164	1744	12908	26	2.1	0.38	0.08
83	5	421	426	76.9	2.1	0.09	0.00
84	397	318	715	14.1	1.5	0.03	0.00
85	404	269	673	80.2	2.7	0.48	0.11
86	1	110	111	7.7	0.4	0.08	0.01
87	194	372	566	4.9	0.4	0.16	0.02
88	272	528	800	47.3	2.7	1.33	0.40
89	3101	3899	7000	26.3	2.7	0.30	0.04
90	4440	6560	11000	40.6	4.8	0.88	0.14
91	1719	2277	3996	27.1	1.8	0.12	0.03
92	924	1076	2000	121.7	7.3	0.28	0.05
93	276	2398	2674	79	5.4	0.58	0.10
94	1954	4016	5970	45.3	4.2	0.26	0.10
95	48	984	1032	33.9	2.4	0.16	0.02
96	8285	445	8730	11.9	0.9	0.70	0.11
97	11652	2869	14521	52	4.8	0.96	0.17
98	800	1118	1918	9.95	0.94	0.96	0.21

Table 2. NAFO Subarea 3 Division 4R short-finned squid Catch (mt) by month and processing category for 1998.

Div.	Proc. Category	July	Aug	Sept	Oct	Nov	Dec	Total
3K	Round		92	110	8			210
	Total		**92**	**110**	**8**			**210**
3L	Round		155	330	88	5		578
	Dried		2		5			7
	Total		**157**	**330**	**93**	**5**		**585**
3PS	Round	1						1
	Total	**1**						**1**
4R	Round				1			1
	Total				**1**			**1**
Combined	Round	1	247	440	97	5		790
	Dried		2		5			7
	Total	**1**	**249**	**440**	**102**	**5**		**797**

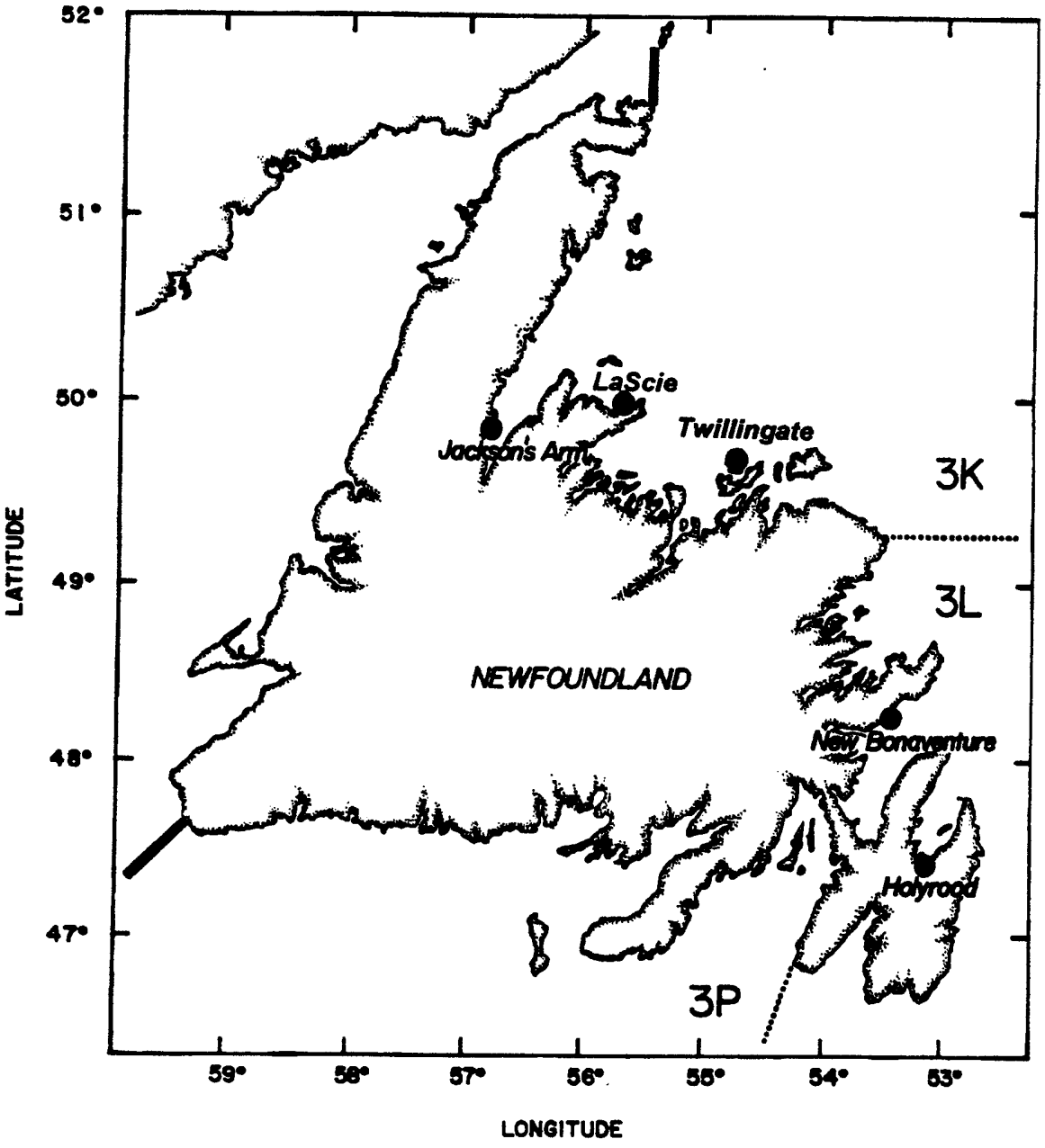

Fig. 1. Map showing location of inshore Newfoundland sampling sites

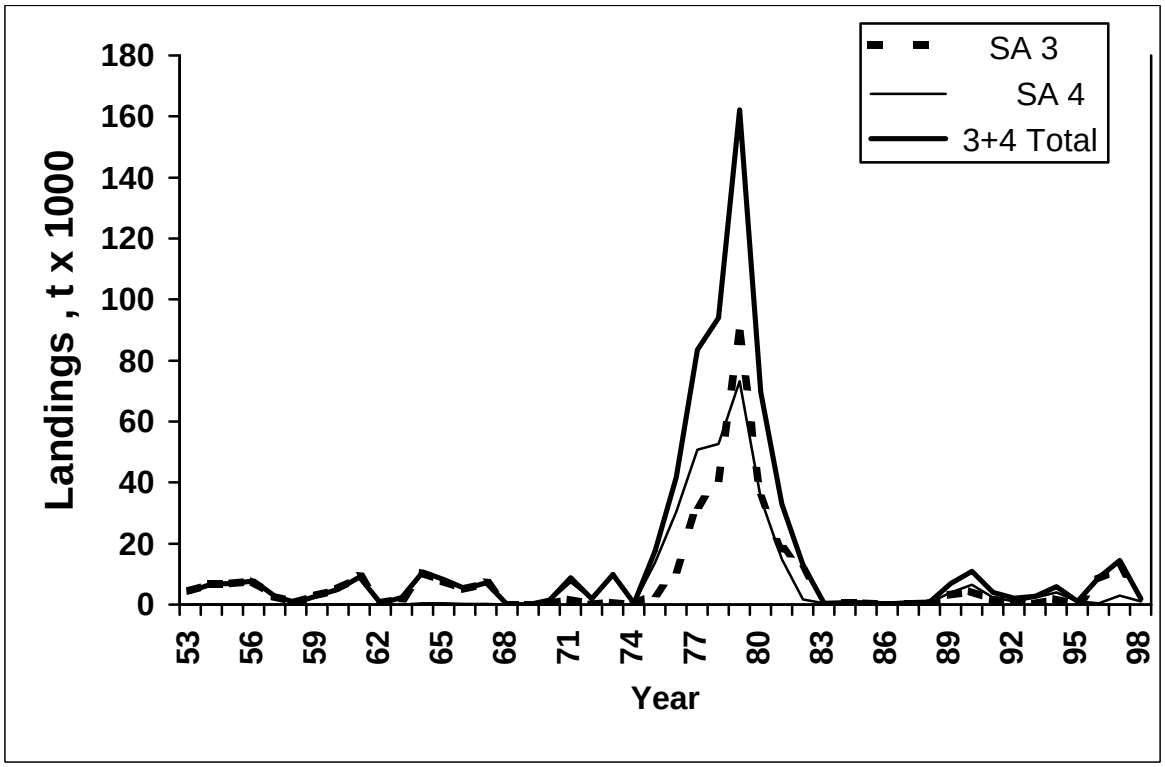

Fig. 2. Trends in annual landings for NAFO Subareas 3 and 4, 1953-1998.

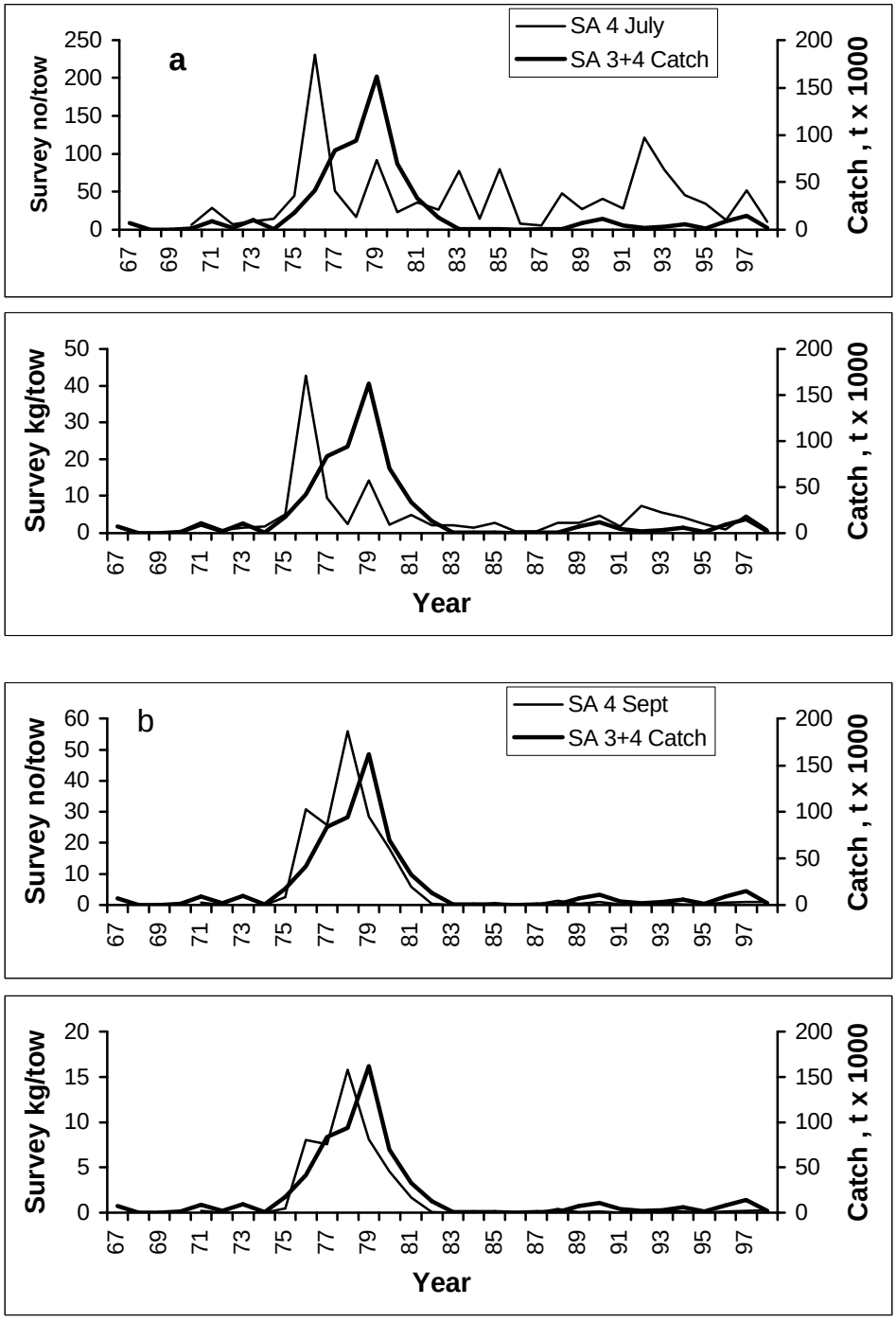

Fig. 3. Relationship of annual Subarea 3+4 catch with indices of abundance and bionass from Subarea 4 bottom trawl surveys conducted on the Scotian Shelf in July (a) and in the Southern Gulf of St. Lawrence in September (b).

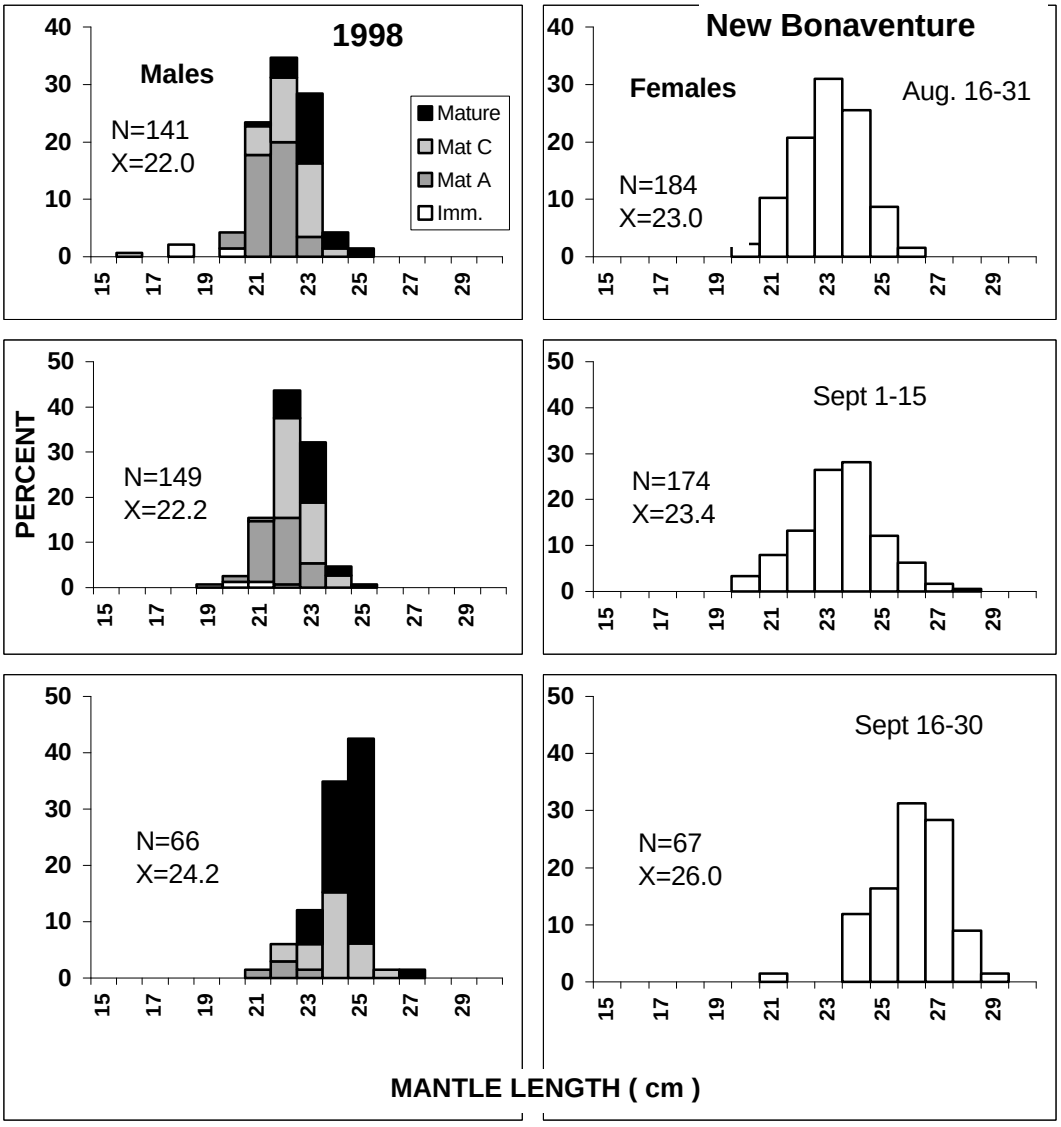

Fig. 4. Mantle length frequency distributions for males, with maturity overlain (left), and for females (right), for biweekly periods, from New Bonaventure in 1998.

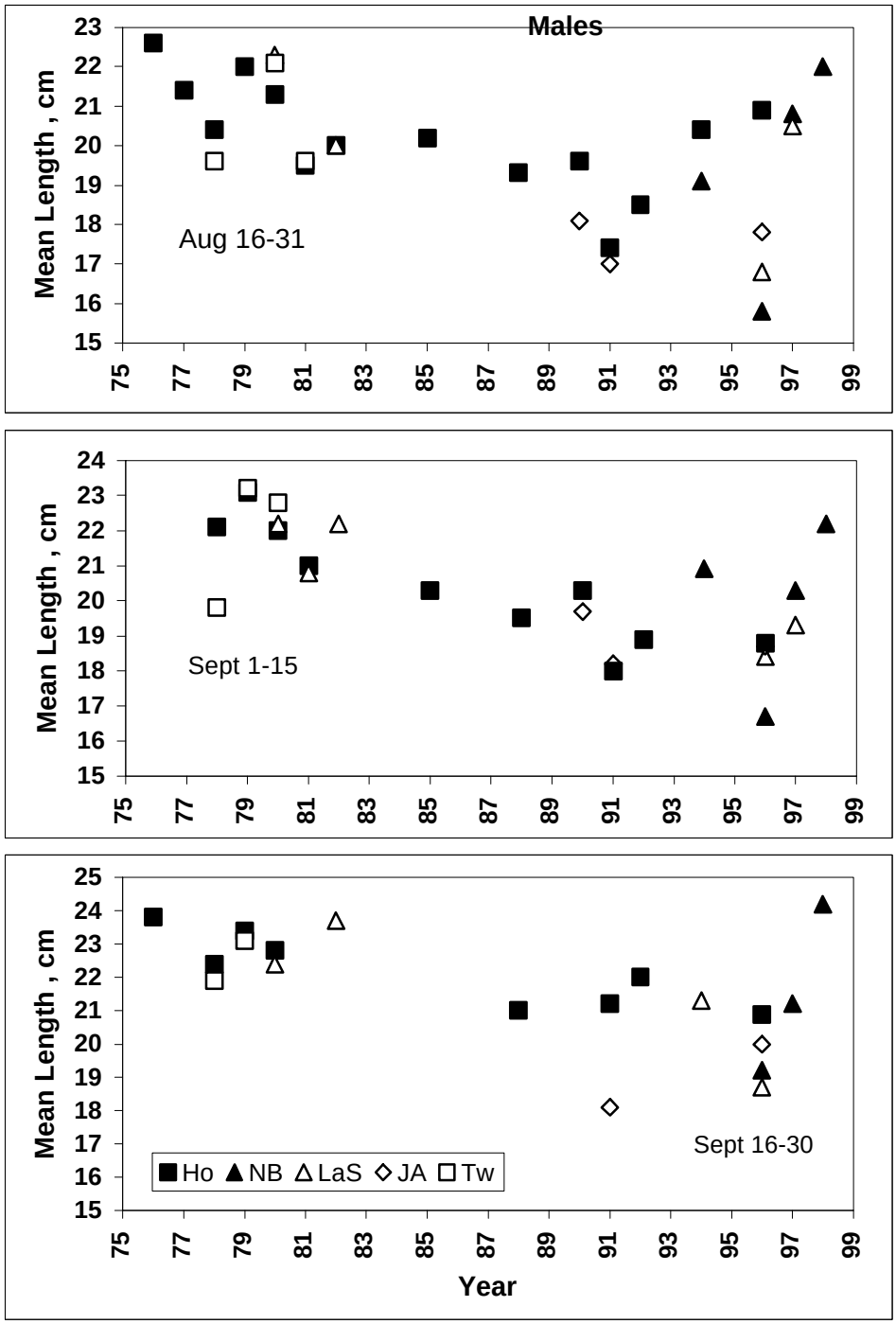

Fig.5. Annual mean mantle length of males from the Nfld. inshore commercial jig fishery for each of three 2-week intervals

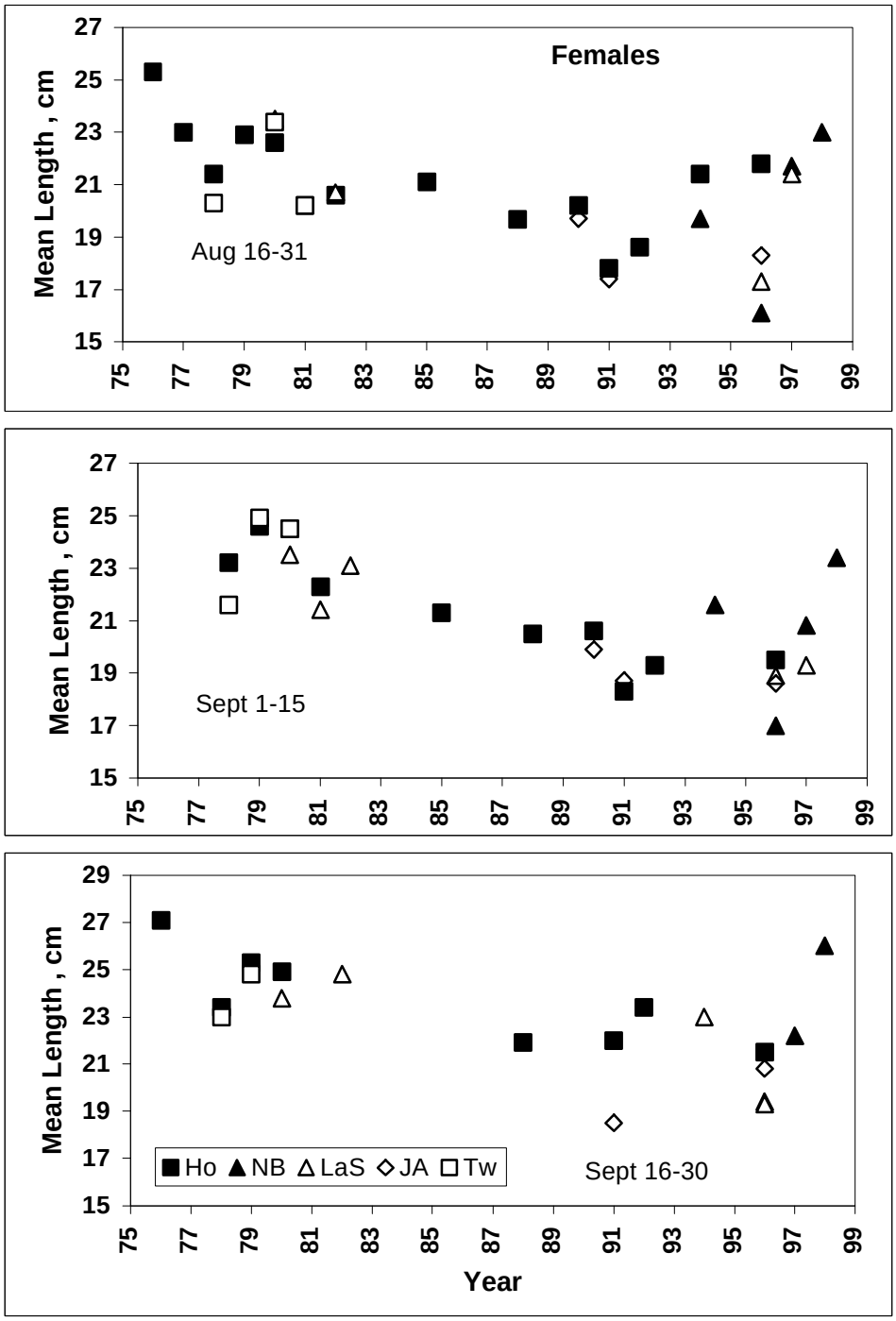

Fig.6. Annual mean mantle length of females from the Nfld. inshore commercial jig fishery for each of three 2-week intervals

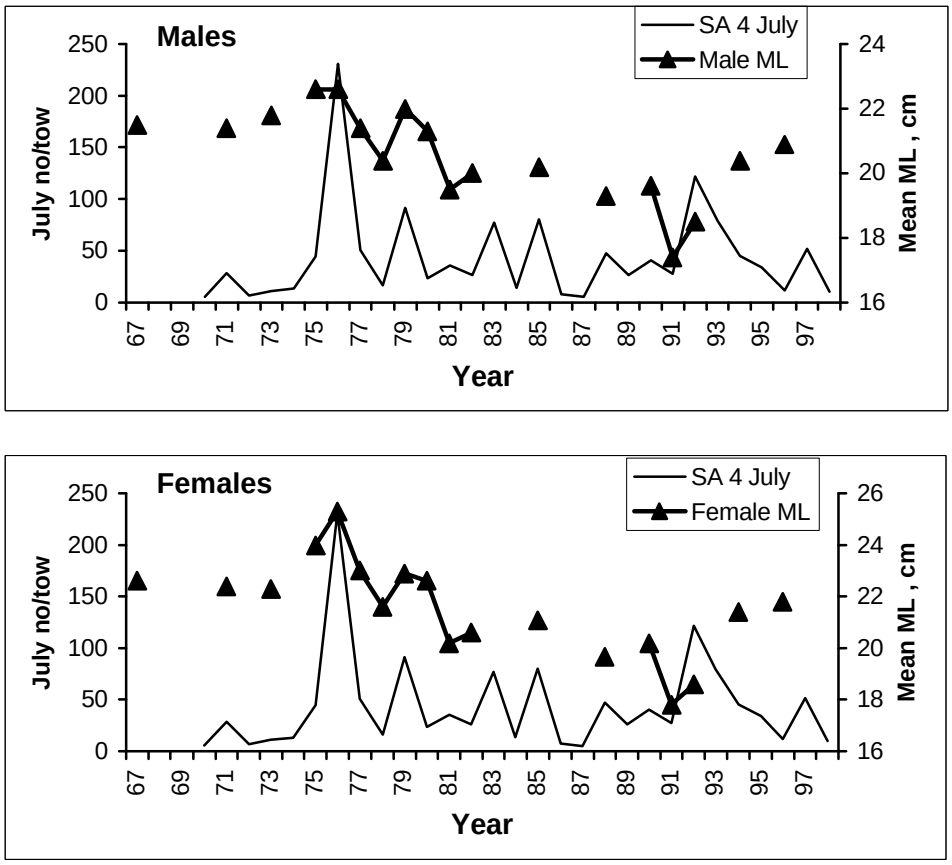

Fig. 7. Comparison of SA 4 July survey catch no/tow, 1970-1998, with mean Aug 16-31 mantle length for males (above) and females (below) from the inshore jig fishery at Holyrood Newfoundland.