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An Update of the Fishery for Short-finned Squid (*Illex illecebrosus*) in the Newfoundland Area During 1989-93 with Descriptions of Some Biological Characteristics and Temperature Trends

by

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Introduction

This paper provides a description of the fishery for Illex illecebrosus in the Newfoundland area (NAFO Subarea 3) during 1989-93. Commercial catches 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. Seasonal trends in nearshore temperature are described for all five years at one sampling site. Yearly catches and biological characteristics have been described for most years between 1965 and 1988 (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; Drew et al. MS 1984, MS 1985).

Materials and Methods

Data on monthly inshore squid catches by NAFO Division were obtained from the Fisheries Systems and Statistics Branch, Department of Fisheries and Oceans, Newfoundland Region. Biological samples were taken (from the commercial jig fishery), when available, at Holyrood, NAFO Div. 3L (Fig. 1) during 1989-92; no samples could be acquired at Holyrood in 1993. Other samples were opportunistically acquired from NAFO Div. 3L in 1993 at Chance Cove and New Bonaventure (Fig. 1). Samples were acquired from Div. 3K in 1990 (Great Harbour Deep) and 1991 (Jackson's Arm). Only a single sample was obtained from Div. 3P during this 5-year period; that from Bay d'Espoir (Fig. 1) in October of 1993.

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.

Temperature data were collected at Holyrood using Ryan thermographs,

moored near the bottom at a depth of 11 m. Thermographs were maintained throughout most of June-November in all five years.

Results and Discussion

Reported Catches

The annual Newfoundland squid catch increased gradually since 1986, to 3101 t in 1989 and 4439 t in 1990 (Fig. 2, Table 1). It subsequently declined regularly to 923 t in 1992 and only about 100 t in 1993 (preliminary data). The marginal improvement in the squid fishery in 1989 and 1990 reflected slight increases in abundance of squid in those years. However, squid abundance at Newfoundland has remained generally low throughout 1983-93. This 11-year period of low squid abundance is the longest on record. Such extended periods of low squid abundance, as also seen during 1968-74 (Fig. 2), have generally coincided with cold conditions on the eastern Newfoundland Shelf (Petrie et al. 1992).

Largest monthly catches occurred in either September or October for all five years during 1989-93 (Table 1), as has commonly been observed. Historically, most of the annual catch has been derived from Div. 3L (Mercer 1973b), as was also true during 1987 and 1988 (Beck et al. 1989). During 1989-92, however, most of the annual catch (52-84%) was derived from Div. 3K (Table 1). The reasons for this change in spatial distribution of the catch are unclear and they could include a northern shift in distribution of the local population, perhaps in response to prey distribution. Also possible is that recent changes in socio-economic factors may have resulted in an increase in fishing effort in Div. 3K relative to that in Div.3L. Unfortunately, however, we have no data on fishing effort.

Most production was in the form of round (whole) squid, with dried squid also prevalent (Table 1). A seasonal trend was evident, especially in 1989 and 1990, whereby round squid predominated early in the season (June-September) and dried squid production was most prevalent late in the season (October-December). This change in prominence of production categories was probably related to seasonal increase in squid size.

Biological Characteristics

Length frequency distributions were unimodal for most localities and biweekly periods sampled during 1989-93 (Fig. 3-7). Only for both August sampling periods at Holyrood in 1992 was a second modal group (of small squid) apparent (Fig. 6). The presence of more than one modal group is rarely observed within length-frequency distributions which are aggregated over two-week periods. For example, it has only been previously observed twice within the Holyrood series based on jigged samples; once in 1978 (Hurley et al. MS 1979) and once in 1985 (Beck et al. MS 1986).

Mean biweekly mantle lengths throughout 1989-93 (Fig. 3-7) were generally smaller than those of any earlier years during 1978-88 (Beck et al. MS 1982, MS 1983, MS 1986, MS 1989). Smallest mean mantle lengths were seen at Holyrood and Jackson's Arm in 1991 (Fig. 5). For the earliest periods sampled at Holyrood in 1991 (August 16-31 and September 16-30) mean mantle lengths for males were 1.9-5.7 cm smaller than those for any earlier years since 1977. Similarly, for those same Holyrood sampling periods, mean lengths for females in 1991 were 1.9-6.5 cm smaller than any previously recorded. It is unknown whether small size of squid at Newfoundland, during recent years of low abundance and cold conditions, is related to late spawning, poor growth, or other factors.

Sexual maturation of males during 1989-93 (Fig. 3-7) was generally similar to that in earlier years. Squid of both sexes sampled at Bay d'Espoir (NAFO Div. 3P, Fig. 1) during October 16-31, 1993 were larger and males were in more advanced stages of sexual maturation than those sampled later at Chance Cove and New Bonaventure (Fig. 7). Advanced sexual maturation of male squid on the South Coast of Newfoundland may be related to warmer conditions or different feeding regime than on the Northeast Coast.

Inshore Temperature Trends

Seasonal trends in local water temperature at the Holyrood sampling site appeared to vary among years, especially with respect to day-to-day variability during the June-August period of warming (Fig. 8). In 1990 and 1991 daily temperature frequently dropped below 5°C until mid-August. Any possible relationships between local temperature and squid catch, distribution, size or maturation would require more stringent analysis. However it appears that in 1991, when squid were unusually small, local conditions were especially cold. Temperatures for the other years during 1989-93 peaked at about 14°C, as was the case during 1986-88 (Beck et al. 1989) whereas in 1991, maximum temperature did not reach 12°C (Fig. 8). Colbourne (1993) also showed that surface water was particularly cold during summer, 1991.

Acknowledgements

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Table 1. Subarea 3 short-finned squid catch (t) by NAFO Division, month and processing category for 1989-93.

Year	Div.	Proc. cat.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	(Percent)
1989	3K	Round	-	7.1	5.3	348.2	608.9	36.0	.5	.2	1006.2	
		Dried	-	1.8	3.7	155.1	457.1	298.1	56.2	-	972.0	
		Total	-	8.9	9.0	503.3	1066.0	334.1	56.7	.2	1978.2	(63.8)
	3L	Round	-	2.5	131.0	298.9	67.4	50.6	.3	-	550.7	
		Dried	-		13.7	77.2	181.2	112.9	8.8	-	393.8	
		Total	-	2.5	144.7	376.1	248.6	163.5	9.1	-	944.5	(30.5)
	3P	Round	-	-	37.1	41.2	34.5	12.3	.8	-	125.9	
		Dried	-	-	1.9	8.4	20.7	19.0	2.5	-	52.5	
		Total	-	-	39.0	49.6	55.2	31.3	3.3	-	178.4	(5.8)
	Combined	Round	-	9.6	173.4	688.3	710.8	98.9	1.6	.2	1682.8	
		Dried	-	1.8	19.3	240.7	659.0	430.0	67.5	-	1418.3	
		Total	-	11.4	192.7	929.0	1369.8	528.9	69.1	.2	3101.1	
		(Percent)	-	(0.4)	(6.2)	(30.0)	(44.2)	(17.1)	(2.2)	(<0.1)		
1990	3K	Round	-	-	3.0	218.6	1142.0	626.7	1.6	-	1991.9	
		Dried	-	-	.2	34.1	235.0	661.8	126.4	-	1057.5	
		Tubes	-	-	-	-	.9	26.9	-	-	27.8	
		Total	-	-	3.2	252.7	1377.9	1315.4	128.0	-	3077.2	(69.3)
	3L	Round	-	-	3.6	195.8	158.5	239.8	299.6	-	897.3	
		Dried	-	-	.5	13.7	123.9	206.5	75.4	9.8	429.8	
		Tubes	-	-	-	-	-	-	-	-	-	
		Total	-	-	4.1	209.5	282.4	446.3	375.0	9.8	1327.1	(29.9)
	3P	Round	-	-	.1	7.0	15.8	3.8	4.5	-	31.2	
		Dried	-	-	-	.4	3.5	-	-	-	3.9	
		Tubes	-	-	-	-	-	-	-	-	-	
		Total	-	-	.1	7.4	15.8	7.3	4.5	-	35.1	(0.8)
	Combined	Round	-	-	6.7	421.4	1316.3	870.3	305.7	-	2920.4	
		Dried	-	-	.7	48.2	358.9	871.8	201.8	9.8	1491.2	
		Tubes	-	-	-	-	.9	26.9	-	-	27.8	
		Total	-	-	7.4	469.6	1676.1	1769.0	507.5	9.8	4439.4	
		(Percent)			(0.2)	(10.6)	(37.8)	(39.9)	(11.4)	(0.2)		

Table 1. Continued ...

Year	Div.	Proc. cat.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	(Percent)
1991	3K	Round	-	-	.2	222.0	1050.4	37.7	.5	-	1310.8	
		Dried	-	-	-	2.5	78.8	48.6	.5	-	130.4	
		Tubes	-	-	-	-	-	-	1.9	-	1.9	
		Total	-	-	.2	224.5	1129.2	86.3	2.9	-	1443.1	(83.7)
	3L	Round	-	-	-	19.0	56.5	64.0	5.7	.3	145.5	
		Dried	-	-	-	-	13.9	13.3	4.8	-	32.0	
		Tubes	-	-	-	-	-	-	-	-	-	
		Total	-	-	-	19.0	70.4	77.3	10.5	.3	177.5	(10.3)
	3P	Round	-	-	-	2.3	22.8	60.3	7.3	-	92.7	
		Dried	-	-	-	4.2	2.6	2.4	.9	-	10.1	
		Tubes	-	-	-	-	-	-	-	-	-	
		Total	-	-	-	6.5	25.4	62.7	8.2	-	102.8	(6.0)
Combined		Round	-	-	.2	243.3	1129.7	162.0	13.5	-	1548.7	
		Dried	-	-	-	6.7	95.3	64.3	6.2	-	172.5	
		Tubes	-	-	-	-	-	-	1.9	-	1.9	
		Total	-	-	.2	250.0	1225.0	226.3	21.6	-	1723.1	
		(Percent)			(<0.1)	(14.5)	(71.1)	(13.1)	(1.3)			
1992	3K	Round	-	-	-	4.0	251.8	78.8	9.0	-	343.6	
		Dried	-	-	.4	3.5	43.9	72.0	16.0	-	135.8	
		Tubes	-	-	-	-	-	-	-	-	-	
		Total	-	-	.4	7.5	295.7	150.8	25.0	-	479.4	(51.9)
	3L	Round	.9	-	.6	1.3	69.3	83.8	112.9	.5	268.4	
		Dried	-	-	-	2.3	37.9	71.4	22.4	2.0	136.0	
		Tubes	-	-	-		1.2	3.4	-	-	4.6	
		Total	.9	-	.6	3.6	108.4	158.6	135.3	2.5	409.9	(44.4)
	3P	Round	-	-	-	.5	9.0	12.9	8.5	-	30.9	
		Dried	-	-	-	.4	2.0	1.9	-	-	4.3	
		Tubes	-	-	-		-	-	-	-	-	
		Total	-	-	-	.9	11.0	14.8	8.5	-	35.2	(3.8)
Combined		Round	.9	-	.6	5.8	330.1	175.5	130.4	.5	642.8	
		Dried	-	-	.4	6.2	83.8	145.3	38.4	2.0	276.1	
		Tubes	-	-	-	-	1.2	3.4	-	-	4.6	
		Total	.9	-	1.0	12.0	415.1	324.2	168.8	2.5	923.5	
		(Percent)	(0.1)		(0.1)	(1.3)	(44.9)	(35.1)	(18.3)	(0.3)		

Table 1. Continued ...

Year	Div.	Proc. cat.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	(Percent)
1993	3K	Round	-	-	.1	.5	4.3	7.7	24.7	-	37.3	
		Dried	-	-	-	-	.2	1.9	-	-	2.1	
		Total	-	-	.1	.5	4.5	9.6	24.7	-	39.4	(40.2)
	3L	Round	-	-	-	.6	5.5	22.2	8.0	-	36.3	
		Dried	-	-	-	-	.3	2.0	2.0	-	4.3	
		Total	-	-	-	.6	5.8	24.2	10.0	-	40.6	(41.4)
	3P	Round	-	-	-	-	1.2	5.9	1.3	-	8.4	
		Dried	-	-	-	-	2.4	1.2	.4	-	4.0	
		Total	-	-	-	-	3.6	7.1	1.7	-	12.4	(12.7)
	4R	Round	-	-	-	3.5	1.4	.5	-	-	5.4	
		Dried	-	-	-	-	.2	-	-	-	0.2	
		Total	-	-	-	3.5	1.6	.5	-	-	5.6	(5.7)
Combined		Round	-	-	.1	4.6	12.4	36.3	34.0	-	87.4	
		Dried	-	-	-	-	3.1	5.1	2.4	-	10.6	
		Total	-	-	.1	4.6	15.5	41.4	36.4	-	98.0	
		(Percent)			(0.1)	(4.7)	(15.8)	(42.2)	(37.1)			

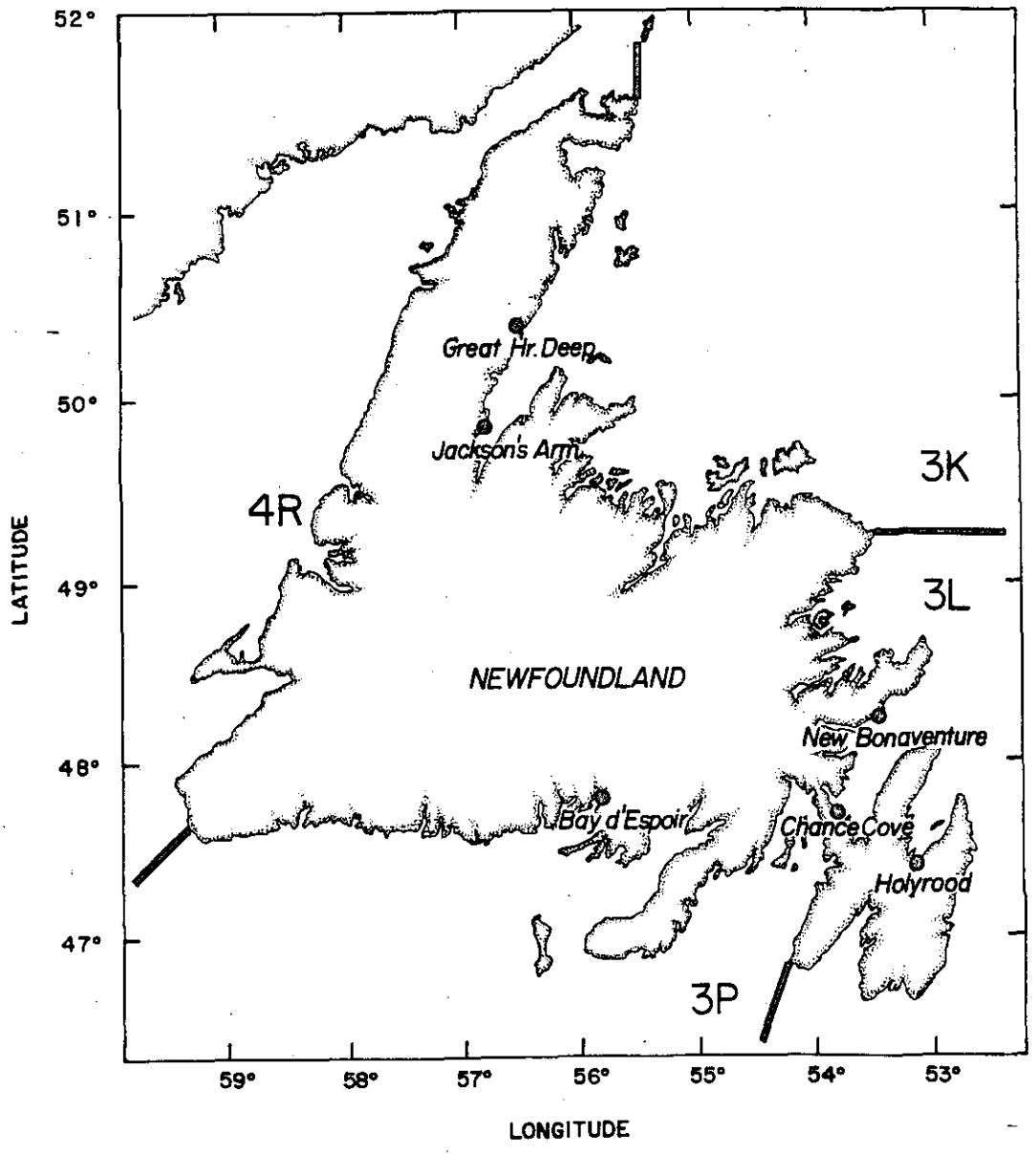

Fig. 1. Location of 1989-93 squid sampling sites in relation to NAFO Divisions.

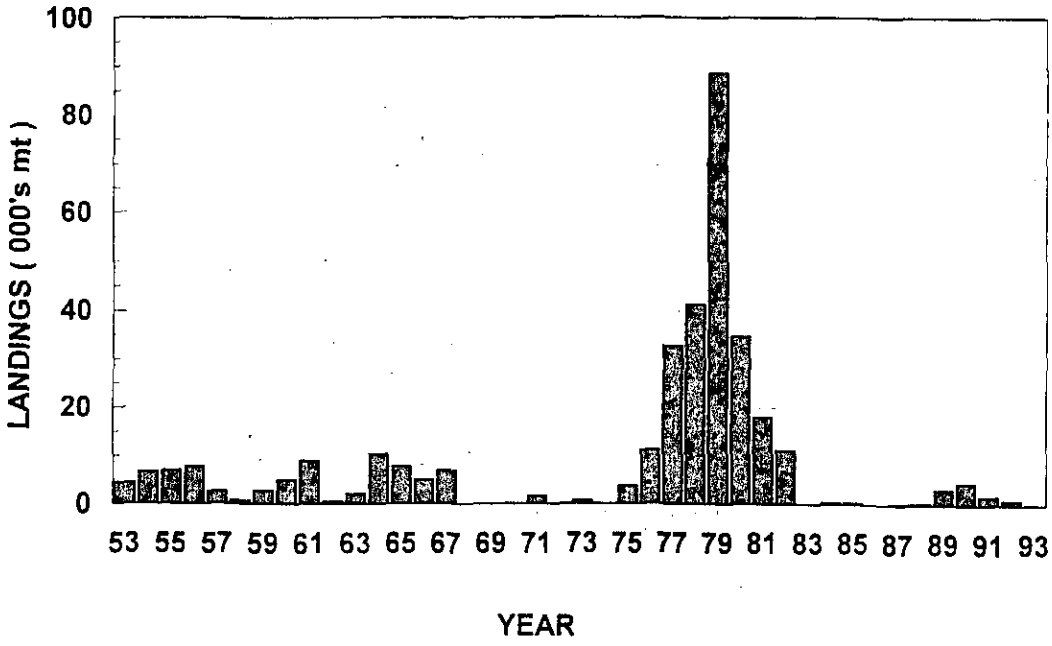

Fig. 2. Annual landings of short-finned squid for NAFO Subarea 3, 1953-93.

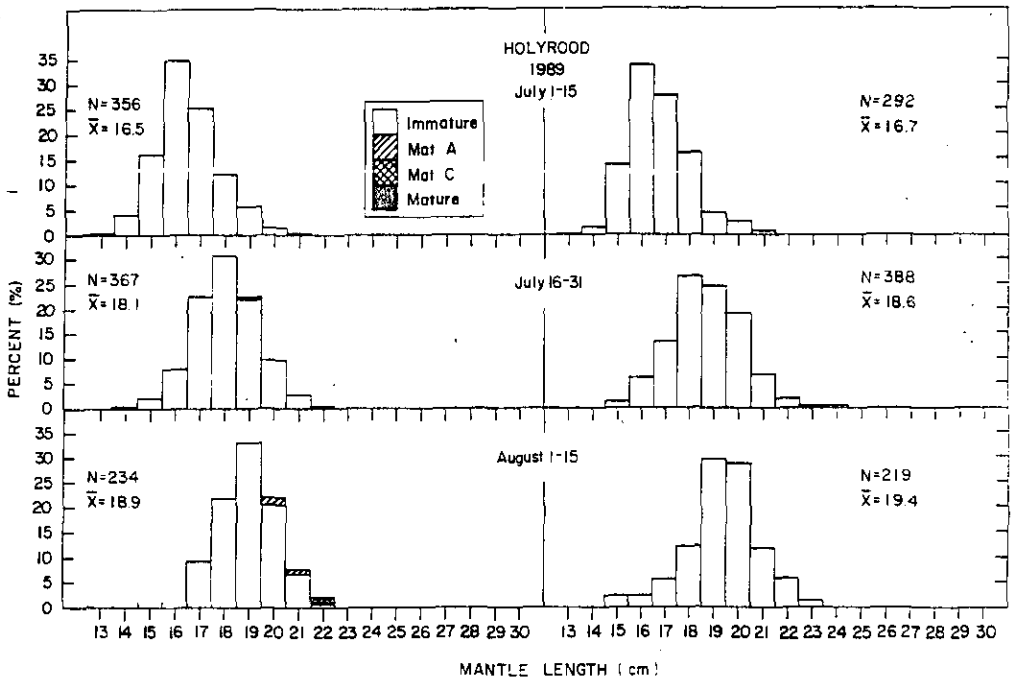

Fig. 3. Length-frequency distributions for males (left, with maturity overlain) and for females (right) by biweekly periods at Holyrood in 1989.

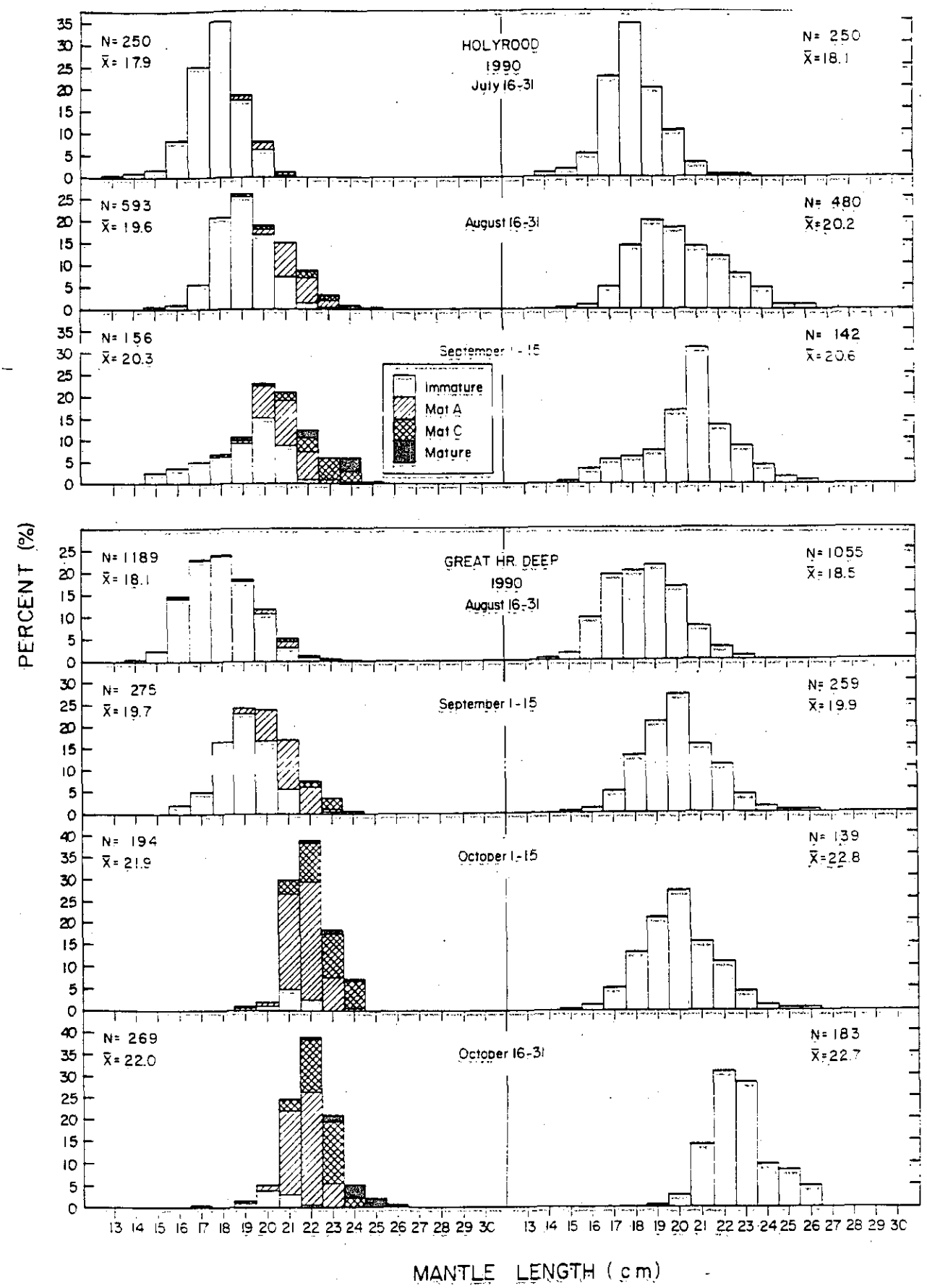

Fig. 4. Length-frequency distributions for males (left, with maturity overlain) and for females (right) by biweekly periods at Holyrood (above) and Great Harbour Deep (below) in 1990.

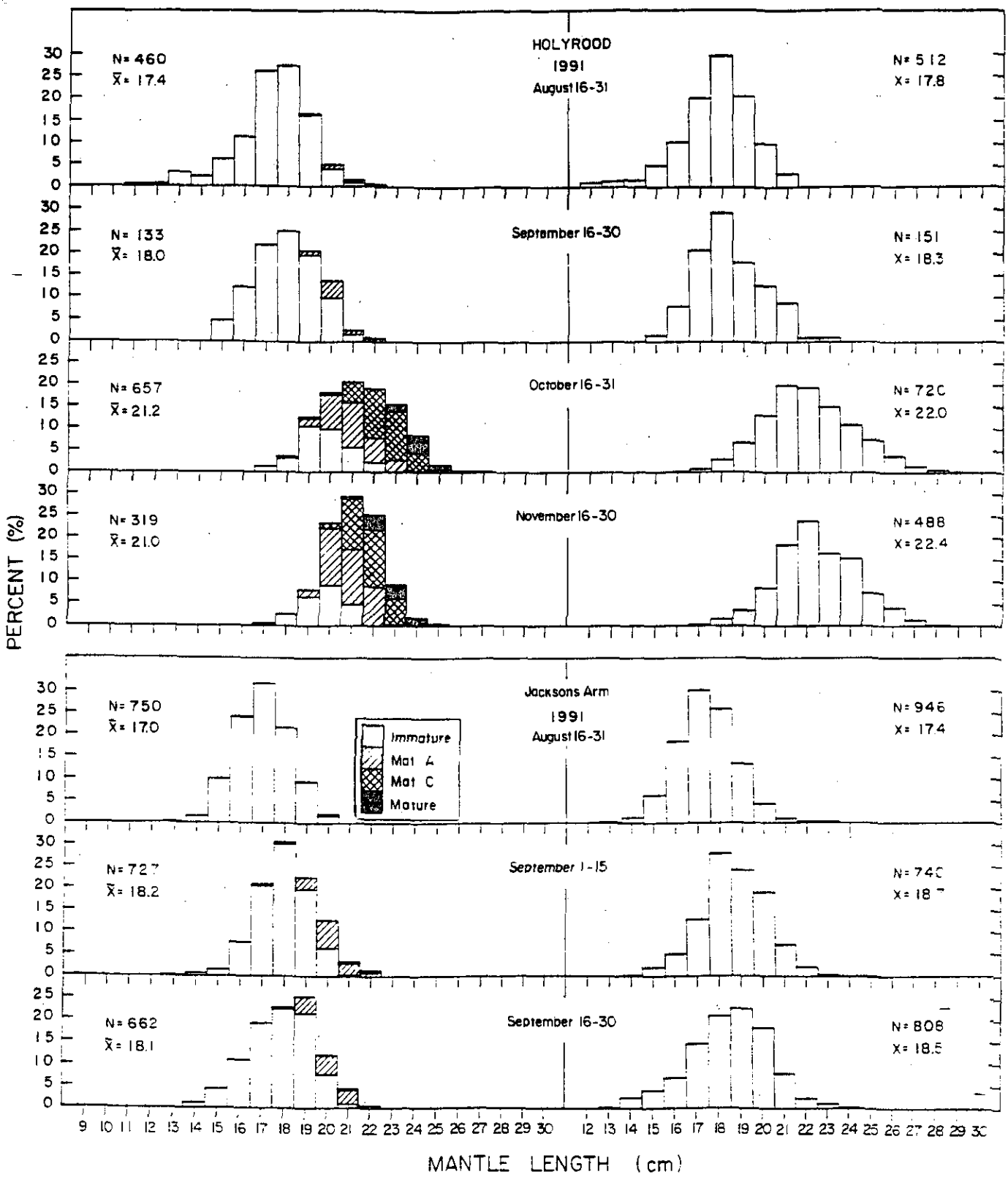

Fig. 5. Length-frequency distributions for males (left, with maturity overlain) and for females (right) by biweekly periods at Holyrood (above) and Jackson's Arm (below) in 1991.

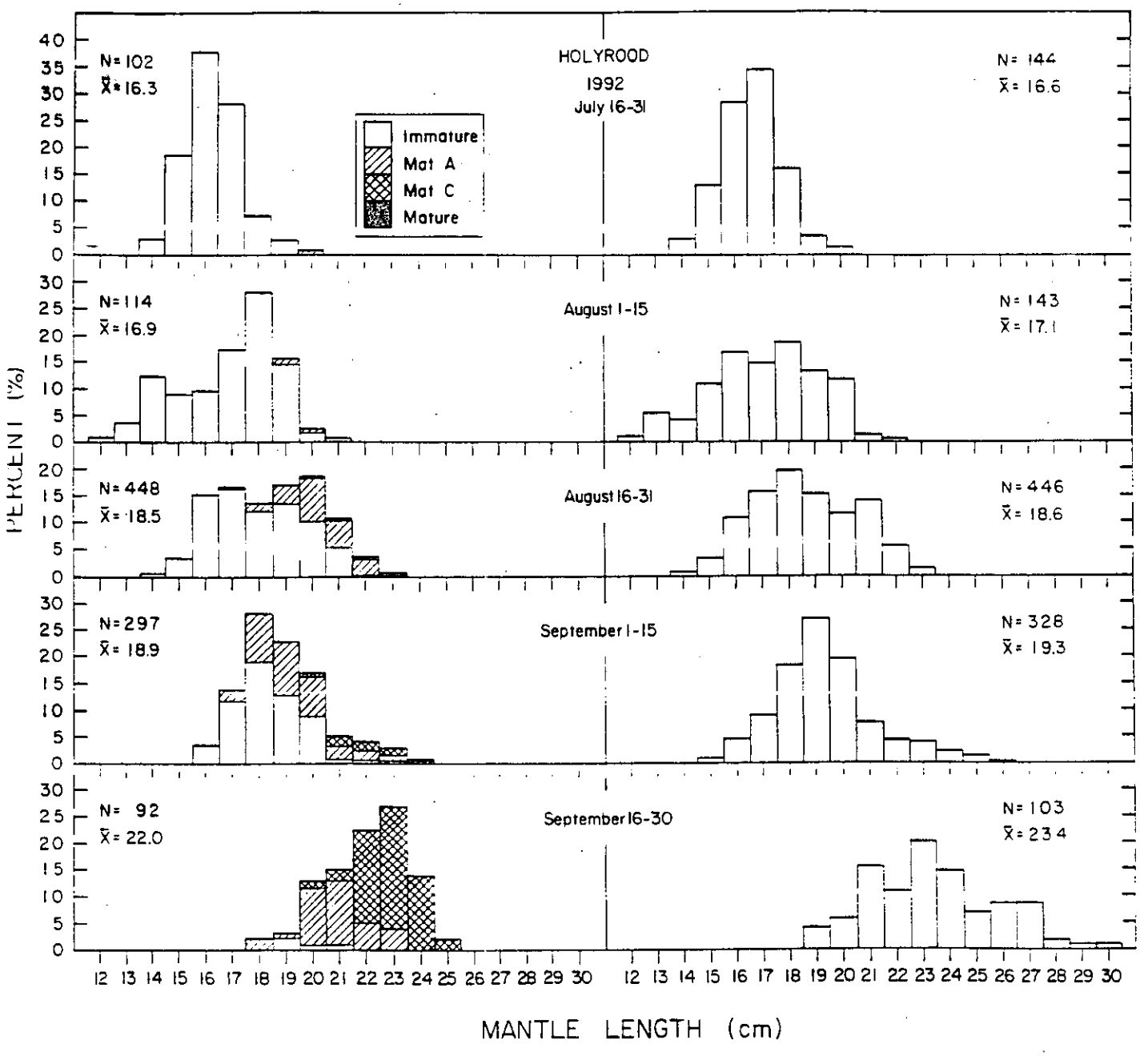

Fig. 6. Length-frequency distributions for males (left, with maturity overlain) and for females (right) by biweekly periods at Holyrood in 1992.

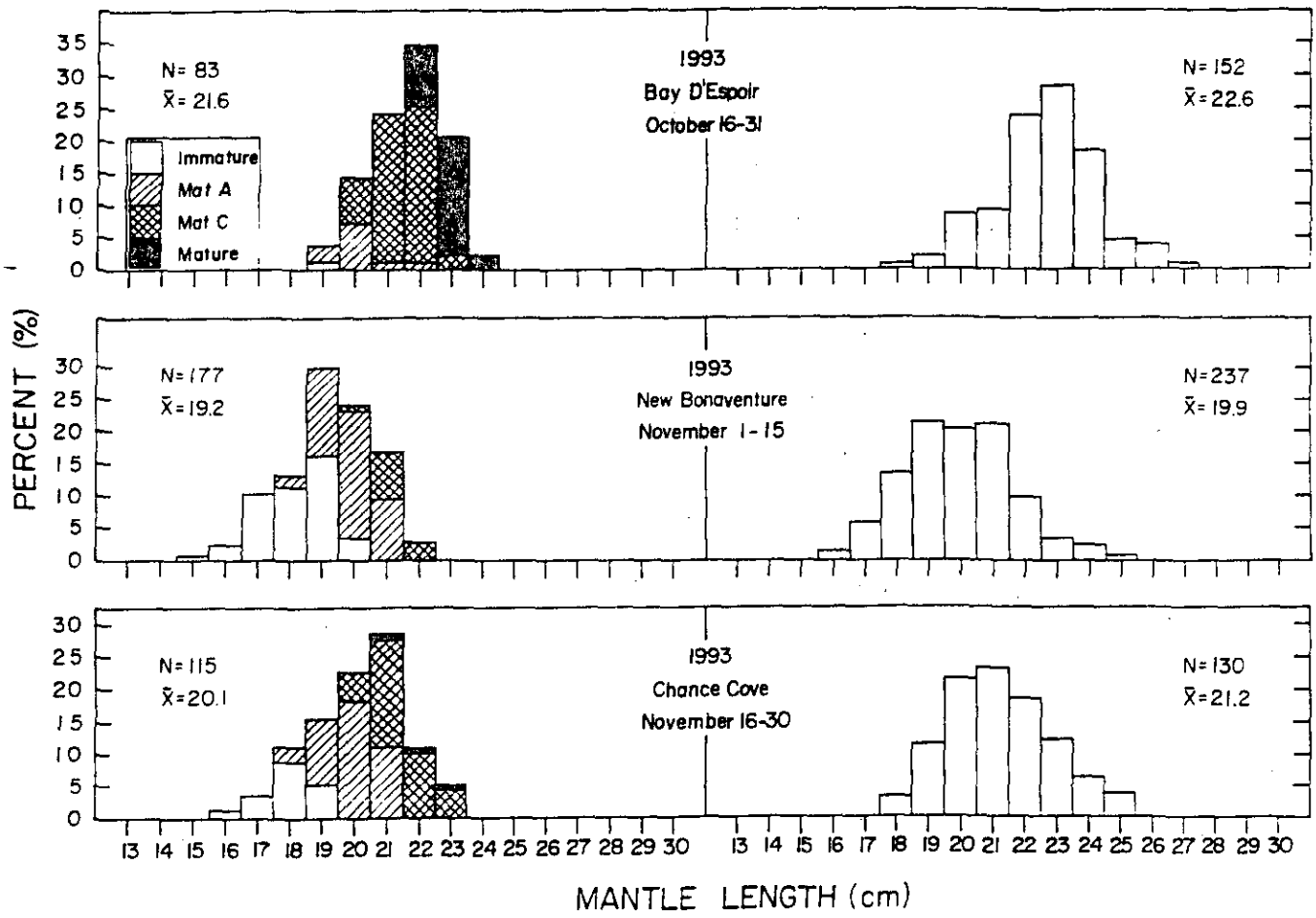

Fig. 7. Length-frequency distributions for males (left, with maturity overlain) and for females (right) by biweekly periods at Bay d'Espoir (top), New Bonaventure (middle) and Chance Cove (bottom) in 1993.

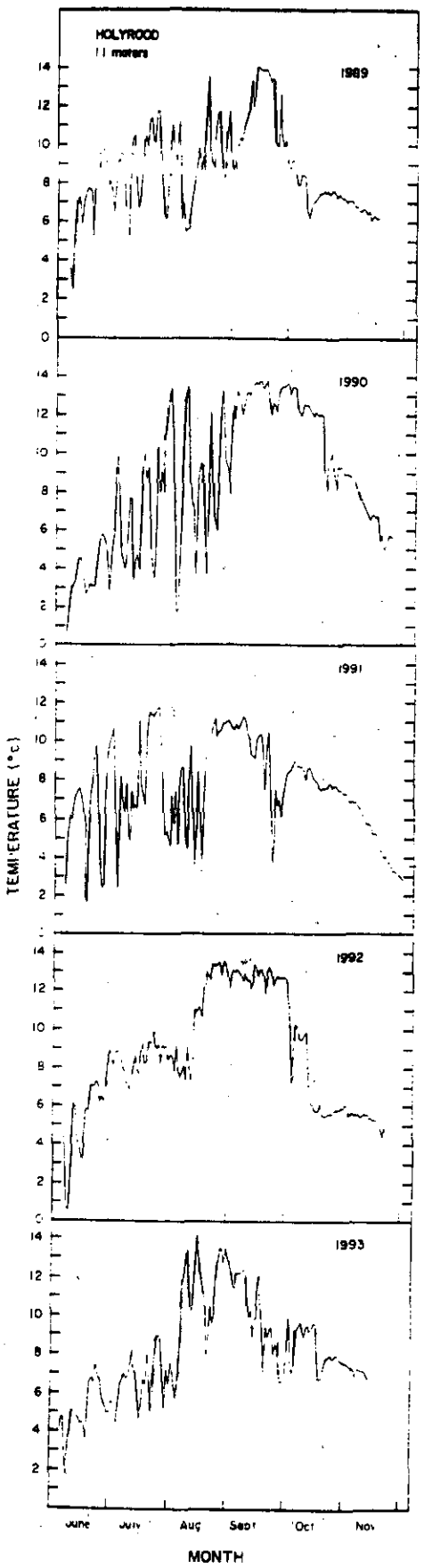

Fig. 8. Mean daily bottom (11 m) water temperatures at Holyrood throughout spring-autumn of 1989-93.