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**The Status of Rainbow Smelt Stocks in Scotia-Fundy Region
as Indicated by Catch and License Statistics**

by

**B.M. Jessop
Biological Sciences Branch
Department of Fisheries and Oceans
P.O. Box 550
Halifax, Nova Scotia
B3J 2S7**

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¹La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

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Abstract

The status of rainbow smelt (Osmerus mordax) stocks in Scotia-Fundy Region, from the perspective of available data on reported commercial fisheries landings and licenses (sport and commercial) issued, is one of much intraregional and annual variability in catch. Large catches are limited to a few large rivers such as the Saint John, Tusket, and La Have rivers. The statistical data base is insufficient to intensively analyze but regional reported catches have steadily declined in Nova Scotia since the mid-1960s and remained low and relatively constant in New Brunswick except for a short-lived increase in catch in the late 1980s. Catches by sport anglers and dipnetters may be substantial in some areas but are impossible to quantify.

Résumé

D'après les données dont on dispose sur les débarquements déclarés des pêcheurs commerciaux et sur les permis (de pêche sportive et de pêche commerciale) délivrés, les prises dans le stock d'éperlan arc-en-ciel (Osmerus mordax) de la région de Scotia-Fundy se caractérisent par une grande variabilité annuelle et intrarégionale. Seuls quelques grands cours d'eau, comme le Saint-Jean, la Tusket et La Have, produisent des prises élevées. Les statistiques sont insuffisantes pour effectuer une analyse en profondeur, mais les prises régionales déclarées ont constamment diminué en Nouvelle-Écosse depuis le milieu des années 1960 et sont demeurées faibles et relativement constantes au Nouveau-Brunswick, exception faite d'une brève remontée à la fin des années 1980. Les prises des pêcheurs sportifs et des pêcheurs au haveneau peuvent être importantes dans certaines régions, mais il est impossible de les quantifier.

Introduction

Rainbow smelt (*Osmerus mordax*) support small recreational and commercial fisheries in Scotia-Fundy Region. Concern has recently been expressed by fishermen and fishery managers about a perceived decline in the abundance of smelt. Recent biological data are unavailable for any smelt stock in the region; the only available information is the number of licenses (commercial and recreational) issued and reported landings (commercial fishery only) by Fishery Statistical District (FSD).

Historical Perspective

Rainbow smelt have been fished in the Maritimes since colonial times. The most important fishery occurs in the Miramichi River estuary; the fishery in Scotia-Fundy Region is relatively small. The development of a large smelt fishery in the Great Lakes during the late 1950s and early 1960s greatly reduced the importance of the Maritime fishery. Environmental degradation, including acid precipitation in geologically sensitive areas such as south-eastern Nova Scotia (Watt et al. 1983), may be of as much concern now as the obstruction of access to spawning areas by man-made barriers such as mill dams and culverts (smelt cannot ascend vertical drops exceeding 15-20 cm). There is no proof yet that low pH in rivers of Atlantic coastal Nova Scotia has reduced smelt populations in a manner similar to the reduction of Atlantic salmon stocks, but the effects of low pH are a plausible concern. Survival of smelt eggs was unaffected by exposure to pH values of 4.5 and 5.5 for 48 hours, but longer exposure decreased survival (Geffen 1990).

Biology

Rainbow smelt occur in anadromous and land-locked forms in Scotia-Fundy Region, although the anadromous form is more widespread and important (Scott and Crossman 1973; Scott and Scott 1988). Anadromous smelts are found in inshore coastal areas during summer; during autumn they enter bays, estuaries and the lower tidal reaches of rivers to feed through the winter months. Smelt ascend streams in the spring shortly after ice-out. Spawning occurs mainly at night at water temperatures of about 4-9 °C, may last for 2-3 weeks, and may utilize a variety of habitats from swift currents to low-flow pools and of substrates from silt to gravel to rock ledge. The eggs, which sink to the bottom, become attached via a holdfast and may form dense mats, hatch after 2-3 weeks depending upon water temperature. After hatch, larval smelt drift downstream to a lake or estuary where they grow during summer. Estuarine growth of anadromous smelt can be rapid, with lengths of 5-6 cm reached by autumn. Sexual maturity and first spawning occurs at age-2 or -3, the ages which dominate the fishery; maximum ages are 5-6 years. Smelt are predators that feed generally on crustacean zooplankton and opportunistically on insects, other aquatic invertebrates, and small fish. Smelt are prey to a variety of predators, particularly several sport-fish species.

Catch and License Statistics

Catch (reported landings, more properly sales) statistics (1960-1992) for rainbow smelt in each Fishery Statistical District (FSD) in Scotia-Fundy Region (Figure 1) indicate that only a few FSDs report substantial catch and that the catches in productive areas have declined to very low levels in recent years (Table 1; Figure 2). Catch statistics are of variable accuracy and completeness. Catches may be landed or sold in an FSD different from the one where capture occurred, and records were maintained with varying thoroughness. The mid-1980s saw a reduction in the attention given to the collection of sales slip information and Supplementary B report submission because Fishery Officer resources were reallocated to other priorities. Consequently, the catch statistics should be interpreted with caution, particularly after the early 1980s. The recreational harvest is believed to exceed that of the commercial fishery in some areas but recreational catch quantities are unknown.

Commercial fishing gear includes trap (bag and box) and gill nets; recreational fishing is primarily by unlicensed angling or dip-net methods but recreational trap- and gill-net licences are also issued. Categorization of trap- and gill-net licenses as commercial or recreational seems somewhat haphazard because instances occur of commercial sale by fishermen with recreational licenses and with unlicensed angling gear.

Catch Trends

From 1960 to 1992, reported catches of rainbow smelt in Scotia-Fundy Region have fluctuated between about 1 and 75 t. The anomalously high 1967 reported catch of 197 t in FSD 81 (Table 1) has been omitted from further consideration because it is undoubtedly in error. Catches by sport anglers and dipnetters may be substantial in some areas but are impossible to quantify.

Within Scotia-Fundy Region, catches in New Brunswick remained low and stable until a rise in the mid-1980s and decline in the late 1980s; catches in Nova Scotia have declined rather steadily since a peak in 1967 (Figure 1). Trends in smelt catch differ among rivers in which substantial fisheries exist (Figure 2), which indicates a discreteness among river stocks (smelt are believed to be limited in their coastal migrations and to home to a natal river) and geographic differences in the prosecution of the fishery. Within the Saint John River, the harbour and upriver fisheries both report increasing catches during the late 1980s, a peak in 1988, then a decline to the recent low level (Figure 3).

License Statistics

The number of licenses issued in each FSD for gill and trap nets has remained relatively stable in recent years (Tables 2 and 3). The number of gear units actually fished is unknown (a license issued is not necessarily a gear unit fished and more than one gear unit or type may be authorized on a single licence). Gill nets are the preferred licensed gear for commercial and recreational fisheries. Commercial trap nets are common only in FSDs 4, 42, 43, 48, and 55 whereas recreational trap nets are common in FSDs 9, 42, and 43. In some FSDs, recreational gill net licenses greatly outnumber commercial licences, e.g., FSD 9; in other FSDs, recreational and commercial licenses are about equal in number, e.g., FSD 8, but in most FSDs, commercial licenses outnumber recreational licenses, e.g., FSDs 19, 20, 26, 33, 34, and 48.

Conclusions

Substantial variability has occurred in annual reported catches of rainbow smelt within Scotia-Fundy Region. Reported catches in the last three years have been at the lower limit of the historical catch range. Anecdotal comments about some rivers, e.g., Tusket, have concluded that stocks are seriously depleted, whereas in other rivers, e.g., Saint John, the stock is viewed as low but stable. The statistical base is insufficient to analyze intensively. Catches may well be low in many areas but conclusions as to stock status cannot be reliably made. Market conditions, fishing effort, the recreational catch and the degree of environmental effect in some areas are unknowns that complicate any analysis. Having said that, the conservative approach would be to accept that the decline in reported catch represents a true decline in stock abundance sufficient to justify a degree of effort restriction on both commercial and recreational fisheries. Restrictions could be limited to those rivers that are believed most in need of stock rebuilding rather than applied regionally.

References

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Table 1. Annual smelt landings (t), by Fishery Statistical District (FSD), for Scotia- Fundy region (Nova Scotia and New Brunswick), 1960-1992. Dash indicates either no catch or no reported catch.

Fisheries Statistical District																															
Year	1	4	6	7	8	9	14	15	16	17	19	20	21	23	24	25	26	27	28	30	31	33	34	38	39	48	49	51	55	81	
1960	1	<1	<1	3	2	3	8	-	<1	9	3	-	-	-	-	<1	2	<1	-	-	-	1	1	-	-	-	1	-	-	-	
1961	1	2	1	3	4	7	7	-	<1	4	3	2	1	<1	-	<1	1	<1	<1	<1	-	7	2	-	-	1	<1	<1	-	-	
1962	1	8	1	1	<1	9	5	-	1	7	3	8	2	-	-	1	<1	<1	<1	<1	-	5	<1	-	<1	-	-	-	-	-	
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1965	3	-	-	-	2	6	<1	-	1	5	6	4	<1	-	-	1	1	<1	<1	<1	-	4	-	-	-	2	<1	-	-	-	
1966	2	4	8	<1	6	3	-	-	<1	9	8	11	-	-	-	<1	<1	5	<1	<1	5	5	-	-	-	<1	<1	-	-	-	
1967	1	2	1	-	4	3	-	-	1	10	10	-	1	-	-	<1	2	2	-	<1	-	4	<1	-	-	5	-	-	-	197 ^a	
1968	2	4	3	-	5	4	-	-	<1	4	8	-	<1	-	-	<1	3	5	-	-	2	13	<1	-	<1	<1	-	-	-	-	
1969	<1	3	2	<1	3	1	-	-	<1	5	3	-	-	-	-	<1	3	2	-	-	-	4	-	-	-	<1	1	-	-	-	
1970	1	2	-	<1	2	1	-	-	<1	4	2	-	-	-	-	<1	4	1	-	1	-	9	-	-	-	<1	-	-	-	-	
1971	-	4	<1	-	2	6	-	-	<1	2	3	-	-	-	-	<1	2	-	-	2	-	15	-	-	-	-	<1	-	<1	<1	
1972	<1	4	<1	-	1	2	-	-	<1	4	5	-	-	-	-	<1	2	1	-	1	-	3	-	-	-	<1	-	-	-	-	
1973	5	2	-	-	1	2	-	-	<1	4	6	-	<1	-	-	1	2	1	-	1	1	6	-	-	-	1	6	-	-	-	
1974	-	4	2	-	<1	2	-	-	<1	7	3	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-	<1	
1975	-	7	<1	<1	<1	<1	-	-	<1	9	6	-	<1	-	-	<1	<1	<1	-	-	-	6	-	-	-	1	<1	-	-	-	
1976	<1	4	-	-	-	6	-	-	<1	3	7	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	
1977	-	5	-	<1	<1	2	-	-	<1	5	5	-	-	-	-	-	<1	<1	-	-	-	-	-	-	-	<1	<1	-	-	-	
1978	-	4	-	1	<1	5	-	-	<1	1	3	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
1979	<1	1	-	<1	-	1	-	-	-	1	6	-	-	-	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-	
1980	-	1	-	-	-	-	-	-	-	4	11	-	<1	-	-	-	<1	<1	-	3	-	-	-	-	-	-	-	-	-	-	
1981	-	4	1	<1	-	-	-	-	<1	5	10	-	-	-	-	-	<1	-	-	1	-	-	-	1	-	-	-	-	11	-	
1982	-	3	-	1	-	-	-	-	-	1	<1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	<1	<1	-	-	-	
1983	-	1	-	<1	-	-	-	-	-	1	<1	-	-	-	-	<1	-	2	-	<1	-	-	-	-	-	-	-	-	6	-	
1984	-	6	-	<1	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	5	-	
1985	-	3	<1	1	-	-	-	-	-	<1	<1	-	-	-	-	2	4	3	-	3	-	-	-	-	-	-	-	-	5	-	
1986	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	22	-	
1987	-	4	-	-	-	-	-	<1	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	16	-	
1988	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	30	-	-	
1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	1	-	15	-	
1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	1	-	
1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	<1	<1	-	-	-	
1992	-	2	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	

^aValue regarded as erroneous.

Table 2. Number of commercial rainbow smelt licences issued, by gear type (gill and trap net), and Fishery Statistical District (FSD), 1988-1992. More than one gear type may be issued per license; the total number of licenses issued may be less than the sum of gill and trap licenses. FSDs where trap nets are not listed had no licenses issued for this gear type.

FSD	Net type	Year				
		1988	1989	1990	1991	1992
1	Gill	2	0	0	0	3
3	Gill	1	2	2	3	2
4	Gill	5	4	3	6	9
	Trap	7	7	7	7	6
6	Gill	10	9	10	16	10
	Trap	0	0	0	0	1
7	Gill	5	8	6	10	13
8	Gill	4	3	4	6	4
9	Gill	20	20	16	16	16
	Trap	0	1	0	0	0
14	Gill	2	3	3	2	1
15	Gill	5	7	4	8	8
16	Gill	4	3	3	2	2
17	Gill	14	15	17	16	19
	Trap	1	1	1	1	2
18	Gill	1	1	1	1	3
19	Gill	36	39	37	39	31
	Trap	0	1	0	1	2
20	Gill	27	34	36	45	45
21	Gill	1	0	0	0	0
22	Gill	1	1	1	1	1
23	Gill	2	1	1	0	1
24	Gill	2	1	2	2	2
	Trap	1	0	0	0	1
25	Gill	3	3	3	4	4
26	Gill	43	38	37	39	32
	Trap	1	1	0	0	0
27	Gill	18	20	18	17	16
28	Gill	12	13	10	9	7
30	Gill	8	8	12	11	8
31	Gill	11	10	10	11	9
32	Gill	2	2	1	2	1
	Trap	1	1	1	1	1
33	Gill	11	11	9	15	14
	Trap	0	0	0	1	1
34	Gill	7	7	8	9	14
38	Gill	0	0	0	0	1
41	Gill	1	0	0	0	0
42	Gill	8	9	10	10	10
	Trap	3	3	3	3	3
43	Gill	6	5	4	4	3
	Trap	5	5	4	4	0
48	Gill	24	26	32	32	32
	Trap	5	4	5	4	5
49	Gill	3	3	3	5	6
51	Gill	2	3	2	6	3
55	Gill	5	4	4	4	4
	Trap	6	5	5	5	5
79	Gill	0	1	1	1	1
80	Gill	1	1	1	1	1
	Trap	1	1	1	1	1

Table 3. Number of recreational rainbow smelt licences issued, by gear type (gill and trap net), and Fishery Statistical District (FSD), 1988-1992. More than one gear type may be issued per license; the total number of licenses issued may be less than the sum of gill and trap licenses. FSDs where trap nets are not listed had no licenses issued for this gear type.

FSD	Net type	Year				
		1988	1989	1990	1991	1992
1	Gill	4	7	7	9	4
	Trap	0	0	1	0	0
3	Gill	1	0	0	0	1
4	Gill	3	1	1	2	2
6	Gill	31	26	21	34	26
7	Gill	11	10	14	17	15
8	Gill	2	3	5	2	5
	Trap	1	1	0	0	0
9	Gill	97	96	96	83	59
	Trap	1	2	2	1	1
14	Gill	9	8	7	7	3
15	Gill	7	9	11	8	9
16	Gill	2	3	0	1	1
17	Gill	10	17	22	18	18
19	Gill	17	20	16	22	14
20	Gill	25	19	20	26	12
21	Gill	4	2	1	3	1
22	Gill	0	2	4	3	1
23	Gill	1	2	2	0	2
24	Gill	1	0	0	0	0
25	Gill	15	13	16	16	8
26	Gill	20	21	19	29	23
	Trap	0	0	0	0	1
27	Gill	4	2	5	3	3
28	Gill	1	1	1	2	1
30	Gill	0	1	0	0	0
31	Gill	0	0	0	0	1
32	Gill	0	1	1	2	2
33	Gill	1	2	1	5	3
34	Gill	1	1	1	1	1
36	Gill	0	0	0	0	1
40	Gill	0	0	0	0	1
41	Gill	0	0	0	2	3
	Trap	0	0	0	0	1
42	Gill	3	3	3	6	3
	Trap	0	0	3	4	1
43	Gill	1	1	0	1	0
	Trap	2	2	1	0	0
44	Gill	0	0	0	1	3
	Trap	0	0	0	1	0
51	Gill	1	0	0	0	0
55	Gill	1	0	0	0	0

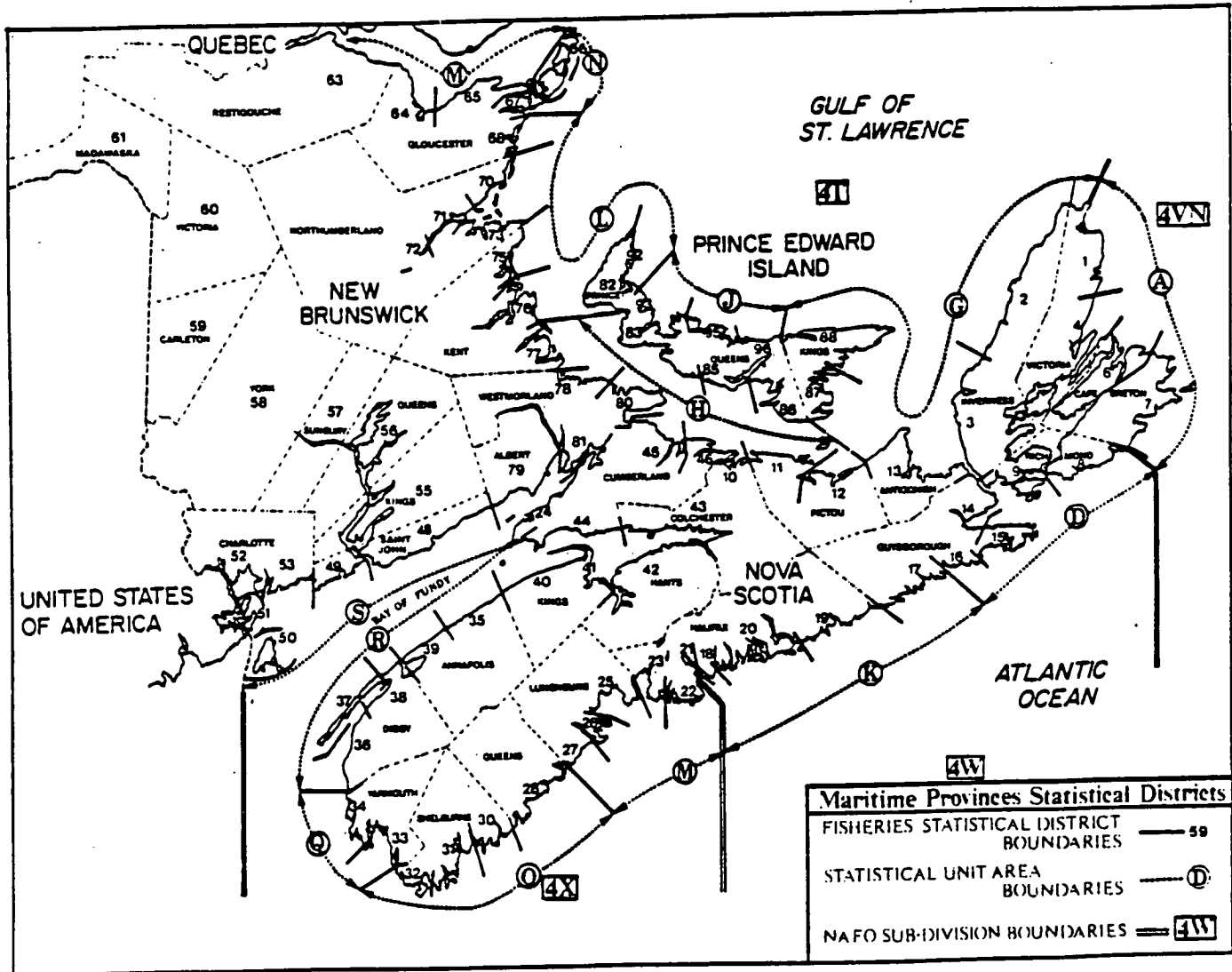


Figure 1. Maritime Provinces Statistical Districts.

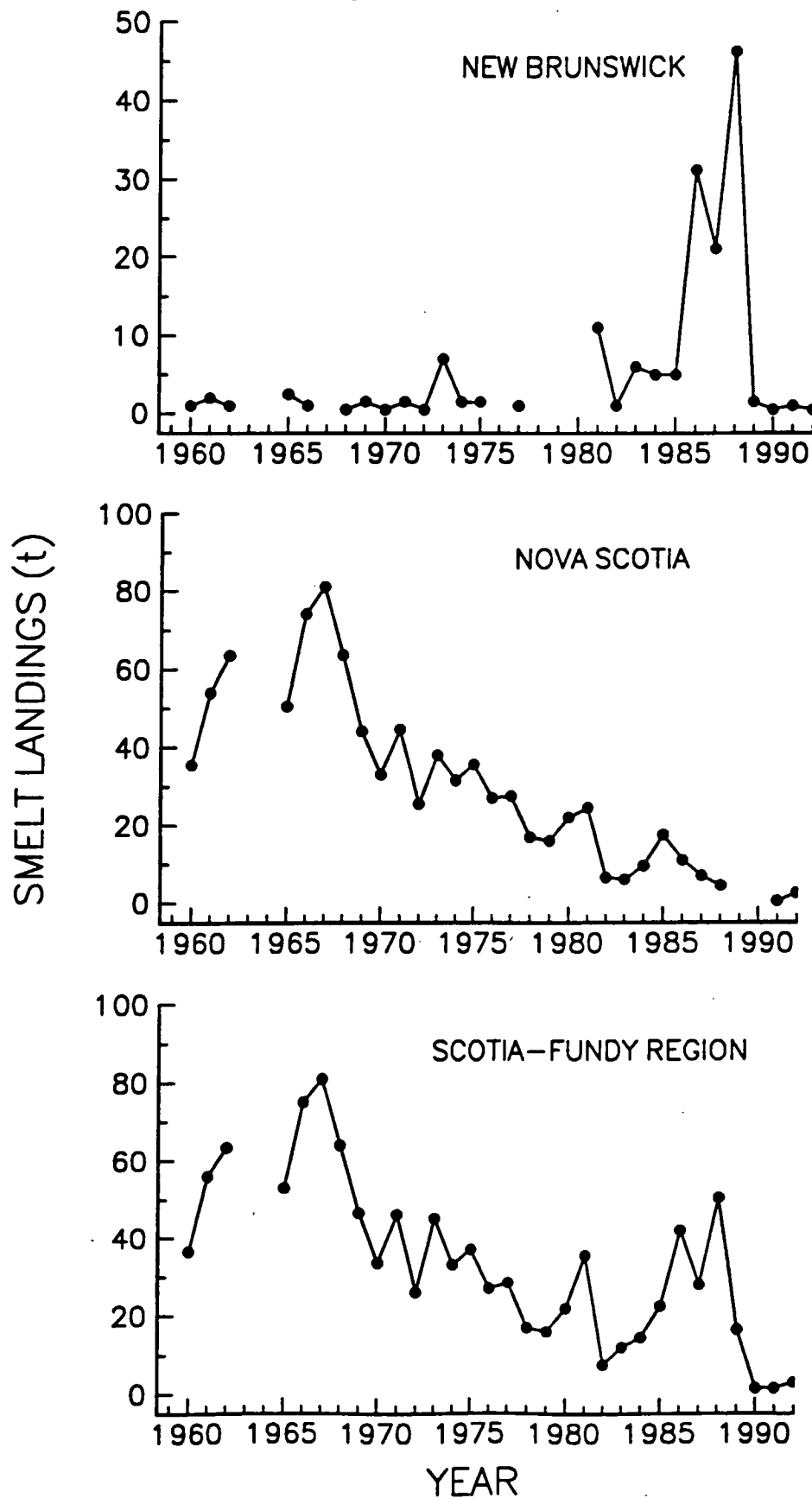


Figure 2. Reported landings (t) of rainbow smelt in Scotia-Fundy Region and by province (New Brunswick, Nova Scotia) within region, 1960-1992.

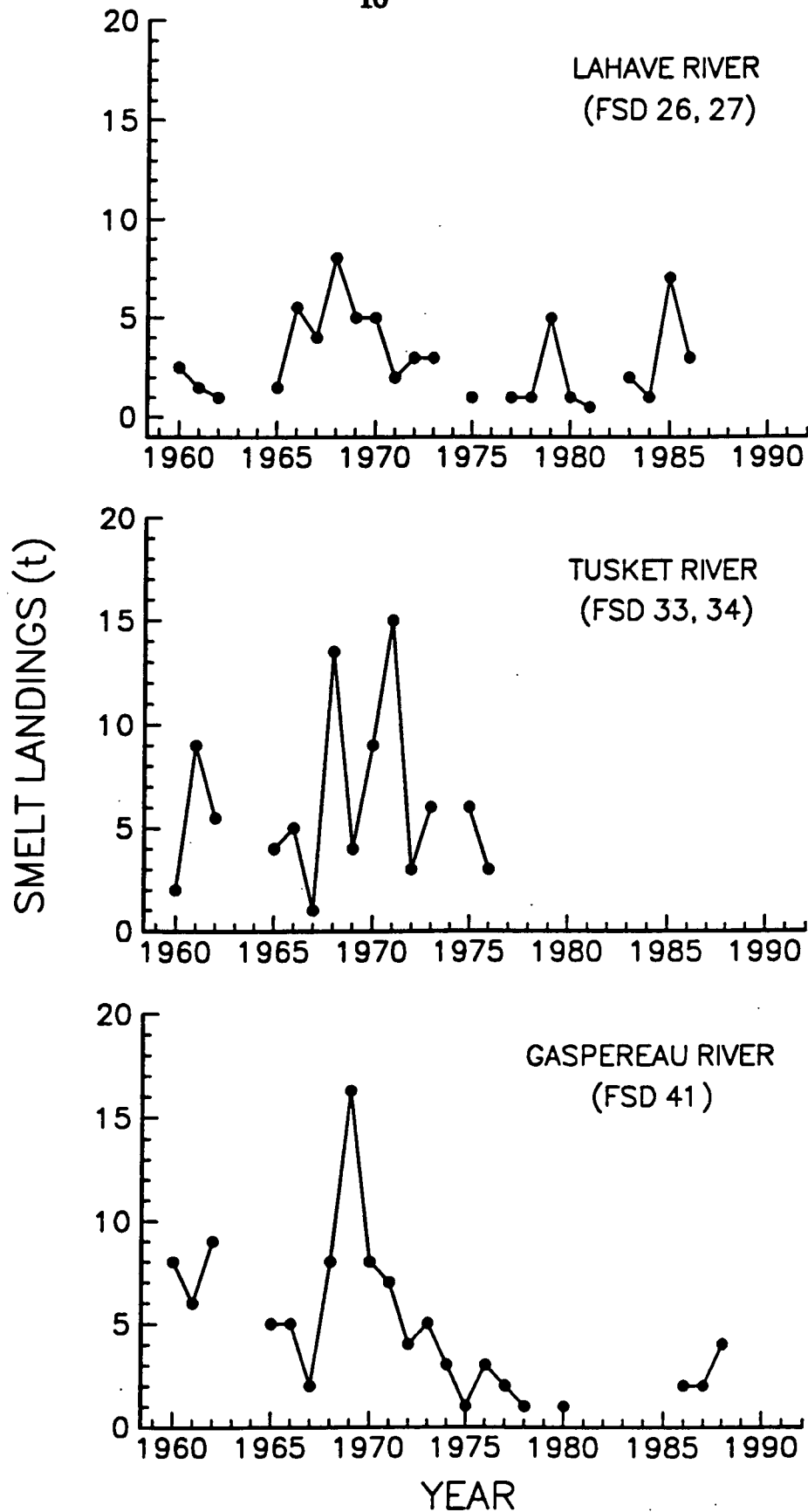


Figure 3. Reported landings (t) of rainbow smelt in the LaHave, Tusket, and Gaspereau rivers within Scotia-Fundy Region, 1960-1992.

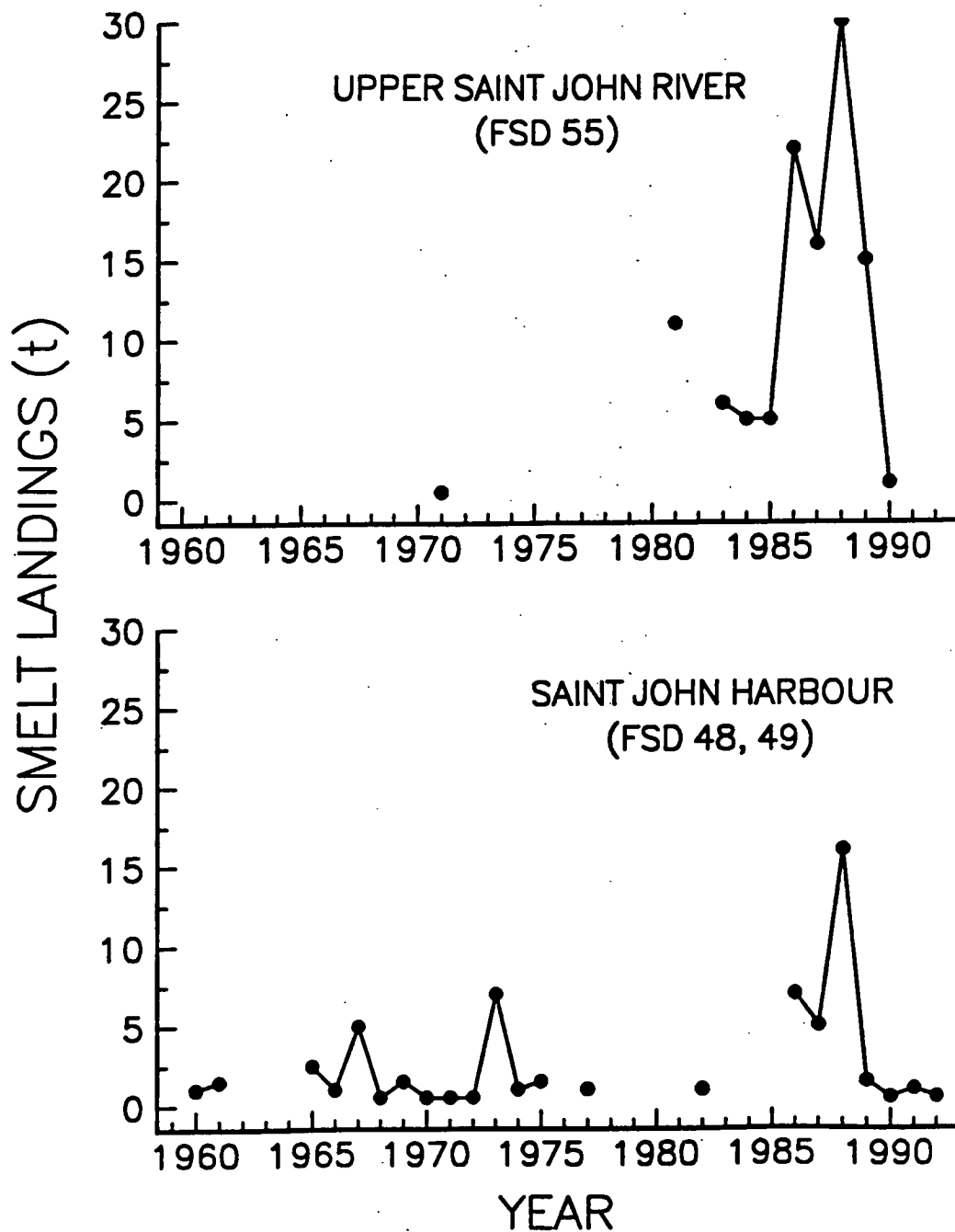


Figure 4. Reported landings (t) of rainbow smelt in the harbour and in the upriver areas of the Saint John River, Scotia-Fundy Region, 1960-1992.