

Department of Fisheries and Oceans
Canadian Stock Assessment Secretariat
Research Document 97/74

Ministère des pêches et océans
Secrétariat canadien pour l'évaluation des stocks
Document de recherche 97/74

Not to be cited without
permission of the authors¹

Ne pas citer sans
autorisation des auteurs¹

A Biological Review of Commercial Diadromous Fishes of Prince Edward Island

David K. Cairns

Science Branch
Department of Fisheries and Oceans
Box 1236
Charlottetown
Prince Edward Island C1A 7M8
cairnsd@mar.dfo-mpo.gc.ca

¹ This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

¹ La présente série documente les bases scientifiques des évaluations des ressources halieutiques 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.

Research documents are produced in the official language in which they are provided to the Secretariat.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

Table of Contents

Abstract	iii
Résumé	iii
Introduction	1
Eels	1
Gaspereau	3
Silversides	4
Smelts	5
Shad	7
Tomcod	7
Sturgeon	7
Acknowledgments	7
Literature cited	7
Tables	10
Figures	29
Appendix	53

List of Tables

Table 1. Regulations governing non-salmonid diadromous fisheries on Prince Edward Island.....	10
Table 2. Number of fishermen holding licences for commercial diadromous species on PEI	11
Table 3. Number of gears permitted to PEI eel, gaspereau, silverside, and smelt licence-holders.....	12
Table 4. Frequency distribution of number of gears permitted to PEI eel, gaspereau, silverside, and smelt licence-holders	13
Table 5. Reported landings of PEI non-salmonid commercial diadromous species, 1917-1996	14
Table 6. Reported landings and landed values of eels on PEI	16
Table 7. Estimated recreational harvest of eels and smelts on PEI.....	17
Table 8. Catch rates of non-salmonid diadromous fishes on PEI.....	18
Table 9. Densities of eels from electrofishing surveys on the Morell River.....	20
Table 10. Reported landings and landed values of gaspereau on PEI.....	21
Table 11. Reported landings and landed values of silversides on PEI.....	22
Table 12. Age distribution of silversides in 1996.....	23
Table 13. Counts of smelt nets and smelt shacks in winter in PEI.....	24
Table 14. Reported landings and landed values of smelts on PEI.....	25
Table 15. Reported landings and landed values of shad on PEI.....	26
Table 16. Reported landings and landed values of tomcod on PEI.....	27
Table 17. Reported landings and landed values of sturgeon on PEI.....	28

List of Figures

Fig. 1. Prince Edward Island, showing locations and numbers of smelt shacks and nets in winter 1995.....	29
Fig. 2. Locations and numbers of smelt shacks and nets in PEI in winter 1997.....	30
Fig. 3. Reported landings of commercial diadromous fishes on PEI, 1917-1996.....	31
Fig. 4. Catch rates of legal and undersized eels in trap-nets in 1996.....	32

Fig. 5. Number of eels moving downstream at Indian Bridge on the Morell River, 1995 and 1996.....	34
Fig. 6. Movements of eels through the Leards fishway, Morell River.....	35
Fig. 7. Counts of eels moving upstream at Leards Pond fishway, 1986-1996.....	36
Fig. 8. Densities and river-wide populations of eels on the Morell River, from electrofishing surveys.....	36
Fig. 9. Length frequencies of eels captured by electrofishing and in smolt traps on the Morell River.....	37
Fig. 10. Seasonal trends in gaspereau catch rates from trap-nets in Prince County, 1992-1996.....	38
Fig. 11. Upstream and downstream movements of gaspereau through the Dunk River fish fence in 1995.....	38
Fig. 12. Upstream and downstream movements of blueback herring at the West River counting fence, 1990.....	39
Fig. 13. Number of gaspereau heading upstream which were captured in the salmon trap in the lower Morell, 1994-1995.....	39
Fig. 14. Number of gaspereau moving downstream at the Indian Bridge smolt trap on the Morell River, 1996.....	40
Fig. 15. Upstream movements of gaspereau through the Leards fishway, Morell River, 1987-1996.....	41
Fig. 16. Daily rhythm of upstream and downstream gaspereau movements at the Dunk River fish fence, 1995.....	42
Fig. 17. Counts of gaspereau moving upstream at the Leards Pond fishway on the Morell River.....	43
Fig. 18. Catch rates of gaspereau in commercial trap-nets at a site in Prince County.....	43
Fig. 19. Length-frequencies of gaspereau captured at the fish fence on the lower Morell, 1994.....	44
Fig. 20. Catch rates of silverside traps from logbook records.....	45
Fig. 21. Length frequencies of silversides from commercial traps, 1996.....	46
Fig. 22. Silverside length-age relationship, from a stratified sample from Little Harbour.....	46
Fig. 23. Length frequencies of smelts on PEI.....	47
Fig. 24. Catch rates of smelts and winter flounder in trap-nets, fall 1996 and winter 1997.....	48
Fig. 25. Catch rates of smelts in trap-nets in Bedeque Bay, 1979-1996.....	49
Fig. 26. Upstream and downstream movements of smelts through the Dunk River fish fence in 1995.....	50
Fig. 27. Upstream and downstream movements of smelts at the West River counting fence, 1990.....	50
Fig. 28. Number of smelts moving downstream at Indian Bridge, 1995 and 1996.....	51
Fig. 29. Catch rates of smelt and tomcod in Bedeque Bay, 1979-1996.....	51
Fig. 30. Length-weight relationships of smelts sampled in commercial trap-nets in Bedeque Bay.....	52
Fig. 31. Smelt age-length relationship from Bedeque Bay, November 1996.....	52

Appendix

Appendix A. First page of PEI eel logbook form.....	53
---	----

Abstract

Prince Edward Island, with its shallow bays, broad estuaries, and short rivers, contains an abundance of favourable habitat for diadromous fishes. PEI's commercial diadromous species are the American eel (*Anguilla rostrata*), gaspereaue, (*Alosa aestivalis* and *A. pseudoharengus*), Atlantic silverside (*Menidia menidia*), rainbow smelt (*Osmerus mordax*), American shad (*Alosa sapidissima*), Atlantic tomcod (*Microgadus tomcod*) and Atlantic sturgeon (*Acipenser oxyrhynchus*).

Eels are fished commercially in spring by spearing and in fall by trap-nets, and recreationally by spearing through the ice. Reported landings have fallen by a factor of ten in the last decade. Catch rates in 1996, recorded by seven logbook fishermen, averaged 0.37 kg/trap-day. Electrofishing surveys on the Morell River suggest that eel densities have fallen sharply on that system since the 1970s and 1980s, but eel counts at Leards fishway on the same river fail to confirm a decline. Industry sources are unanimous that eel abundance has decreased, but current data are not sufficient to distinguish between recruitment reductions or growth overfishing as possible reasons for the decline.

Gaspereaue are fished by commercial licence-holders authorized to sell to others and by bait licence-holders who are permitted to catch gaspereaue as bait for their own use. Both fisheries operate during the spring spawning run. Gaspereaue landings in PEI are not known because catches used for bait are usually not registered with official statistics. The one available catch rate time series suggests a sustainable fishery at that site. However, this does not necessarily mean that the resource is healthy overall because rivers probably have separate stocks which can vary independently of each other. Given the sparseness of information on PEI's gaspereaue resource, a cautious approach to management is warranted.

Silversides are fished by trap-net in the fall, primarily in eastern PEI. Sticklebacks are commonly caught in silverside gear, and often force the suspension of fisheries because stickleback bycatches are not acceptable to buyers. Thus sticklebacks may provide an ecological refuge that reduces the risk that silversides will be overfished. Similarity between catch rates recorded in 1975 and 1995-1996 suggest that PEI's silverside fishery is sustainable.

Smelts are fished commercially in fall and winter by box and bag nets and by gillnets. They are also fished recreationally by spear, gillnet, and dipnet. Reported commercial landings in 1996 were 98 tons. Harvest by spearing, the main recreational gear, was estimated as 4.1 tons, using data from 1995 and 1997. A catch rate time series from Prince County suggests that the smelt fishery is sustainable at the site, but catch rates are unavailable from other areas. The PEI smelt fishery should be managed with caution.

There is no directed fishery for shad on PEI and no bycatch is recorded in most years. Substantial catches were taken in cod gillnets in 1991 and 1992. Tomcod is not subject to a directed fishery on PEI, but the species is regularly taken in the smelt fishery. Reported landings in the past several years are a small fraction those recorded in the 1970s, but the cause of this decline is not known. Atlantic sturgeon is taken sporadically and incidentally.

Résumé

Les baies peu profondes, les estuaires larges, et les rivières courtes de l'Île du Prince Édouard contiennent une abondance d'habitat favorable pour les poissons diadromes. Les espèces commerciales diadromes de l'ÎPÉ sont l'anguille d'Amérique (*Anguilla rostrata*), le gaspereaue (*Alosa aestivalis* et *A. pseudoharengus*), la capucette (*Menidia menidia*), l'éperlan arc-en-ciel (*Osmerus mordax*), l'alose savoureuse (*Alosa sapidissima*), le poulamon atlantique (*Microgadus tomcod*) et l'esturgeon noir (*Acipenser oxyrhynchus*).

La pêche commerciale de l'anguille se pratique au printemps à l'aide des harpons et en automne à l'aide des trappes. La pêche récréative hivernale utilise des harpons. Les débarquements rapportés ont chuté par un facteur de 10 durant la dernière décennie. Le taux des prises en 1996, enregistrés par sept pêcheurs-répères, étaient en moyenne 0.37 kg/trappe-jour. La pêche électrique dans la rivière Morell suggère une diminution marquée des densités des anguilles depuis les années 1970 et 1980. Pourtant des décomptes des anguilles dans la passe migratoire à Leards dans cette rivière ne confirment pas un tel déclin. L'industrie s'accorde pour dire que l'abondance des anguilles a diminué, mais les données actuelles ne sont pas suffisantes pour distinguer entre une réduction dans le recrutement et la sur-pêche de croissance comme raisons possibles pour le déclin en abondance.

Le gaspereaue est pêché par les détenteurs des licences commerciaux qui sont autorisés à vendre aux autres, et les détenteurs des licences d'appât qui sont permis de pêcher le gaspereaue pour leur propre usage comme appât. Les deux pêches se pratiquent durant la migration printanière. Les débarquements des gaspereaues à l'ÎPÉ ne sont pas connus parce que dans la plupart des cas les prises utilisées pour appât ne sont pas enregistrées en statistiques officielles. L'unique série de données sur le taux de prise suggère une pêche soutenable à ce site. Pourtant ceci n'indique pas nécessairement une ressource en bon état car les stocks dans les différentes rivières sont probablement indépendants, et ainsi pourraient varier de façon indépendante. Étant donné la pénurie d'information sur le gaspereaue de l'ÎPÉ, une approche conservatrice est demandée.

La capucette est pêchée par trappe en automne, surtout dans la partie est de l'ÎPÉ. Les épinoches sont souvent prises dans les engins utilisés pour la capucette et leur présence oblige souvent la cessation de cette pêche parce que les acheteurs n'acceptent pas les épinoches. L'épinoche fournit ainsi une sorte de refuge écologique qui réduit le risque d'une sur-pêche de la capucette. Les taux de prises enregistrés en 1975 et en 1995-1996 étaient similaires, qui suggère que la pêche de la capucette est soutenable.

La pêche à l'éperlan se pratique en automne et en hiver par les trappes et les filets maillants. L'éperlan est également pêché de façon récréative à l'aide des harpons, les filets maillants, et les épousettes. Les débarquements rapportés en 1996 étaient 98 tonnes. Les prises capturées à l'aide du harpon, l'engin récréatif principal, étaient estimées à 4.1 tonnes, en se servant des données récoltées en 1995 et en 1997. Une série de données sur le taux de prise dans le comté de Prince suggère que la pêche à l'éperlan à ce site est soutenable, mais les taux de prise ne sont pas disponibles aux autres sites. La pêche à l'éperlan devrait être gérée de façon conservatrice.

Il n'y a pas de pêche intentionnelle pour l'alose savoureuse et aucune prise accidentelle n'est enregistrée dans la plupart des années. Des prises substantielles, capturées dans les filets maillants à morue, étaient rapportées en 1991 et 1992. Il n'y pas de pêche intentionnelle pour le poulamon à l'IPÉ, mais l'espèce est régulièrement capturée durant la pêche à l'éperlan. Pour des raisons inconnues, les débarquements ne sont qu'une petite fraction de ceux rapportés durant les années 1970. L'esturgeon atlantique est pris de façon sporadique.

Introduction

The coastline of Prince Edward Island is characterized by shallow bays, broad estuaries, and short rivers. Given this favorable habitat, it is not surprising that diadromous fishes are a major component of PEI's aquatic fauna, and form the basis of significant fisheries.

PEI's commercial diadromous species are the American eel (*Anguilla rostrata*), blueback herring (*Alosa aestivalis*), the alewife (*A. pseudoharengus*), the Atlantic silverside (*Menidia menidia*), rainbow smelt (*Osmerus mordax*), American shad (*Alosa sapidissima*), Atlantic tomcod (*Microgadus tomcod*), and Atlantic sturgeon (*Acipenser oxyrinchus*). The term gaspereau refers collectively to blueback herring and alewives, which are not distinguished in the fishery. This paper reviews information on the biology and the fishery of these species on Prince Edward Island, including fishing patterns, landings, catch rates, historic abundance indices, and size and age structures.

Diadromous fishes were major food sources for natives prior to European contact, and soon became the target of fisheries prosecuted by European settlers (Wells 1986, Cairns 1995). Writing at the beginning of the 19th century, John Stewart (1967) described abundant stocks of diadromous fishes, and outlined their fishery by methods that would be familiar to modern observers. Eels, Stewart reported, were "in great plenty" and were speared in winter through the ice and in summer from boats with the aid of birch bark flambeaus. Stewart also noted eels' high market value, surpassing that of salmon. Gaspereau were common and widespread, and "great shoals" ascended the Hillsborough River in the beginning of June. They were netted in rivers and brooks in May and June. Smelt, found in "great abundance," were angled on baited hooks through holes in the ice, and scooped from brooks in April during their spawning run.

Despite their ecological and commercial importance, no non-salmonid diadromous species has been subject to a comprehensive life history investigation on PEI. However, much of the material in Chaput's (1995) account of diadromous fishes of the Miramichi River probably also applies to PEI. Chaput and LeBlanc (1991) review fisheries for estuarine species in the southern Gulf of St. Lawrence, including PEI, and LeBlanc and Chaput (1991) tabulate historic landings for these species.

Stock status reports for eels in the southern Gulf describe fishing methods and seasons on PEI, and provide data on licences and reported landings (Locke et al. 1995, Chaput and Locke 1997). Eales (1968) presents a list of PEI rivers where eels were fished. Eels are also subject to a recreational fishery on PEI, and sport harvest has been estimated through quinquennial mail-out surveys to licenced anglers (Thomson 1975; Anon. 1978, 1988, 1994; Smith and Brickley 1985). Smith and Saunders (1955) reported movements and standing stocks of eels in Eilerslie Brook, a small stream in western PEI. Biological data for eels in other Maritime provinces have been provided by Smith and Saunders (1955), Eales (1968) and Jessop (1987). Castonguay et

al. (1994 a,b) examine reasons for declining eel recruitment in the southern Gulf.

Dupuis et al. (1991) reported run timing of blueback herring in the West River, and Johnston and Cheverie (1988) described the planktonic ecology of their eggs and larvae in the river's estuary. Johnston (1980) noted the timing and importance of gaspereau eggs in brook trout (*Salvelinus fontinalis*) diet in the Dunk River. Data on gaspereau ecology and population dynamics in New Brunswick and Nova Scotia have been provided by Messieh (1977), Jessop (1990a,b; 1993) and Jessop et al. (1983).

Silversides stand apart from PEI's other diadromous fishes because significant fisheries for this species did not develop until the 1970s, and because the species is not fished elsewhere in Canada. The early silverside fishery on PEI was described by Lewis and Cavanagh (1973), Lewis et al. (1974, 1975), and Jessop and Morantz (1982). Cairns (1996) reported recent landings data and biological information on catches and catch rates for the 1995 fishing season. Jessop (1983) described silverside life history in the Annapolis River of Nova Scotia.

For smelts, Chaput and LeBlanc's (1996) stock status report for the southern Gulf updates landings for PEI. Cairns (1989) reported the seasonal distribution of bycatch, gear types and fishing effort in the southern Gulf smelt fishery, as determined from responses to a mail-out survey. Recreational harvest of smelt has been estimated by quinquennial mail-out surveys (Thomson 1975, Anon. 1978, Anon. 1988, Anon. 1994). Dupuis et al. (1991) reported run timing of smelt in the West River, and Johnston and Cheverie (1988) described the planktonic ecology of their eggs and larvae in the West River estuary. Johnston (1980) noted the timing and importance of smelt eggs in brook trout diet in the Dunk River. McKenzie (1964) provides a detailed life history of the species in the Miramichi River.

Eels

Description of fisheries

Eels are subject to both commercial and recreational fisheries on Prince Edward Island (Figs. 1 and 2). The spring commercial season opens on 1 April by administrative policy and closes on 30 June by regulation (Table 1). During this season, eels are speared at night under intense lights powered by gasoline-burning generators, a practice known as flambeauing. The fall commercial season runs from 16 August to 31 October. Both trap-nets (fyke nets) and pots are authorized during this season. However, only trap-nets are used during the fall season, and holders of pot licences fish trap-nets in their place. An unlicenced recreational fishery opens by regulation on 1 January and closes by administrative policy on 30 March. This fishery is prosecuted by spearing through holes in the ice.

A minimum size of 46 cm has applied to both commercial and recreational eel fisheries since the 1970s. The rationale for imposition of this limit is unknown. There is no fresh-water fishery for eels on

Prince Edward Island, although regulations allow for a pot fishery in fresh water.

In 1996, 978 commercial eel licences were issued on PEI, including 93 licences issued to native bands (Tables 2 and 3). Eel licences more than tripled from 1992 to 1994, following the imposition of a licencing requirement on the spear fishery, which was previously unlicensed.

A total of 5,043 traps and pots and 842 spears is authorized for use in PEI's commercial eel fishery (Table 3). The number of participants in the recreational fishery is unknown because licences are not required. Two hundred and eight fishermen are licenced for traps, most of whom are authorized to use between 10 and 40 traps (Table 4). A total of 842 licences is authorized for spearing, of which 629 are permitted this gear type only. Industry sources indicate that the majority of licences in both the trap and spear sectors are inactive. Eel traps and pots must bear tags, which fishermen pick up at the DFO Area Office in Charlottetown. Forty-five percent of those authorized to fish traps and pots in 1996 picked up their tags (Table 3).

Fisheries and assessment data

Harvests. Fisheries landings data are collected on Prince Edward Island by collating purchase slips which record quantity and value of sales by fishermen to registered buyers. There is no official record of landings which are sold to unregistered buyers or retained for personal consumption or for use as bait. Such landings are estimated by field personnel on Supplementary B slips. Prior to 1995, purchase slips were collected from PEI buyers by PEI-based staff, and Supplementary B estimates were provided by DFO Conservation and Protection officers. Beginning in 1995, mainland-based staff collect purchase slips from buyers during biweekly visits to PEI. These staff are also responsible for Supplementary B estimates. However, they may be less well positioned to estimate unregistered catches because their duties do not bring them into contact with fishermen.

Reported eel landings on Prince Edward Island have been declining since the 1980s (Table 5, Fig. 3). Reported landings in 1996 were 10.6 tons, less than one tenth of the level reported in the early 1980s. The chief fishing area on PEI is Statistical District 93 (Malpeque Bay and vicinity; Table 6). Seasonal distribution of reported landings has varied considerably among years, but in 1995 and 1996 most landings were reported from the fall trap season (Table 6).

Prices for eels have increased substantially in recent years (Table 6). Industry sources indicate that participation in the eel fishery has declined in recent years because catch rates have declined to the point that fishing is no longer profitable at many locations, despite the high prices.

National mail-out surveys of sport anglers have been conducted every five years since the 1970s. On Prince Edward Island, these surveys cover holders of trout angling licences. In 1995, this group harvested an estimated 4,536 eels from PEI waters (Table 7). Based on the mean weight of eels greater than 46 cm long sampled from commercial traps in fall 1997 (385.1 g),

this harvest is equivalent to 1.7 tons, or 5.1% of combined commercial and recreational landings for that year. Recreational harvest estimates for previous years ranged from 2,481 to 79,100 eels.

Abundance indicators. In 1996, seven eel trap fishermen recorded catch and effort data from 10,504 trap-days at 18 sites (Table 8, Fig. 4, log form in Appendix A). Location of fishing sites is not indicated to preserve fisherman confidentiality. At most sites, fishing began at the beginning of the fishing season (16 August), but traps were pulled from several areas by early October following declines in catch rates. Catch rates dipped at most sites in the few days before and after a full moon, in accordance with anecdotal reports by fishermen. Overall catch rate was 0.37 kg/net-day (Table 8).

Log-keepers also recorded captures of undersize eels (<46 cm) which they returned to the water. In general, catch rates of undersized eels showed parallel trends to those of legal eels, with a decline in October, and with dips around full moons (Fig. 4). Overall catch rate was 0.69 undersize eels/trap-day. Log keepers unanimously reported that catch rates of undersize eels were higher than in previous years.

Daily eel captures at downstream traps for Atlantic salmon (*Salmo salar*) smolts at Indian Bridge on the Morell River (Cairns et al. 1997) were highest in mid-May 1995 and late April 1996 (Fig. 5). However, this provides an incomplete picture of spring eel movements because of the short time periods during which the fences operated. At Leards Pond, upstream on the same river, eels were captured in a fishway trap that operates from June to October or later. Most captures occurred in August, but in 1996, captures occurred from July through September (Fig. 6).

Total eels captured at the Leards fishway varied irregularly from 1986 to 1995, but peaked with 10 captures in 1996 (see also Fig. 7).

Year	Number of eels
1986	1
1987	0
1988	1
1989	2
1990	3
1991	0
1992	5
1993	3
1994	0
1995	1
1996	10

However, the high number in 1996 does not necessarily mean increased movement, because a new trap was installed in that year which may have increased capture efficiency.

Eel densities have been measured during electrofishing surveys on the Morell in 1975, 1984-1985, and 1994-1996 (Table 9, Fig. 8). Measured densities averaged 6.0 (SD=6.3) eels/m² in 1975-1985 and 0.7 (SD=1.5) eels/m² in 1994-1996 (F=18.6, P<.0001; December 1994 and October-November 1995 densities

are excluded from this analysis because eels may be in wintering phase at this time). River-wide eel populations were estimated from densities at electrofishing sites and measurements of total river area (see Cairns 1997 for details). Estimated river populations totaled 741 in 1996 and 14,000-20,000 in the 1970s and 1980s.

Eels captured in Morell electrofishing surveys and at the Morell smolt trap were measured. Modal lengths were 20-25 cm for electrofished eels and 60 cm for trapped eels (Fig. 9). The greater lengths in trapped samples may reflect capture bias, as smaller eels were probably able to pass between the conduits of the smolt fence.

The trap-net fishery for eels commonly takes winter flounder as bycatch. Four log keepers recorded an overall bycatch rate of 0.29 winter flounder/net-day in 5,227 net-days, and two others recorded a rate of 0.55 kg/net-day in 2,950 net-days (Table 8). Other bycatch noted by log keepers included perch (likely either white perch or cunners), sticklebacks, hake, chubs, lobster, crab, tomcod, silversides, gaspereau, gudgeon (killifish or mummichogs), trout, and starfish.

Stock status

Fishable eel biomass on PEI depends on numbers recruiting to the 46 cm commercial size, the schedule of growth and survivorship in subsequent years, and age and size upon departure for the spawning grounds. Biomass available to the fishery also depends on movements to and from fresh water, where eels are not fished.

There is broad agreement in the industry that eel abundance on PEI has steeply declined in the last decade. A decline in eel abundance on PEI could be due to one or several of the following: i) a reduction in recruitment caused by physical oceanographic factors, ii) a reduction in recruitment due to excessive fishing that reduces production of young (recruitment overfishing) and iii) excessive exploitation of recruits before they can gain weight (growth overfishing). Pertaining to i), it has been proposed that changes in North Atlantic current systems may have depressed recruitment of young eels in the Gulf of St. Lawrence and the St. Lawrence River (Castonguay 1994 a,b). Regarding ii), it is unlikely that the PEI fishery could cause recruitment overfishing because PEI forms only a small fraction of the total stock.

The third possible factor, growth overfishing, cannot be evaluated because no data are available on age-specific growth and survivorship of eels in PEI waters. However, given the recent fishing pressure on what appears to be a small population, it is plausible that PEI eel populations have suffered from growth overfishing.

Research recommendations

Given that recruitment is beyond local control, management of PEI's eel resources should emphasize avoidance of growth overfishing. Age- and size-specific exploitation patterns that optimize total yield can be calculated through yield-per-recruit analyses. A complete yield-per-recruit analysis requires full growth, demographic, and migration schedules. However, even

partial information could probably provide a rough guide to optimum exploitation patterns of PEI eels. It is recommended that data necessary for a yield-per-recruit analysis be gathered, according to a descending order of priority as follows: population size structure, sex structure, age structure, age- and sex-specific survivorship rates, movement schedules between fresh and salt water, timing of departures to the spawning grounds, and elver counts to determine numbers of eels arriving in PEI waters.

Collection of catch rate information from logbook fishermen should continue.

Management considerations

The current lack of information on PEI eel populations precludes the provision of specific management advice. The increase in undersize eels reported by fishermen in 1996 may presage an improvement in recruitment to commercial size-classes. There is a large reserve of licenced but currently unused effort which could rapidly return to the fishery if recruitment increased. Hence it seems unlikely that increases in recruitment would result in substantial increases in fishable biomass. In general, PEI eel populations appear to be at low levels, and commercial and recreational exploitation should not be permitted to increase.

Gaspereau

Description of fisheries

Gaspereau are fished during their spring spawning runs into PEI rivers. The season is open from 30 April to 30 June, with the exception of week-ends between 2000 hours on Fridays to 0800 hours on Mondays (Table 1). These seasons apply to both commercial and bait licence-holders. Commercial licence-holders are authorized to sell to others, whereas bait licence-holders are permitted to fish gaspereau only for their own use as bait in other fisheries (usually the lobster fishery). Legal gears are trap nets, gillnets, and dip nets. However, dip net licence holders use sweep nets (beach seines), which are not authorized by regulations, to concentrate fish before dipnetting them. Bait licence holders are permitted to fish one gillnet.

Twenty-three commercial gaspereau licences are held on PEI (Table 2). The number of licences has been relatively steady during the 1990s, and no new licences are issued. Authorized gears for the commercial gaspereau fishery on PEI totaled 25 traps, 15 gillnets, and 9 dipnets in 1996 (Table 3). At least 660 fishermen held bait licences for gaspereau in 1996 (Table 2). Bait licences are available to commercial fishermen who require bait for their other fisheries. Previous possession of a bait licence is not required.

Fisheries and assessment data

Harvests. Reported gaspereau landings have fluctuated on PEI, with a peak of 464 tons in 1986 (Table 5 Fig. 3). However official landings data must be considered as minimum values as most landings are used for bait, and are not recorded on purchase slips. Supplementary B estimates were >50% of total landings

from 1985 to 1994, but fell to zero in 1995 and 1996 (Table 10). This decline is likely attributable to the re-assignment of Supplementary B estimations from local Conservation and Protection officers to mainland-based staff (see Eel section for description of statistical recording methods).

The majority of officially recorded landings come from the eastern part of PEI (Districts 87, 88, 96) (Table 10).

Abundance indicators. Gaspereau catch rates varied seasonally at commercial traps at a site in Prince County in 1992-1996 (Fig. 10), and at monitoring traps in the Dunk, West, and Morell Rivers (Figs. 11-15). The location of the Prince County site is not indicated to preserve fisherman confidentiality. The West River run was identified as exclusively blueback herring by repeated collection and examination of specimens (T. Dupuis, Atlantic Salmon Federation, pers. comm.). Species composition for other sites is not known.

Gaspereau were counted at the Dunk trap from dusk to about 0100 prior to 27 June, and 24 hours per day thereafter, in 1995. During light runs, movement rates were estimated by periodically fishing the trap. During heavy runs, movement rates were estimated by allowing fish to transit the fence via a shallow ramp where they were counted visually during minute-long sessions conducted every 10 minutes. Daily totals were estimated by applying measured movement rates to times when movements were not measured. Data are unavailable for 6-12 June because field sheets were lost.

Movements at the Prince County site, the Dunk fence, and the West River fence generally peaked in the latter half of June. Peak counts on the Morell varied from the first week of June to the first week of July. During the peak run at the Dunk fence, night-time movement was exclusively downstream whereas most daytime movement was upstream (Fig. 16).

Gaspereau movements through the Dunk fence in 1995 were estimated as 422,195 upstream and 1,093,227 downstream. It is possible that the lower upstream numbers are due to upstream migration during the gap in fence records between 6 and 12 June, which occurred just prior to the major period of recorded movements (Fig. 11). Given the incomplete fence data and the discrepancy between upstream and downstream estimates, the estimated downstream number is taken as a minimum estimate of the river's gaspereau run. Based on a mean weight of 188 g (from gaspereau trapnet catches in Bedeque Bay, June 1997), the recorded downstream run weighed 205.5 tons.

An estimated 40,000 blueback herring entered the West River in 1990 (Dupuis et al. 1991). Both Dunk and West estimates must be treated with caution because of difficulties in counting large numbers of fish during short time intervals, and because some fish entering fresh water may fall back and later enter again (Dupuis et al. 1991).

Annual totals of gaspereau ascending the Leards Pond fishway on the Morell River rose during the 1980s to peak in 1991, and then fell sharply (Fig. 17).

Year	Number of gaspereau
1987	15
1988	17
1989	34
1990	182
1991	423
1992	146
1993	52
1994	75
1995	7
1996	64

Commercial catch rates were recorded at a site in Prince County from 1992 to 1996. Catch rates peaked in 1994 at 264 kg/trap-day before falling to 160 kg/trap-day in 1995 and 1996 (Table 8, Fig. 18).

Modal lengths of gaspereau captured at the lower Morell fish fence in 1994 were 23-25 cm (Fig. 19).

Stock status

The data presented in this report present a very incomplete picture of gaspereau stocks on Prince Edward Island. In particular, the absence of full landings data and the lack of species identification preclude meaningful conclusions regarding the state of the resource. The single available commercial time series suggests that catches are sustainable at that site. However, because anadromous fishes typically form individual stocks for each river they occupy, trends in one river do not necessarily indicate status of the resource in other rivers. In one river, the Fortune, industry sources report that the gaspereau run disappeared after several years of intense fishing pressure. Gaspereau stocks are undoubtedly vulnerable to local extinction, but it is not known how many PEI rivers have lost their runs due to overfishing.

Management considerations

In view of the limited information on PEI's gaspereau resources, the fishery should be managed with caution, and measures that would increase exploitation should be avoided.

Silversides

Description of fisheries

Silversides are fished in tidal waters by trap nets between 30 September and 31 December (Table 1). There are currently 103 licences to fish silversides on PEI (Table 2). The number of licences rose sharply in 1994 when strong stocks and market demand attracted interest to the fishery. Entry into the fishery has been frozen since 1994. A total of 145 traps is authorized in the silversides fishery (Table 3). Industry sources indicate that only a small fraction of licences are active.

The major market for PEI silversides is food for exotic birds in U.S. zoos.

Fisheries and assessment data

Harvests. Early catches for silversides were sporadic and went unrecorded in official statistics. The modern

silverside fishery began in 1973, when first beach seines, and then traps, were used to capture fish in a coastal pond (Lewis et al. 1975). Landings have fluctuated irregularly since that time. An anomalous peak (543 tons) occurred in 1994, when industry sources indicate that silversides were unusually abundant (Table 5, Fig. 3). Reported landings in 1996 were 151 tons.

The silverside fishery is concentrated in Statistical District 88 at the eastern end of PEI, particularly the Souris-Little Harbour area where the modern fishery began. This district has produced a mean of 72% of provincial landings since 1973 (Table 11). In 1996, Districts 87 and 88 contributed similar landings (65 and 66 tons, respectively), with most of the remaining landings coming from District 92. Most silversides are landed in October and November. Normally all silversides are sold to plants. No Supplementary B landings have been reported in recent years, but, for unknown reasons, Supplementary Bs comprised 84% of reported landings in 1986 (Table 11).

Abundance indicators. Silverside catch and effort were recorded by two logbook fishermen in 1995 and three in 1996. Logbooks had a similar format to those used in the eel log program (Appendix A). Daily catch rates from log records varied seasonally (Fig. 20). Site locations are not given to preserve logkeeper confidentiality. In both 1995 and 1996, several traps had to be removed or shifted in mid-season because of a high bycatch of sticklebacks (pinfish), which buyers will not accept.

Overall catch rate in logbook traps was 752 kg/trap-day in 1995 and 415 kg/trap-day in 1996 (Table 8). This straddles the value reported for 1975 by Lewis et al. (1975) (521 kg/trap-day), but is much higher than catch rates reported for 1979 by Jessop and Morantz (1982) (<100 kg/trap-day).

Silverside lengths sampled at three locations showed means from 8.4 to 9.0 cm (Fig. 21). Scales from Little Harbour showed age 0+ fish up to 10.3 cm, and age 1+ fish as short as 10.1 cm (Fig. 22). Using 10.25 cm as the separation point between ages 0+ and 1+, percent of age 0+ fish in samples ranged from 90.3 to 97.0% by number and from 82.9 to 93.5% by weight (Table 12). The proportion of age 0+ fish at the same sites in 1995 was also high (>94% by number, Cairns 1996).

In addition to sticklebacks, log keepers reported bycatches of hake, sand lance, smelts, winter flounder, trout, tomcod, and eels.

Stock status

The silverside fishery has continued over two decades with the same fishing techniques and with many of the same fishermen. Recorded catch rates at Little Harbour have not declined despite annual exploitation that began in the early 1970s. Silverside fishing is frequently halted by excessive bycatches of sticklebacks, and the presence of this species may provide an ecological refuge that blocks overfishing of silversides. The above considerations suggest that current exploitation of silversides on PEI is sustainable.

Management considerations

Silverside fishing effort on PEI is currently limited by low prices. However, there are a large number of currently unused silverside licences which could be brought into use if prices rose. PEI's silverside resources should be managed with caution, because there is no basis for knowing how much additional pressure the resource could sustain. In addition, silversides are a food source to many species of predators, including other commercially valuable fish. Hence management decisions should also consider the role of silversides in aquatic food chains.

Smelts

Description of fisheries

Smelts are fished on Prince Edward Island by both commercial and recreational fishermen. The commercial season runs from 1 October to the end of February for gillnets, and from 15 October to the end of February for box and bag nets (Table 1). In practice, the commercial season is split into a fall open-water period, which typically shuts down by early December, and a winter period of January and February, when smelts are fished through the ice.

The main recreational fishery for smelts is by spearing from huts set on winter ice. The season for the spear fishery is 30 November to 31 March (Table 1). Recreational fishermen are permitted to fish smelts with a single gillnet from 1 October to the end of February. There is also a recreational dipnet season, which has a daily limit of 60 smelts per person. This season runs from 31 March to 15 June, which includes the species' spawning run into freshwater streams.

In 1996, 372 commercial smelt licences were issued on PEI (Table 2). The number of licences in this fishery has declined slightly each year since the mid 1980s. In all, 900 box nets, 25 bag nets, and 3,842 gillnets were authorized for use in PEI's commercial smelt fishery in 1996 (Table 3). Fifty-one percent of smelt licence-holders are authorized to use only gillnets. All commercial smelt gear must be tagged. Fishermen picked up 2,961 tags, which represents 62% of authorized gears.

DFO fisheries officers counted smelt gear by ground patrol in winter 1995 and by helicopter supplemented by ground counts in winter 1997 (Figs. 1 and 2). Most counts in 1995 were in the central part of PEI, but the 1997 count was complete except for eastern Kings County, where industry sources indicate that little or no fishing has taken place in recent years.

Provincial totals for winter 1997 were 188 box nets, 2 bag nets, and 17 gillnets (Table 13). Hillsborough River is the chief smelt fishing region, with 65 nets counted in 1995 and 64 in 1997. The other main fishing areas in winter 1997 were the West River (24 nets), Bedeque Bay (23 nets), the Alberton area (16 nets), and New London Bay (14 nets). Smelt gear was absent from many bays and estuaries, particularly in eastern PEI.

Counts of smelt shacks have been conducted on Prince Edward Island since 1974. Counts in 1974, 1975, and 1997 were complete or nearly so, but most counts in

other years probably missed significant sections of PEI, and hence must be considered minima.

Counts in 1997 totaled 292 shacks, with the largest concentration (107) being found in Bedeque Bay (Table 13, Fig. 2). Other concentrations were found in the Hillsborough River (57 shacks), Orwell Bay (25 shacks), and the West River (13 shacks).

Fisheries and assessment data

Harvests. Reported smelt landings on PEI totaled 98.5 tons in 1996 (Table 5). The winter fishery produces about two thirds of total landings (Table 14). Trap-nets (box and bag) are the major gear, accounting for 74% of landings in 1985-1996.

Estimates of recreational smelt harvests on PEI from mail-out surveys between 1973 and 1995 ranged from 134,655 to 520,523 (Table 7). These surveys covered trout licence-holders only, and include recreational spear, gillnet, and dipnet harvests. Recreational spearing harvest alone can be calculated from the harvest per smelt shack recorded in a 1995 logbook survey (461 smelts/shack-year, Table 8), and the number of shacks on the ice in 1997 (292, Table 13). This method yields an estimate of 134,612 smelts speared from shacks. The weight of this harvest, given a mean weight of 28.2 g in winter 1995 samples (Fig. 23), is 4.1 tons, which is 1.5% of reported commercial landings for 1995 (Tables 5 and 7).

Abundance indicators. Smelt catch and effort data were recorded by three fishermen in fall 1996 and one in winter 1997, using log forms similar to those of eel log keepers (Appendix A). Locations are not given to preserve fisherman confidentiality. No distinct seasonal trends in catch rate emerged from the fall data (Fig. 24). Similarly, seasonal trends were not evident in daily catch rates recorded at a fall fishing site in Bedeque Bay from 1979 to 1996 (Fig. 25).

Smelt movements have been recorded during spring runs at counting fences on the Dunk, West, and Morell Rivers (Figs. 26-28). At the Dunk fence, heavy upstream movements in the third week of May were followed by a strong downstream run at the end of May and the beginning of June (Fig. 26). However, this gives only a partial picture of the Dunk smelt run because fence operations did not begin until 21 April, and because operations were interrupted several times in April, May and June. Movements during periods of fence operation were estimated as 687,974 upstream and 2,229,086 downstream (see Gaspereau section for counting methods). Large numbers of upstream-moving fish were obviously missed, as all fish moving downstream must have previously moved upstream. In view of this discrepancy and the gaps in fence data, the estimated downstream number can be considered a minimum and incomplete estimate of the Dunk's smelt run in 1995. Given a mean weight of 28.2 g (Fig. 23), the estimated downstream run during periods of data collection weighed 62.9 tons.

In the West River, upstream and downstream smelt movements occurred from the second week of May to mid June (Fig. 27). Movements prior to 7 May are

unknown because the fence was not in operation. Dupuis et al. (1991) estimated that 400,000 smelts (at 28.2 g each, equivalent to 11.3 tons) entered the West River during fence operations. However, these authors emphasized that it was not possible to obtain a reliable total because of back-and-forth movements between fresh and salt water.

Highest numbers of smelts descending the Morell River at Indian Bridge were recorded in the third week of May in both 1995 (Cairns et al. 1997) and 1996 (Fig. 28). However, movements may also have occurred when the fences were not in operation.

Overall smelt catch rates were 11.95 kg/net-day among fall logbook fishermen in 1996, and varied from 8.47 to 63.13 kg/net-day at a site in Prince County where catch and effort have been recorded in most falls between 1979 and 1996 (Table 8, Fig. 29).

Daily catches, number of spearers, and fishing hours were recorded by the owners of 12 smelt shacks in 1995. Catch rates have been calculated separately for fishing sessions with one, two, and three spearers, because of the possibility that individual catch rates may be affected by within-shack competition among spearers. Catch rate varied from 0.5 to 44 smelts/spearer-hour (Table 8). The overall catch rate at all sites and for any number of spearers up to three was 5.68 smelts/spearer-hour. Mean total seasonal harvest recorded in log records from 15 shacks in 1995 averaged 461 smelts/shack.

Biological characteristics. Length-frequencies of smelts sampled during winter 1995 and fall 1996 are presented in Fig. 23. Overall mean fork length for winter 1995 samples was 15.6 cm. Mean weights for these samples were calculated as the quotient of total sample weight and number in the sample. Overall mean weight for winter 1995 samples was 28.2 g. The largest smelts were found in St. Peters Bay, where mean length was 17.7 cm and mean weight was 47.4 g (Fig. 23).

The length-weight relation for smelts sampled in trap-nets in Bedeque Bay in fall 1996 is expressed as $\text{Weight} = 0.00301 \text{ Length}^{3.301}$, where weight is in g and length is fork length in cm (Fig. 30). Smelts from the same sample were aged by scale reading as 1+, 2+, and 3+ (Fig. 31, aging by R. Pickard, DFO-Moncton).

Bycatch. Bycatch reported by smelt log keepers included winter flounder, Atlantic salmon, rainbow trout, brook trout, rock eel, skate, mackerel, gaspereau, cod, rock crabs, sculpins, silversides, seals, and tomcod. A log keeper in the Bedeque Bay area noted captures of about 40 striped bass, ~16 cm in length, in the fall 1996 smelt season. The keeper commented that this was an unusually high bycatch of this species, and that other fishermen in the same area had also noted an increase in striped bass bycatches in fall 1996.

Stock status

The data reviewed in this paper do not permit a clear statement of the health of smelt stocks on PEI. The single time series of catch rate at a site in Prince County suggests that fishing is sustainable at that location, but that does not preclude the possibility that stocks might be overexploited elsewhere. The best that can be said,

given that fishing has continued at most sites for many years and that landings have not collapsed, is that smelt stocks in PEI are probably not grossly overexploited, at least in most areas.

As anadromous species, smelts must enter fresh water to spawn. A high proportion of PEI streams have been dammed, and most of the larger dams are furnished with fishways. However, observations during spring smelt runs indicate that smelts are not able to ascend fishways used on PEI (D.L. Guignion, UPEI Biology Dept., pers. comm.). It is presently unclear what impact such barriers have on PEI's smelt stocks.

Management considerations

In light of the limited knowledge on PEI smelt stocks, the smelt fishery should be managed with caution, and measures that would increase catches should be avoided.

Shad

Although a spring season for shad on PEI exists in regulations, no licences are issued and there is no directed fishery (Tables 1 and 2). Shad is a legal bycatch in the gaspereau fishery (Table 1). Substantial shad catches have been recorded on PEI only in 1991 and 1992 (Table 15, Fig. 3). Most of the harvest in these years was obtained in July in Districts 82 and 92, at the western end of PEI (Table 15). According to industry sources, these shad were taken in cod gillnets and frozen for use as bait in the fall lobster season. Given the infrequent and sporadic nature of shad landings on PEI, no management measures are recommended.

Tomcod

Tomcod may be fished with similar seasons and gear as smelt on PEI, but no licences are issued and there is no directed fishery (Tables 1 and 2). Tomcod are legal bycatch in the smelt fishery, which is the source of landings. Reported landings exceeded 70 tons annually throughout the 1970s (Table 5). Since 1982, reported landings have been under 15 tons (except 1986, when reported landings were 181 tons). Tomcod are taken in both the fall and winter smelt seasons, and the major fishing areas are Districts 83 and 93 in west-central PEI (Table 16).

Tomcod catch rates in smelt box nets at a site in Bedeque Bay varied from 1.81 to 29.04 kg/net-day during 11 years between 1979 and 1996 (Table 8, Fig. 29).

The dramatic fall in landings after the 1970s and their continuing failure to recover could reflect a reduction in tomcod abundance on PEI. However, given that tomcod is fished as a bycatch only, and that demand is variable, it is also possible that the drop in landings reflects changes in market conditions.

Given that tomcod are not subject to a directed fishery, and that commercial landings derive from the smelt fishery, it is recommended that the same cautionary principles suggested for smelt (see above) also apply to tomcod on PEI.

Sturgeon

Regulations provide for a gillnet fishery for sturgeon on Prince Edward Island, but no licences are issued and there is no directed fishery (Table 1). Sturgeon landings were reported in five years during the period 1985-1996 (Table 17). The highest reported landings were 580 kg in 1985. The most recent reported landings were 20 kg in 1994. Atlantic sturgeon wander widely (Scott and Scott 1988) and PEI landings presumably reflect incidental catches of fish spawned elsewhere.

Acknowledgments

This report has benefited greatly from the generosity of many people and agencies. I am particularly grateful to the logkeepers who recorded catch and effort in the eel, silverside, and smelt fisheries. I also thank Harold Adams, Jamie Adams, Randy Angus, Eric Bernard, Keith Brickley, Gerald Chaput, John Clarey, Conservation Officers of the PEI Fish and Wildlife Division, Kevin Davidson, Super Dennis, Pete Doucette, Todd Dupuis, East Prince Wildlife, Simone Gallant, Ron Grey, Daryl Guignion, Jason Heffel, Falk Huttman, Jim Jenkins, Dely Keen, James Landry, Inis LeBlanc, Patrick Leclair, Brian Lewis, Kevin MacAdam, Tyler MacAdam, Gerald MacDougall, Rosie MacFarlane, Bobby MacInnis, Colin MacIsaac, Francis MacLean, Allie MacLennan, Kent MacRae, the Montague Watershed Co-op, Melissa Moore, the Morell River Management Co-op, Fran Mowbray, Charlie Murdoch, Mike Murray, Monique Niles, Gilberte Nowlan, Dwaine Oakley, Robin Paynter, the PEI Estuarine Fisheries Advisory Committee, Russel Pickard, Kevin Roach, Bill Sonier, and Billy Warren for data, field assistance, and comments.

Literature cited

- Anon. 1978. Survey of sportfishing in Prince Edward Island in 1975. Prince Edward Island Department of the Environment, Charlottetown, and Fisheries and Environment Canada, Ottawa. 20 pp.
- Anon. 1988. Sport fishing in Prince Edward Island, 1985. Prince Edward Island Department of Community and Cultural Affairs, Charlottetown, and Department of Fisheries and Oceans, Ottawa. 12 pp.
- Anon. 1994. 1990 survey of recreational fishing in Canada. Economic and Commercial Analysis Report no. 148. Department of Fisheries and Oceans, Ottawa. 146 pp.
- Cairns, D.K. 1989. Gear types, seasonal distribution of effort, and bycatch of the smelt fishery in the southern Gulf of St. Lawrence. Can. Tech. Rep. Fish. Aquat. Sci. no. 1668.
- Cairns, D.K. 1995. Fisheries management on Prince Edward Island: Insular autonomy or Pax Ottawa? Pp. 95-133 in R. Arnason and L. Felt (eds.). The North Atlantic Fisheries: successes, failures, and challenges. Institute of Island Studies, Charlottetown.
- Cairns, D.K. 1996. An update on the Atlantic silverside fishery of Prince Edward Island, 1995. DFO Atlantic Fisheries Research Document 96/116.

- Cairns, D.K. 1997. Status of Atlantic salmon on Prince Edward Island in 1996. DFO Atlantic Fisheries Research Document 96/21.
- Cairns, D.K., R. Angus, M. Murray, and K. Davidson. 1996. Status of Atlantic salmon in the Morell, Mill, Dunk, West, and Valleyfield Rivers, Prince Edward Island, in 1995. DFO Atl. Fish. Res. Doc. 96/120.
- Cairns, D.K., K. Davidson, and R. Angus. 1995. Status of Atlantic salmon in the Morell, Mill, Dunk, West, and Valleyfield Rivers, Prince Edward Island, in 1994. DFO Atl. Fish. Res. Doc. 95/100.
- Cairns, D.K., K. MacAdam, and D.L. Guignion. 1997. The Atlantic salmon smolt exodus from the Morell River, Prince Edward Island, in 1995. Prince Edward Island Tech. Rep. Environ. Sci. No. 2.
- Castonguay, M., P.V. Hodson, C.M. Couillard, M.J. Eckersley, J.-D. Dutil, and G. Verreault. 1994a. Why is the recruitment of the American eel, *Anguilla rostrata*, declining in the St. Lawrence River and Gulf? Can. J. Fish. Aquat. Sci. 51:479-488.
- Castonguay, M., P.V. Hodson, C. Moriarity, K.F. Drinkwater, and B.M. Jessop. 1994b. Is there a role of ocean environment in American and European eel decline? Fish. Oceanogr. 3:197-203.
- Chaput, G.J. 1995. Temporal distribution, spatial distribution, and abundance of diadromous fish in the Miramichi River watershed. Pp. 121-139 in E.M.P. Chadwick (ed.). Water, science, and the public: the Miramichi ecosystem. Can. Spec. Publ. Fish. Aquat. Sci. 123.
- Chaput, G.J., and C.H. LeBlanc. 1991. Les pêches commerciales de poissons dans les baies, estuaires et rivières du sud-ouest du golfe du Saint-Laurent. Can. Spec. Publ. Fish. Aquat. Sci. No. 113:293-301.
- Chaput, G.J., and C.H. LeBlanc. 1996. Anadromous rainbow smelt (*Osmerus mordax* Mitchell) from the Gulf of St. Lawrence - update of fishery and preliminary status of stock. DFO Atl. Fish. Res. Doc. 96/109.
- Chaput, G.J., and A. Locke. 1997. Status of American eel from the southern Gulf of St. Lawrence. Paper presented to Eel Management Meeting, Quebec City, January 1997.
- Ducharme, L.J.A. 1977. Atlantic salmon enhancement on the Morell River, Prince Edward Island. Dept. Fisheries and the Environment Tech. Rep. Mar/T-77-2.
- Dupuis, T.D., R.W. Redmond and J.L. MacMillan. 1991. Anadromous movements, incidence of ectoparasites and age of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and Atlantic salmon (*Salmo salar*) in the West (Eliot) River, Prince Edward Island. Unpublished report, PEI Federation of Fly Fishers, Charlottetown.
- Eales, J.G. 1968. The eel fisheries of eastern Canada. Fish. Res. Board Canada Bull. 166. 79 pp.
- Jessop, B.M. 1983. Aspects of the life history of the Atlantic silverside (*Menidia menidia*) of the Annapolis River, Nova Scotia. Can. Manu. Rep. Fish. Aquat. Sci. No. 1694.
- Jessop, B.M. 1987. Migrating American eels in Nova Scotia. Trans. Am. Fish. Soc. 116:161-170.
- Jessop, B.M. 1990a. Stock-recruitment relationships of alewives and blueback herring returning to the Mactaquac Dam, Saint John River, New Brunswick. North Am. J. Fish. Manage. 10:19-32.
- Jessop, B.M. 1990b. Diel variation in density, length composition, and feeding activity of juvenile alewife, *Alosa pseudoharengus* Wilson, and blueback herring, *A. aestivalis* Mitchell, at near-surface depths in a hydroelectric dam impoundment. J. Fish Biol. 37:813-822.
- Jessop, B.M. 1993. Fecundity of anadromous alewives and blueback herring in New Brunswick and Nova Scotia. Trans. Am. Fish. Soc. 122:85-98.
- Jessop, B.M., W.E. Anderson, and A.H. Vromans. 1983. Life-history data on the alewife and blueback herring of the Saint John River, New Brunswick, 1981. Can. Data Rep. Fish. Aquat. Sci. 367.
- Jessop, B.M., and D.L. Morantz. 1982. A survey of the Atlantic silverside fishery of Prince Edward Island, 1979. Can. Manu. Rep. Fish. Aquat. Sci. No. 1639.
- Johnston, C.E. 1980. Observations on the foods of brook trout (*Salvelinus fontinalis*) and rainbow trout (*Salmo gairdneri*) in the Dunk River system, Prince Edward Island. Proc. Nova Scotia Instit. Sci. 30:31-40.
- Johnston, C.E., and J.C. Cheverie. 1988. Observations on the diel and seasonal drift of eggs and larvae of anadromous rainbow smelt, *Osmerus mordax*, and blueback herring, *Alosa aestivalis*, in a coastal stream on Prince Edward Island. Can. Field-natur. 102:508-514.
- LeBlanc, C.H., and G.J. Chaput. 1991. Landings of estuarine fishes in the Gulf of St. Lawrence 1917-1988. Can. Data Rep. Fish. Aquat. Sci. No. 842.
- Lewis, B., and C. Cavanagh. 1973. Silversides report 1973. Prince Edward Island Department of Fisheries Tech. Rep. No. 133.
- Lewis, B., C. Cavanagh, M. Smith, and R. Ross. 1974. Silverside survey, 1974. Prince Edward Island Department of Fisheries Tech. Rep. No. 166.
- Lewis, B., M. Smith, C. Cavanagh, and K. McKenna. 1975. Atlantic silversides 1975. Prince Edward Island Department of Fisheries Tech. Rep. No. 173.
- Locke, A., R. Claytor, C. LeBlanc and G. Chaput. 1995. Status of American eels, *Anguilla rostrata* in the Gulf Region. DFO Atl. Fish. Res. Doc. 95/79.
- McKenzie, R.A. 1964. Smelt life history and fishery in the Miramichi River, New Brunswick. Fish. Res. Board Can. Bull. No. 144. 77 pp.
- Messieh, S.B. 1977. Population structure and biology of alewives (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*) in the Saint John River, New Brunswick. Environ. Biol. Fish. 2:195-210.
- Scott, W.B., and M.G. Scott. 1988. Atlantic fishes of Canada. University of Toronto Press, Toronto.
- Smith, A., and K.W. Brickley. 1985. 1980 survey of sportfishing in Prince Edward Island. Prince Edward Island Department of Community and Cultural Affairs,

- Charlottetown, and Department of Fisheries and Oceans, Ottawa. 48 pp.
- Smith, M.W., and J.W. Saunders. 1955. The American eel in certain fresh waters of the Maritime Provinces of Canada. *J. Fish. Res. Board Can.* 12:238-268.
- Stewart, J. 1967. An account of Prince Edward Island in the Gulf of St. Lawrence, North America. S.R. Publishers Ltd., East Ardsley, U.K.
- Thomson, I.D. 1975. Sportfishing in Prince Edward Island: a survey of anglers. Prince Edward Island Department of the Environment, Charlottetown, and Department of the Environment, Ottawa. 70 pp.
- Wells, K. 1986. The fishery of Prince Edward Island. Ragweed Press, Charlottetown.

Table 1
Regulations governing non-salmonid diadromous fisheries on Prince Edward Island in 1996.

Species	Sec- tor ^a	Waters	Gear	Open season	Week- end closures	Licence re- quired	Minimum distance between gears (m)	Allowable mesh size (mm)	Minimum size (cm) that may be retained	Maximum daily catch	Allow- able bycatch	Comments	
Eel	Com	Tidal	Trap nets	16 Aug - 31 Oct		Yes	200		46			A 46 cm minimum size was imposed in all PEI eel fisheries between 1974 and 1978. Eel pots are defined as leaderless non-emeshing gear into which eels are attracted by baiting. This gear is not used on PEI. Licence-holders authorized to use pots use trap nets in their stead. Spearing takes place at night with the aid of generator-powered lights (flambeauing). Regulations specify an opening date of 31 Dec, but licences are not issued until 1 Apr. Prior to 1993, the season was 1 Apr - 15 Aug. Prior to 1996, spearing was also permitted in Nov.	
			Pots	16 Aug - 31 Oct		Yes	200		46				
			Spears	1 Apr - 30 Jun		Yes			46				
	Com	Inland	Pots	15 Aug - 31 Oct		Yes	200		46		No eel pots are used on PEI, and no other gear is permitted in fresh water.		
	Rec	Tidal	Spears	1 Dec - 30 Mar		No			46		Regulations specify a closing date of 30 Jun, but the season is closed on 30 Mar by administrative policy.		
Gaspereau	Com	Tidal	Trap nets	30 Apr - 30 Jun	Yes ^b	Yes	200				Shad	Fishermen commonly use sweep nets to corral fish before dip netting, although sweep nets are not an authorized gear.	
			Gillnets	30 Apr - 30 Jun	Yes ^b	Yes	200	≤89			Shad		
			Dip nets	30 Apr - 30 Jun	Yes ^b	Yes					Shad		
	Bait	Tidal	Trap nets	30 Apr - 30 Jun	Yes ^b	Yes	200				Shad		No licences issued.
			Gillnets	30 Apr - 30 Jun	Yes ^b	Yes	200	≤89			Shad		Bait for lobster traps. Sale to other fishermen not permitted.
			Dip nets	30 Apr - 30 Jun	Yes ^b	Yes					Shad		No licences issued.
Com	Inland	Dip nets	30 Apr - 30 Jun	Yes ^b	Yes					Shad	No licences issued on PEI.		
Silversides	Com	Tidal	Trap nets	30 Sep - 31 Dec		Yes	200	≤65				This method is not used.	
			Dip nets	30 Sep - 31 Dec		Yes	200						
Smelt	Com	Tidal	Bag nets	15 Oct - end Feb		Yes	90/45 ^c	≥31				Tomcod	Net must not have a leader.
			Box nets	15 Oct - end Feb		Yes	90/45 ^c	≥31				Tomcod	Leader must not exceed 31 m in length.
			Gillnets	1 Oct - end Feb		Yes	90/45 ^c	≥31				Tomcod	
	Rec	Tidal	Dip nets	31 Mar - 15 Jun		No					60		Commonly fished through the ice from "smelt shacks." Net length must not exceed 27.4 m.
			Spears	30 Nov - 31 Mar		No							
			Gill nets	1 Oct - end Feb		Yes	90/45 ^c	≥31					
Rec	Inland	Dip nets	31 Mar - 15 Jun		No					60			
Rec	Both	Angling	1 Jan - 31 Dec		No					60			
Tomcod	Com	Tidal	Bag nets	15 Oct - end Feb		Yes	90/45 ^c	≥31				There is no directed fishery for tomcod on PEI.	
			Box nets	15 Oct - end Feb		Yes	90/45 ^c	≥31					
			Gill nets	1 Oct - end Feb		Yes	90/45 ^c	≥31					
	Rec	Tidal	Spears	30 Nov - 31 Mar		No							
Striped bas	Rec	Tidal	Angling	31 Dec - 29 Dec		No			30	10			
	Rec	Inland	Angling	14 Apr - 30 Sep		No							
Shad	Com	Tidal	Trap nets	14 May - 30 Jun	Yes ^b	Yes	200					There is no directed fishery for shad on PEI.	
			Gillnets	14 May - 30 Jun	Yes ^b	Yes	200	≥127					
Sturgeon	Rec	Both	Angling	30 Jun - 31 May		No			120			There is no directed fishery for sturgeon on PEI. No licences issued on PEI.	
	Com	Both	Gill nets	30 Jun - 31 May		Yes	200	≥330	120				

^aCommercial: for sale to others, recreational: for pleasure and personal consumption, bait: for personal use as bait in the commercial fishery

^bFishery closed from 20:00 on Friday to 8:00 on Monday

^cMinimum spacing is 90 m upstream or downstream, 45 m in other directions.

Table 2

Number of fishermen holding licences for commercial diadromous species on PEI, 1986-1996.

	Eels ^a	Gaspereau		Silversides	Smelt		Shad	Tomcod
		Commercial	Bait		Commercial	Recreational gillnet		
1986	274	33		32	432		0	0
1987	269	89		34	420		0	0
1988	262	57		33	415		0	0
1989	258	38		32	409		0	0
1990	261	26		34	402		0	0
1991	262	26		39	400		0	0
1992	258	23		41	393		0	0
1993	334	24		44	382		0	0
1994	896	26		103	376		0	0
1995	903	24		101	374		0	0
1996	885	23	660 ^{bc}	103	372	71 ^c	0	0

^aNumbers do not include licences issued to native bands^bFrom a database which may be incomplete. The true number of licences may be higher^cNumbers of licences issued in previous years are unavailable.

Table 3
Number of gears permitted to PEI eel, gaspereau, silversides, and smelt licence-holders.

	Eels				Gaspereau					Silversides			Smelt				
	Trap-net	Pot	Spear	All gears	Commercial			All gears	Bait	Trap/box net	Dip net	All gears	Commercial			Recreational Gillnet	
					Trap-net	Gill-net	Dip net		Gill-net				Trap/box	Bag	Gillnet		All gears
Maximum number of gears per individual licence	35	50	1	50	6	3	1	7	1	4	1	4	20	4	75	94	1 ^a
Mean number of gears for licence-holders authorized for this gear	19.7	19.3	1.0	6.5	2.3	1.7	1.0	2.1	1.0	1.4	1.0	1.5	5.2	1.8	13.2	12.8	1.04
Total number of gears allowed	4095	948	750	5793	25	15	9	49	660 ^b	145	7	152	900	25	3842	4767	74
Number of individual licence-holders authorized for this gear	208	49	750	885	11	9	9	23	660 ^b	102	7	103	172	14	292	372	71
Number of individual licence-holders authorized for this gear only	96	39	629		6	6	5			96	1		67	8	189		
Number of licences issued to native bands			92	93													
Total number of authorized gears	4095	948	842	5886	25	15	9	49		145	7	152	900	25	3842	4767	74
Total number of licences authorized for this gear	208	49	842	978	11	9	9	23		102	7	103	172	14	292	372	71
Number of licence-holders who picked up tags ^c				116													217
Number of tags picked up				2342													2961
Percent of licence-holders picking up tags				45.1													58.3
Tags picked up as a percent of allowable gear				46.4													62.1

^aFishers are normally limited to 1 licence authorizing a single net, but 3 fishers were issued 2 licences each.

^bFrom a database which may be incomplete. The true number of licences may be higher than this.

^cEel traps and pots and smelt traps, bagnets, and gillnets must be tagged. Tags picked up may include a small number of replacements for tags which were lost.

Table 4

Frequency distribution of number of gears permitted to PEI eel, gaspereau, silversides, and smelt licence-holders in 1996

Number of gears permitted	Number of licence-holders authorized to use the given number of gears																
	Eels				Gaspereau				Silversides			Smelt					
	Trap- net	Pot	Spear	All gears	Commercial			Bait	Trap/ box net	Dip net	All gears	Commercial			Recrea- tional Gillnet		
					Trap- net	Gill- net	Dip net	All gears				Gill- net	Trap/ box	Bag		Gillnet	All gears
<u>Individuals holding licences</u>																	
1	3		750	630	4	5	9	10	660 ^a	72	7	71	38	8	36	44	71
2	4	2		7	5	2		6		20		21	25	3	13	30	3
3	4	3		7		2		5		7		5	21	1	12	22	
4	2	2		3						3		6	13	2	6	12	
5	21			19	1			1					16		40	46	
6	6	4		10	1								11		16	22	
7	1			5				1					2		1	3	
8	4			1									7		2	5	
9				3									2			4	
10	25	7		20									16		36	21	
11-14	5	1		17									11		10	31	
15-19	22	2		24									9		20	23	
20-24	24	12		35									1		47	40	
25-29	20	1		20											23	26	
30-34	24	5		29											18	15	
35-39	43	9		54											4	12	
40-44															3	7	
45-49															1	3	
50-59		1		1											2	3	
60-69															1	1	
75															1		
94																	1
<u>Native bands holding licences</u>																	
19				1	1												
23				1	1												
50				1	1												

^aFrom a database which may be incomplete. The true number of licences may be higher than this.

Table 5

Reported landings (metric tons) of PEI non-salmonid commercial diadromous species, 1917-1996.

Data are from LeBlanc and Chaput (1991) for 1917-1984 and from DFO Statistics Branch for 1985-1996.

Year	Eel	Gaspereau	Silverside	Smelt	Shad	Striped bass ^a	Tomcod	Total
Reported landings - PEI								
1917	3.4	13.6		290.6			4.3	311.9
1918	23.9	38.6		293.2			15.0	370.7
1919		5.4		390.4			8.0	403.8
1920	8.2	16.8		495.1			0.3	520.4
1921	37.0			475.9			1.7	514.6
1922	9.5	1.8		428.7			11.3	451.3
1923	3.8			444.2			27.9	475.9
1924	35.6	13.6		648.0			58.8	756.0
1925	14.5	3.8		798.8			116.0	933.1
1926	8.7	16.3		698.7			105.8	829.5
1927	5.9			678.1			82.8	766.8
1928	11.1	6.8		595.7			87.9	701.5
1929	2.8			430.7			101.9	535.4
1930	5.9	1.4		353.6			61.4	422.3
1931	4.9	7.0		341.5			66.4	419.8
1932	8.2			468.6			31.8	508.6
1933	5.9			418.0			23.5	447.4
1934	5.1	72.6		374.0			16.1	467.8
1935	10.2	44.2		454.7			13.6	522.7
1936	8.6	15.6		537.7			13.4	575.3
1937	16.4	75.5		404.1			10.9	506.9
1938	9.7	219.7		436.2			16.9	682.5
1939	9.7	140.8		441.0			13.6	605.1
1940	21.4	34.1		482.0			17.3	554.8
1941	15.7	26.8		391.5			12.4	446.4
1942	6.9	24.0		253.5			13.1	297.5
1943	10.9	10.2		326.9			13.3	361.3
1944	6.3	43.4		487.5			17.8	555.0
1945	6.1	42.9		534.8			11.7	595.5
1946	6.4	237.5		560.0			8.5	812.4
1947	7.7	203.4		485.8			3.2	700.1
1948	29.1	181.6		530.7			22.7	764.1
1949	15.9	10.9		450.4			23.6	500.8
1950	10.4	2.3		517.1			19.1	548.9
1951	13.6	2.3		385.9			17.7	419.5
1952	14.1	4.5		282.4			8.6	309.6
1953	33.1	10.9		403.6			36.3	483.9
1954	16.3	31.8		328.7			17.7	394.5
1955	24.1	72.2		302.8			48.1	447.2
1956	17.7	14.5		442.2			61.7	536.1
1957	12.3	87.6		222.0			56.3	378.2
1958	18.6	39.5		367.7			46.3	472.1
1959	26.3	35.0		327.3			70.4	459.0
1960	31.8	98.5		290.6			51.8	472.7
1961	17.7	132.6		133.5			32.7	316.5
1962	13.2	84.4		129.8			27.7	255.1
1963	15.9	56.3		154.8			19.5	246.5
1964	34.1	4.1		221.6			25.0	284.8
1965	48.6	48.1		210.2			76.7	383.6
1966	32.7	10.0		286.5			144.8	474.0
1967	61.7	16.8		197.5			124.9	400.9
1968	130.7	4.9		216.3			125.2	477.1
1969	194.6	5.1		282.8			155.9	638.4
1970	240.0	47.6		223.6			143.2	654.4
1971	351.5	12.7		226.5			71.2	661.9
1972	272.7	21.3		325.0			159.7	778.7
1973	157.2	61.5	142.0	372.4			165.0	898.1
1974	101.1	47.0		334.9			116.5	599.6
1975	103.4	82.4	68.8	460.3			82.6	797.5
1976	94.2	166.4	99.4	569.4			106.5	1,035.9
1977	97.6	96.3	152.3	456.3			98.1	900.6
1978	113.4	104.2	209.3	401.4	1.3	0.5	122.9	953.0
1979	110.9	405.3	319.2	558.5			133.2	1,527.1

Table 5 (continued)

Year	Eel	Gaspereau	Silverside	Smelt	Shad	Striped bass ^a	Tomcod	Total
1980	120.1	253.2	59.8	413.1	5.8		32.3	884.3
1981	220.1	258.8	32.9	323.5			17.8	853.1
1982	167.6	132.9	62.5	298.6			4.1	665.7
1983	150.5	36.4	107.5	261.5			4.4	560.3
1984	164.8	87.9	131.1	244.0			1.3	629.1
1985	139.6	238.4	47.5	117.8	0.1		12.6	555.9
1986	225.9	463.6	76.2	703.6			181.0	1,650.3
1987	149.9	364.4	136.8	149.9	1.7		12.6	815.3
1988	124.7	234.0	79.9	219.0			6.6	664.1
1989	77.1	132.3	32.9	104.2	0.5		2.8	349.8
1990	123.7	83.1	81.9	85.0			0.8	374.5
1991	129.0	86.8	117.8	158.0	40.5		10.8	542.9
1992	54.2	317.0	46.4	193.4	17.0		1.7	629.7
1993	73.7	200.0	82.7	180.2	0.0		11.7	548.3
1994	45.8	115.0	543.1	255.0	0.3		11.1	970.2
1995	32.5	42.0	222.6	270.5	0.0		5.2	572.9
1996	10.6	53.3	151.1	98.5			2.9	316.4
<u>Mean landings, 1990-1995</u>								
PEI	76.5	140.7	182.4	190.3	9.6	0.0	6.9	606.4
Gulf NB	102.5	3,399.2	0.0	766.5	10.8	5.1	47.3	4,331.4
Gulf NS	75.2	824.3	0.0	56.9	0.0	0.2	0.0	956.6
<u>Mean landings as a percent of Southern Gulf total, 1990-1995</u>								
PEI	30.1	3.2	100.0	18.8	47.1	0.0	12.7	10.3
Gulf NB	40.3	77.9	0.0	75.6	52.9	96.8	87.3	73.5
Gulf NS	29.6	18.9	0.0	5.6	0.0	3.2	0.0	16.2

^aData for 1968-1988 only

Table 6
 Reported landings (metric tons) and landed value of eels on Prince Edward Island, by statistical district, month, and gear type, 1985-1996^a.

Year	Statistical district										Month												Gear			Total	Percent Supp. B ^b	Landed value	Mean price/kg
	82	83	85	86	87	88	92	93	95	96	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Traps	Pots	Spears				
1985	0.1	22.7	0.0	2.1	2.5	30.6	40.9	28.8	10.3	1.4	0.5	0.1	0.1	0.9	2.4	5.8	4.5	0.8	39.8	60.8	18.5	5.4	131.8	0.0	7.7	139.6	NA	\$255,056	\$1.83
1986	0.0	44.9	5.1	23.6	2.2	32.4	28.4	62.8	21.1	5.5	1.2	1.6	0.0	5.0	22.8	45.2	17.3	27.7	48.1	41.7	12.5	2.9	124.0	0.0	101.9	225.9	16.4	\$558,249	\$2.47
1987	0.0	29.5	0.6	0.6	1.7	32.4	9.6	57.8	16.7	1.0	0.7	0.7	0.0	4.9	18.1	19.9	9.8	17.3	35.4	31.9	7.9	3.2	94.0	0.0	55.9	149.9	24.4	\$466,745	\$3.11
1988	0.0	7.7	0.3	5.4	11.3	35.1	15.3	31.3	16.6	1.7	2.8	0.1	0.1	1.6	21.3	12.9	7.2	24.9	33.6	18.7	0.3	1.3	84.0	0.0	40.6	124.7	23.6	\$351,287	\$2.82
1989	0.0	1.8	0.0	0.6	9.2	17.0	7.5	20.1	19.3	1.6	0.3	0.0	0.0	2.0	5.7	5.8	1.4	19.4	32.7	9.0	0.7	0.0	74.4	0.0	2.7	77.1	15.1	\$212,446	\$2.76
1990	0.0	3.2	0.0	0.0	10.3	17.8	15.6	60.1	16.8	0.0	0.3	0.0	0.0	0.6	13.6	21.8	10.6	20.0	27.1	22.5	5.4	1.8	117.3	0.0	6.4	123.7	7.2	\$390,258	\$3.15
1991	2.1	14.0	0.0	0.0	1.6	18.0	7.3	70.7	13.6	1.7	0.1	0.1	0.0	0.0	42.6	29.3	5.8	19.6	25.7	5.4	0.2	0.2	19.9	0.0	109.1	129.0	35.0	\$435,501	\$3.38
1992	0.0	3.3	0.0	0.0	2.2	23.0	6.0	10.8	8.7	0.3	0.0	0.0	0.0	0.0	1.5	0.2	10.3	7.6	18.9	15.8	0.0	0.0	42.1	0.0	12.1	54.2	31.0	\$183,809	\$3.39
1993	0.7	2.5	0.0	0.6	14.5	3.2	17.7	23.5	9.0	2.0	0.0	0.0	0.0	0.0	6.1	20.4	4.1	5.2	12.4	23.2	2.2	0.2	33.6	0.0	40.0	73.7	27.4	\$246,170	\$3.34
1994	1.9	1.6	0.0	0.4	3.3	5.9	6.7	12.8	8.1	5.1	1.7	0.6	0.0	1.4	2.8	8.7		3.5	15.0	8.5	3.1	0.3	20.9	0.0	24.9	45.8	11.1	\$220,056	\$4.81
1995	0.8	0.3	0.0	0.1	2.1	0.2	1.5	22.1	4.1	1.4	0.2	0.1	0.0	0.2	3.6	10.1		5.4	9.5	2.2	1.2	0.0	28.9	0.6	3.1	32.5	1.1	\$194,706	\$5.98
1996	0.8	0.6	0.0	0.0	0.0	0.0	1.5	2.5	3.0	2.0	0.0	0.0	0.0	0.7	0.2	0.1		3.1	5.0	1.5	0.0	0.0	6.8	0.0	3.7	10.6	0.0	\$73,661	\$6.96
Mean	0.5	11.0	0.5	2.8	5.1	18.0	13.2	33.6	12.3	2.0	0.7	0.3	0.0	1.4	11.7	15.0	5.9	12.9	25.3	20.1	4.3	1.3	64.8	0.0	34.0	98.9	16.0	\$298,995	\$3.67
Mean %	0.5	11.1	0.5	2.8	5.1	18.2	13.3	34.0	12.4	2.0	0.7	0.3	0.0	1.5	11.9	15.2	6.0	13.0	25.5	20.3	4.4	1.3	65.5	0.0	34.4	100.0			

^aNote that PEI eel landings in Table 7 of Locke et al. 1995 are shown under incorrect Statistical Districts because the table's heading is misaligned.

^bPercent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Table 7

Estimated recreational harvest of American eels and rainbow smelts on Prince Edward Island.

Year	Eels			Fishing days	Smelts			Source
	Number harvested	Tons harvested ^a	Percent of total harvest ^b		Number harvested	Tons harvested ^c	Percent of total harvest ^b	
1973	3,000	1.2	0.7		252,000	7.1	1.9	Thomson 1975
1975	11,619	4.5	4.1		520,523	15.1	3.1	Anon. 1978
1980	79,100	30.5	20.2		NA			Smith and Brickley 1985
1985	8,307	3.2	2.2		134,655	4.1	3.1	Anon. 1988
1990	2,481	1.0	0.8	5,759 ^d	198,473	6.1	6.2	Anon. 1994
1995	4,536	1.7	5.1	10,786	194,941	5.1	2.0	National angling survey, Brickley unpubl. (data are preliminary)
1995/1997					134,612	4.1	1.5	Present study ^e

^aNumbers converted to weight using a mean weight of 385.1 g, measured in commercial catches (≥ 46 cm) in fall 1997.

^bRecreational harvest as a percent of combined recreational and commercial harvest.

^cNumbers converted to weight using a mean weight of 28.2 g (Fig. 23).

^dTotal ice fishing days, including days spent fishing for other species fished through the ice (eels, rainbow trout)

^eSmelt harvest estimated from the 1995 catch rate from spearer logbooks (461 smelts/shack-year) and the number of shacks counted in 1997 (292)

Table 8

Catch rates of non-salmonid diadromous fishes on Prince Edward Island, from fishermen's personal records and from logbooks.

Species	Gear	Location	Year	Number of fishermen supplying data	Catch	Effort	Catch rate	Units		
								Catch	Effort	Catch rate
Legal size eels	Trap-nets	Prince Co.	1996	3	1,338	3,315	0.40	kg	net-days	kg/net-day
		Queens Co.	1996	2	1,412	3,775	0.37			
		Kings Co.	1996	2	1,132	3,414	0.33			
		PEI	1996	7	3,882	10,504	0.37			
Undersize eels	Trap-nets	Prince Co.	1996	3	3,985	3,315	1.20	no.	net-days	no./net-day
		Queens Co.	1996	2	1,840	3,775	0.49			
		Kings Co.	1996	2	1,468	3,414	0.43			
		PEI	1996	7	7,293	10,504	0.69			
Gaspereau	Trap-nets	Site in Prince Co.	1992	1	9,169	80	114.61	kg	net-days	kg/net-day
			1993	1	8,573	85	100.85			
			1994	1	23,243	88	264.12			
			1995	1	14,670	90	163.00			
			1996	1	4,568	28	163.13			
Silversides	Trap-nets	Little Harbour ^a	1975	1	60,923	117	520.71	kg	net-days	kg/net-day
		District 85	1979 ^b	NA	8,780	156	56.28			
		District 86	1979	NA	18,660	300	62.20			
		District 87	1979	NA	39,320	396	99.29			
		District 88	1979	NA	208,900	2,712	77.03			
		District 96	1979	NA	0	56	0.00			
		PEI	1979	NA	275,660	3,620	76.15			
		Queens & Kings Co.	1995	2	119,558	159	751.94			
		Queens & Kings Co.	1996	3	81,397	196	415.29			
Smelt	Box nets	Site in Bedeque Bay	Fall 1979	1	16,287	258	63.13	kg	net-days	kg/net-day
			Fall 1980	1	7,971	264	30.19			
			Fall 1981	1	7,463	180	41.46			
			Fall 1982	1	9,826	216	45.49			
			Fall 1983	1	7,546	234	32.25			
			Fall 1984	1	6,549	180	36.38			
			Fall 1985	1	3,089	186	16.61			
			Fall 1986	1	2,863	186	15.39			
			Fall 1987	1	2,853	150	19.02			
			Fall 1988	1	3,306	72	45.92			
			Fall 1989	1	2,345	90	26.05			
			Fall 1992	1	1,373	162	8.47			
			Fall 1993	1	6,024	240	25.10			
			Fall 1995	1	8,111	252	32.19			
Fall 1996	1	4,722	224	21.08						
Smelt	Box nets	Prince Co.	Fall 1996	3	10,243	857	11.95	kg	net-days	kg/net-day
		Prince Co.	Winter 1997	1	261	32	8.16			
		Queens Co.	Winter 1997	1	18,753	720	26.05			
		Prince & Queens Co.	Winter 1997	1	19,015	752	25.29			
Smelt	Spears, 1 ^c Spears, 2 ^a Spears, 1 Spears, 2 Spears, 3 ^f Spears, 1 Spears, 2 Spears, 3 Spears, 1 Spears, 2 Spears, 3 Spears, 1 Spears, 2 Spears, 3 Spears, any	Fullertons, Hillsborough R Fullertons, Hillsborough R Stewart Cove, Hills. R. Stewart Cove, Hills. R. Stewart Cove, Hills. R. West River West River West River Summerside Harbour Summerside Harbour Summerside Harbour PEI PEI PEI PEI	Winter 1995	1 ^d	83	16	5.19	no.	spearer- hours	no./ spearer- hour
			Winter 1995	1	2	4	0.50			
			Winter 1995	2	10	8	1.25			
			Winter 1995	2	481	84	5.73			
			Winter 1995	2	264	6	44.00			
			Winter 1995	1	144	15	9.60			
			Winter 1995	1	132	22	6.00			
			Winter 1995	1	84	27	3.11			
			Winter 1995	8	1,320	178	7.41			
			Winter 1995	8	3,345	423	7.91			
			Winter 1995	8	24	23	1.07			
			Winter 1995	12	1,557	217	7.17			
			Winter 1995	12	3,960	533	7.43			
			Winter 1995	12	372	56	6.70			
			Winter 1995	12	6,039	1,064	5.68			

Table 8 (continued)

Species	Gear	Location	Year	Number of fishermen supplying data	Catch	Effort	Catch rate	Units		
								Catch	Effort	Catch rate
Smelt	Spears	Orwell Cove	Winter 1995	2	667	2	334	no.	Shack-	No./
		Hillsborough River	Winter 1995	4	1,045	4	261		years	shack-
		West River	Winter 1995	1	510	1	510			year
		Summerside	Winter 1995	8	4,689	8	586			
		PEI	Winter 1995	15	6,911	15	461			
Tomcod	Smelt box nets	Site in Prince Co.	Fall 1979	1	7,492	258	29.04	kg	net-days	kg/net-day
			Fall 1980	1	1,796	264	6.80			
			Fall 1981	1	1,938	180	10.77			
			Fall 1985	1	1,817	186	9.77			
			Fall 1986	1	935	186	5.03			
			Fall 1987	1	948	150	6.32			
			Fall 1988	1	1,158	72	16.08			
			Fall 1989	1	604	90	6.71			
			Fall 1992	1	293	162	1.81			
			Fall 1993	1	1,700	240	7.08			
Fall 1996	1	894	224	3.99						
Tomcod	Smelt box nets	Prince Co.	Fall 1996	1	274	140	1.95	kg	net-days	kg/net-day
Winter flounder	Eel trap-nets	Prince Co.	1996	2	210	1,640	0.13	no.	net-days	no./net-day
		Queens Co.	1996	1	5	1,448	0.00			
		Kings Co.	1996	1	1,321	2,139	0.62			
		PEI	1996	4	1,536	5,227	0.29			
Winter flounder	Eel trap-nets	Prince Co.	1996	1	1,041	1,675	0.62	kg	net-days	kg/net-day
		Kings Co.	1996	1	571	1,275	0.45			
		PEI	1996	2	1,612	2,950	0.55			
Winter flounder	Smelt box nets	Prince Co.	Fall 1996	3	1,313	857	1.53	kg	net-days	kg/net-day
		Prince Co.	Winter 1997	1	0	32	0.00			
		Queens Co.	Winter 1997	1	0	720	0.00			
		Prince & Queens Co.	Winter 1997	1	0	752	0.00			

^aData from Lewis et al. 1975, from three box traps with dimensions 12'x16', 12'x18', and 20'x30'

^bSilverside data for 1979 from Jessop and Morantz 1982

^cSpear fishing, with 1 fisherman in the shack

^dFor the smelt spear fishery, "Number of fishermen supplying data" refers to number of shack-owners supplying data

^eSpear fishing, with 2 fishermen in the shack

^fSpear fishing, with 3 fishermen in the shack

Table 9

Densities (fish/100m²) of American eels from electrofishing surveys on the Morell River. 1975 data from Ducharme 1977. 1984-1985 data from K. Davidson and R. Grey. See Cairns et al. 1996 for site locations and methods.

Site ^a	8-12 Sep 1975	11 Aug- 11 Sep 1984	21 Aug- 5 Sep 1985	23 Aug- 7 Sep 1994	15-27 Dec 1994	24 Jul- 22 Aug 1995	24 Oct- 7 Nov 1995	14 Aug- 4 Sep 1996
Indian Bridge	33.8							
Rowells Riffle			4.1	1.6	0.0	1.6	0.0	0.0
Mooneys Bridge	5.3		1.1	0.0	0.0			
Grants	6.6					0.6	0.0	0.0
Forks	6.2	3.3		0.8	0.0	0.8	0.0	0.0
Above Landing Pool						1.7	1.0	0.0
Lower Leards			2.3					
Leards Bridge	14.8	16.9	23.8	7.3	0.0	7.0	0.0	0.9
Kennys Hole		1.2	1.7	7.1	0.0	3.9	0.0	0.0
Upper Kennys						0.0	0.0	1.3
Mooney Tracks						0.0	0.0	0.0
Gill Road						0.0	0.0	0.0
Oates						0.0	0.0	
Old Cardigan III						0.0	0.0	0.0
Lower Cranes						0.0	0.0	0.0
Cranes		11.8	2.8	0.5	0.0	0.5	0.0	0.0
Everglades						0.0	0.0	2.2
Martinvale						0.0	0.0	0.0
Mean density ^b	8.2	8.3	6.0	2.9	0.0	1.1	0.1	0.3
SD density	4.4	7.3	8.8	3.4	0.0	1.9	0.3	0.7
Total population ^c	19,508	19,693	14,168	6,822	0	2,543	165	741

^aSite boundaries in 1994-1996 are defined in Cairns et al. 1995. Except for Lower Leards, sites used in 1984-1985 are close to those repeated in 1994-1996, but boundaries may have shifted by several metres. Exact locations of 1975 sites were not recorded (L.A. Ducharme, pers. comm.) These sites are in the same general areas as those used later, but probably do not overlap them.

^bExcludes Indian Bridge

^cBased on the mean density at sites upstream from Indian Bridge, and a river area of 237,176 m² (Cairns et al. 1996)

Table 10
 Reported landings (metric tons) and landed value of gaspereau on Prince Edward Island, by statistical district, month, and gear type, 1986-1996.

Year	Statistical District										Month						Gear			Total	Percent Supp. B ^a	Landed value	Mean price/ kg
	82	83	85	86	87	88	92	93	95	96	May	Jun	Jul	Aug	Sep	Oct	Traps	Dipnet/ beach seine	Gillnet				
1986	0.5	47.8	35.9	48.2	0.0	22.2	1.3	16.3	128.2	163.3	316.8	146.6	0.2	0.1	0.0		2.3	0.0	461.3	463.6	96.7	\$103,146	\$0.22
1987	0.8	22.7	4.5	75.0	25.9	29.7	5.2	14.0	100.1	86.4	201.8	152.5	2.7	6.2	1.1		0.0	0.0	364.4	364.4	85.1	\$104,398	\$0.29
1988	4.9	0.0	0.0	9.1	41.1	41.8	0.0	0.0	54.5	82.5	133.4	100.6	0.0	0.0	0.0		9.5	1.4	223.1	234.0	76.7	\$69,011	\$0.29
1989	0.1	0.0	0.0	6.3	5.7	7.3	6.1	4.1	36.4	66.4	123.7	8.6	0.0	0.0	0.0		125.8	0.0	6.6	132.3	80.8	\$42,986	\$0.32
1990	1.2	0.0	4.5	18.8	28.7	11.7	0.0	0.0	9.1	9.1	3.7	79.5	0.0	0.0	0.0		46.5	0.0	36.6	83.1	39.7	\$26,620	\$0.32
1991	1.1	0.0	4.5	11.3	25.2	12.5	0.0	4.5	11.3	16.2	6.1	80.1	0.5	0.2	0.0		85.7	0.0	1.1	86.8	54.6	\$28,427	\$0.33
1992	37.3	0.0	4.5	11.3	35.8	191.3	0.0	2.3	7.7	26.8	112.7	203.6	0.5	0.1	0.0		84.0	0.0	233.0	317.0	69.3	\$92,608	\$0.29
1993	3.4	0.0	0.0	33.1	14.8	66.1	9.1	0.0	32.4	41.1	33.2	155.1	9.7	2.0	0.0		178.3	0.0	21.7	200.0	53.3	\$68,878	\$0.34
1994	0.7	0.0		4.5	23.0	30.2	4.5	3.0	24.1	25.1	26.9	83.9	0.7	3.4		0.0	37.1	15.1	62.9	115.0	50.5	\$36,149	\$0.31
1995	1.0	8.4		0.9	22.1	9.7	0.0	0.0	0.0	0.0	7.3	34.0	0.7	0.0		0.1	10.2	24.0	7.7	42.0	0.0	\$13,925	\$0.33
1996	10.2	0.0		6.3	20.7	12.2	0.0	3.7	0.2	0.0	21.1	32.2	0.0	0.0		0.0	28.2	8.0	17.1	53.3	0.0	\$22,724	\$0.43
Mean	5.6	7.2	4.9	20.4	22.1	39.5	2.4	4.4	36.7	47.0	89.7	97.9	1.4	1.1	0.1	0.0	55.2	4.4	130.5	190.1	55.2	\$55,352	\$0.32
Mean %	2.9	3.8	2.6	10.8	11.6	20.8	1.3	2.3	19.3	24.7	47.2	51.5	0.7	0.6	0.1	0.0	29.1	2.3	68.6	100.0			

^aPercent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Table 11

Reported landings (metric tons) and landed value of silversides on Prince Edward Island, by statistical district and by month, 1973 and 1975-1996. 1973 figures are from Jessop and Morantz (1982), 1975-1983 figures are from LeBlanc and Chaput (1991), and other figures are from Fisheries and Oceans Statistics Branch

Year	Statistical District										Month							Total	Percent Supp. B ^a	Landed value	Mean price/kg
	83	85	86	87	88	92	93	95	96	Jan	Feb	May	Sep	Oct	Nov	Dec					
1973	0.0	0.0	0.0	24.0	118.0	0.0	0.0	0.0	0.0								142.0				
1975	0.0	0.0	0.0	20.5	48.3	0.0	0.0	0.0	0.0								68.8		\$7,000	\$0.10	
1976	0.0	0.0	0.0	6.2	88.1	0.0	5.1	0.0	0.0								99.4		\$14,000	\$0.14	
1977	0.0	0.0	0.0	27.9	124.4	0.0	0.0	0.0	0.0								152.3		\$30,000	\$0.20	
1978	2.7	0.0	0.0	59.6	142.0	5.0	0.0	0.0	0.0								209.3		\$67,000	\$0.32	
1979	12.0	26.5	0.0	42.1	206.0	32.4	0.2	0.0	0.0								319.2		\$91,000	\$0.29	
1980	2.1	3.9	17.4	0.0	36.4	0.0	0.0	0.0	0.0								59.8		\$14,000	\$0.23	
1981	0.0	0.0	0.3	0.0	32.6	0.0	0.0	0.0	0.0								32.9				
1982	3.4	0.0	0.0	1.6	52.0	4.0	1.5	0.0	0.0								62.5				
1983	18.2	0.0		3.5	71.5	14.2	0.1	0.0	0.0								107.5				
1984	27.6	0.0	0.0	4.4	97.6	1.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	66.2	57.0	7.9	131.1		\$30,694	\$0.23	
1985	23.5		0.0	0.0	19.2	0.0	4.9	0.0	0.0	0.0	0.0	0.0		26.2	11.5	9.9	47.5		\$13,018	\$0.27	
1986	0.0		32.0	0.0	6.5	10.0	0.0	27.3	0.5	0.0	59.1	0.0		0.7	12.2	4.3	76.2	84.0	\$18,553	\$0.24	
1987	0.0		0.0	0.0	132.6	0.0	4.2	0.0	0.0	0.0	0.0	0.0		90.1	46.7	0.0	136.8	0.0	\$37,573	\$0.27	
1988	0.0		0.0	0.0	74.8	0.0	0.9	0.0	4.2	0.0	0.0	0.0		74.8	5.1	0.0	79.9	0.0	\$22,710	\$0.28	
1989	0.0		0.0	0.0	32.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0		32.9	0.0	0.0	32.9	0.0	\$10,864	\$0.33	
1990	0.0		0.0	0.0	81.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0		81.9	0.0	0.0	81.9	0.0	\$27,068	\$0.33	
1991	21.9		0.0	0.0	95.8	0.0	0.0	0.0	0.0	13.6	0.0	0.0		0.6	103.6	0.0	117.8	0.0	\$51,820	\$0.44	
1992	0.0		10.7	0.0	35.7	0.0	0.0	0.0	0.0	0.0	0.0	3.5		12.4	25.4	5.0	46.4	0.0	\$17,539	\$0.38	
1993	1.2		0.0	16.5	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		24.0	53.0	5.8	82.7	0.0	\$29,088	\$0.35	
1994	4.5		13.8	47.9	402.0	35.2	7.2		32.5				2.0	292.9	243.2	5.1	543.1	0.0	\$207,621	\$0.38	
1995	5.3		0.0	45.7	124.7	7.0	24.7		15.2				0.0	149.4	73.3	0.0	222.6	0.0	\$72,108	\$0.32	
1996	0.0		1.2	65.3	66.1	14.0	0.0		4.5				0.0	63.6	86.4	1.1	151.1	0.0	\$43,480	\$0.29	
Mean	5.3	1.3	3.3	15.9	93.6	5.3	2.1	1.2	2.5	1.0	4.5	0.3	0.2	70.4	55.2	3.0	130.6	7.0	\$42,376	\$0.28	
Mean %	4.1	1.0	2.5	12.2	71.7	4.1	1.6	0.9	1.9	0.8	3.5	0.2	0.1	53.9	42.2	2.3	100.0				

^aPercent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Table 12

Age distribution of silversides samples in 1996, by number and weight. Ages are assigned on the basis of fork length, with fish over 10.25 cm in length considered to be 1+. Weights were calculated by the formula $\text{Weight} = 0.004513 \text{ Length}^{3.167}$ (Caims 1996).

	Little Harbour 1 Nov	Souris 6 Nov	Murray River 6 Nov	Total/ mean
Number in sample	300	300	300	900
0+ fish				
Number	271	291	286	848
Percent by number	90.3	97.0	95.3	94.2
Percent by weight	82.9	93.5	89.5	88.6
1+ fish				0
Number	29	9	14	52
Percent by number	9.7	3.0	4.7	5.8
Percent by weight	17.1	6.5	10.5	11.4

Table 13

Counts of smelt nets (1997) and smelt shacks (1974-1997) in winter on Prince Edward Island.

Location	Nets, 1997			Smelt shacks														
	Box nets	Bag nets	Gill-nets	74	75	76	77	78	80	81	87	93	94	95	96	97		
Data source	C ^a	C	C	T ^b	T	F ^c	F	F	F	F	F	F	F	F	F	C		
North Cape to Cape Kildare																		
Total	0	0	0	^d	1											0		
Cape Kildare to Black Banks																		
Alberton & vicinity	16	0	0													0		
Mill River	1	0	0	2	4											1		
Trout River	5	0	0		4											1		
Elsewhere	0	0	0													0		
Total	22	0	0	2	8											2		
Black Banks to Profitts Point																		
Milligans Wharf & vicinity	1	0	0													1		
Lennox Island & vicinity	0	0	0															
Grand River	0	0	0	7	2		5								8	1		
Bentick Cove	0	0	0	3	5	5	7		15	3		5	5	6	4	1		
Darnley	3	0	1						2							0		
Elsewhere	1	0	0	22	5		9		17	10				10	23	15		
Total	5	0	1	32	12	5	21		34	13		5	5	16	39	18		
Profitts Point to Cape Stanhope																		
New London Bay, incl. Southwest R & Hunter R	14	0	0		3						1					0		
Rustico Bay, incl. Hunter R & Wheatley R	9	0	0	2	2					1	6	2		2	1	3		
Brackley/Covehead Bay	0	0	0	4	1					1		4	3	5	11	8		
Elsewhere	0	0	0													0		
Total	23	0	0	6	6					2	7	6	3	7	12	11		
Cape Stanhope to Deroche Point																		
Tracadie Bay, incl. Corran Ban	0	0	5		1						1		1			3		
Elsewhere	0	0	0													0		
Total	0	0	5		1						1		1			3		
Deroche Point to East Point																		
Savage Harbour	0	0	0													0		
St. Peters Bay, incl. Morell River	5	0	0									1				0		
Elsewhere	ns ^e	ns	ns													ns		
Total	5	0	0									1				0		
East Point to Cape Spry																		
Total	0	0	0		1											1		
Cape Spry to Little Sands																		
Boughton River	6	0	4													0		
Cardigan Bay & rivers	0	0	0		6	9	8	5				1	4		1	3		
Murray Harbour & rivers	4	0	0		10	33	14		8		3		1		4	5		
Elsewhere	0	0	0													0		
Total	10	0	4		16	42	22	5	8		3	1	5		5	8		
Little Sands to Point Prim																		
Total	0	0	0		1			7					3	3	2			
Point Prim to entrance to Ch'town Harbour																		
Orwell Bay	0	0	0									20	14	13	9	14	25	
Pownal Bay	0	0	0									3	15	15	2	2	3	1
Elsewhere	0	0	0	2										4	4	3	3	
Total	0	0	0	2		2						3	35	29	19	15	17	29
Charlottetown rivers																		
Hillsborough River	63	1	0	15	37	26	53	66	n	39	28	17	20	61	25	57		
North River	4	0	0	28	34	35	25	31	36	27	4	5		1	1	3		
West River	24	0	0	20	20	27	25	47	34	38	8		8	12	11	13		
Total	91	1	0	63	91	88	103	144	70	104	40	22	28	74	37	73		
Ch'town Harbour entrance to Victoria Lighthouse																		
Total	0	0	0			1	1		1		5		2	1	5	1		
Victoria Lighthouse to Seacow Head																		
Total	0	1	0								1			7		7		
Seacow Head to Cape Egmont																		
Bedeque Bay	23	0	0	59	40	73	85	46	58	36	118	56	72	43	102	107		
Elsewhere	0	0	0	8	2	9	11	25	9	15	4	8	6		6	5		
Total	23	0	0	67	42	82	96	71	67	51	122	64	78	43	108	112		
Cape Egmont to West Point																		
Total	4	0	6		1							12	17	7	n	18		
West Point to North Cape																		
Total	5	0	1		3								2			9		
Grand total	188	2	17	172	183	220	243	227	180	173	214	140	163	173	225	292		

^aData from helicopter surveys conducted by DFO Conservation and Protection officers, supplemented by ground counts.^bData from Thomson 1975. Survey method not given.^cData primarily collected during aerial surveys for winter waterfowl conducted by the PEI Fish and Wildlife Division, supplemented by ground counts^dWhere no entry is given, available records do not indicate whether the area was surveyed or not.^eNot surveyed

Table 14

Reported landings (metric tons) and landed value of smelts on Prince Edward Island, by statistical district, month, and gear type, 1985-1996.

Year	Statistical District										Month												Gear				Total	Percent Supp. B*	Landed value	Mean price/kg
	82	83	85	86	87	88	92	93	95	96	Jan	Feb	Mar	Apr	May	Jul	Aug	Sep	Oct	Nov	Dec	Traps	Gillnets	Spears	Dipnet					
1985	4.1	69.8	0.0	4.3	1.4	7.7	9.9	18.8	1.7	0.0	19.3	2.2	1.1	0.2	0.0	0.1	0.0	1.4	26.9	44.6	22.0	110.6	7.2	0.0	0	117.8	NA	\$131,848	\$1.12	
1986	0.0	62.3	61.4	366.8	2.3	10.9	14.9	14.9	151.0	19.2	134.2	271.6	55.0	10.0	0.0	0.0	0.0	0.0	19.2	22.2	191.4	688.4	15.2	0.0	0	703.6	82.7	\$681,564	\$0.97	
1987	0.6	100.6	0.0	2.8	0.0	23.2	6.9	9.9	3.3	2.4	49.4	35.0	11.0	5.5	5.5	0.0	0.1	0.5	18.5	17.3	7.0	105.1	44.8	0.0	0	149.9	25.0	\$114,813	\$0.77	
1988	0.0	15.5	11.5	89.7	0.6	34.3	11.7	20.8	32.2	2.6	148.5	23.4	0.5	0.8	0.0	0.0	0.0	0.0	28.9	8.5	8.4	131.3	87.7	0.0	0	219.0	42.5	\$172,599	\$0.79	
1989	0.0	60.5	0.0	25.7	0.7	1.2	15.8	0.2	0.2	0.0	44.8	8.7	0.0	0.6	0.0	0.0	0.0	0.0	10.5	28.3	11.3	59.0	45.2	0.0	0	104.2	1.8	\$90,968	\$0.87	
1990	0.0	63.6	0.0	0.0	1.5	0.0	2.5	17.4	0.0	0.0	27.6	20.7	6.3	0.0	0.0	0.0	0.0	0.9	11.9	10.4	7.2	40.6	44.4	0.0	0	85.0	1.8	\$77,238	\$0.91	
1991	0.0	66.2	0.0	43.8	0.0	8.4	11.0	23.8	4.9	0.0	69.2	52.0	14.5	0.0	16.1	0.0	0.0	0.0	1.9	0.5	3.8	94.6	63.4	0.0	0	158.0	48.0	\$145,075	\$0.92	
1992	0.0	164.0	0.0	3.3	0.0	0.7	0.2	25.2	0.0	0.0	82.6	91.3	10.0	0.0	0.0	0.0	0.0	0.9	2.0	6.2	0.3	84.5	108.9	0.0	0	193.4	52.1	\$153,523	\$0.79	
1993	3.2	44.3	0.0	45.6	10.4	19.8	25.6	23.5	7.4	0.4	46.9	25.7	13.9	0.5	0.0	0.0	0.0	0.0	43.6	43.2	6.4	61.4	72.5	46.3	0	180.2	29.1	\$212,597	\$1.18	
1994	0.3	59.8	0.9	106.7	3.8	7.7	25.9	42.6	5.5	1.8	75.6	53.6	17.7	0.2				0.0	39.4	58.9	9.6	209.5	23.5	21.8	0.136	255.0	21.8	\$373,609	\$1.47	
1995	1.2	88.3	0.6	88.8	4.7	18.1	23.3	36.7	8.5	0.3	48.0	125.9	0.6	0.0				0.0	33.4	57.6	4.9	206.1	57.5	6.9	0	270.5	10.7	\$355,995	\$1.32	
1996	1.3	28.2	9.7	17.8	0.7	6.2	16.3	15.2	2.9	0.2	32.3	29.1	0.0	0.0				0.0	11.5	21.3	4.3	86.5	12.0	0.0	0	98.5	4.9	\$97,428	\$0.99	
Mean	0.9	68.6	7.0	66.3	2.2	11.5	13.7	20.7	18.1	2.3	64.9	61.6	10.9	1.5	1.8	0.0	0.0	0.3	20.6	26.6	23.0	156.5	48.5	6.2	0.0	211.2	29.1	\$217,271	\$1.01	
Mean %	0.4	32.5	3.3	31.4	1.0	5.5	6.5	9.8	8.6	1.1	30.7	29.2	5.2	0.7	0.8	0.0	0.0	0.1	9.8	12.6	10.9	74.1	23.0	3.0	0.0	100.0				

*Percent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Table 15

Reported landings (metric tons) and landed value of shad on Prince Edward Island, by statistical district, month, and gear type, 1985-1996.

Year	Statistical District		Month					Gear	Total	Percent Supp. B ^a	Landed value	Mean price/kg
	82	92	Jun	Jul	Aug	Sep	Oct	Gillnet				
1985	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	NA	\$19	\$0.38
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		\$0	
1987	1.7	0.0	0.0	1.7	0.0	0.0	0.0	1.7	1.7	0.0	\$741	\$0.44
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		\$0	
1989	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.5	0.0	\$88	\$0.18
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		\$0	
1991	34.4	6.1	0.0	33.3	2.7	3.7	0.8	40.5	40.5	0.0	\$14,601	\$0.36
1992	16.2	0.8	0.0	16.4	0.5	0.0	0.1	17.0	17.0	0.0	\$6,172	\$0.36
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	\$4	\$0.29
1994	0.2	0.1		0.2		0.1	0.0	0.3	0.3	0.0	\$128	\$0.49
1995	0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0	\$4	\$1.05
1996	0.0	0.0		0.0		0.0	0.0	0.00	0.0		\$0	
Mean	4.4	0.6	0.0	4.3	0.3	0.3	0.1	5.0	5.0	0.0	\$1,813	\$0.44
Mean %	88.3	11.7	0.0	86.7	5.4	6.3	1.5	100.0	100.0			

^aPercent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Table 16

Reported landings (metric tons) and landed value of tomcod on Prince Edward Island, by statistical district, month, and gear type, 1985-1996.

Year	Statistical District									Month								Gear		Total	Percent Supp. B ^a	Landed value	Mean price/kg	
	82	83	85	86	88	92	93	95	96	Jan	Feb	Mar	Jul	Aut	Sep	Oct	Nov	Dec	Traps					Gillnets
1985	0.1	6.1	0.0	2.2	0.0	0.4	3.7	0.1	0.0	0.8	0.0	0.0		0.0	0.0	2.1	6.5	3.2	12.6	0.0	12.6		\$1,684	\$0.13
1986	0.0	10.2	11.4	100.4	0.0	0.1	0.5	52.3	6.1	12.0	99.6	11.6		0.1	0.3	3.7	7.9	45.8	171.9	9.1	181.0	89.6	\$31,995	\$0.18
1987	0.0	10.2	0.0	0.1	0.0	0.0	0.7	1.7	0.0	6.3	0.2	0.0		0.0	0.0	5.1	0.9	0.0	7.2	5.4	12.6	0.0	\$2,706	\$0.21
1988	0.0	0.3	0.0	0.9	0.0	1.2	2.2	2.0	0.0	1.0	0.0	0.0		0.0	0.0	4.2	0.6	0.7	4.6	2.0	6.6	3.4	\$1,977	\$0.30
1989	0.0	1.4	0.0	0.7	0.0	0.6	0.1	0.0	0.0	1.4	0.0	0.0		0.0	0.0	0.3	1.1	0.0	1.4	1.4	2.8	0.0	\$924	\$0.33
1990	0.0	0.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.4	0.3	0.1	0.6	0.3	0.8	0.0	\$145	\$0.18
1991	0.0	3.1	0.0	0.0	0.0	0.5	6.8	0.5	0.0	5.7	5.1	0.0		0.0	0.0	0.0	0.0	0.0	0.0	10.8	10.8	90.6	\$4,500	\$0.42
1992	0.0	1.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.6	0.0	0.0		0.0	0.0	0.0	0.0	0.0	1.6	0.1	1.7	0.0	\$378	\$0.22
1993	0.0	8.1	0.0	0.0	3.1	0.5	0.0	0.0	0.0	0.9	1.2	0.0		0.0	0.0	3.9	4.8	0.9	2.6	9.1	11.7	26.2	\$3,914	\$0.34
1994	0.0	9.2		0.1	0.8	0.4	0.6	0.0		4.6	0.3		0.0		0.0	3.3	2.7	0.2	8.5	2.6	11.1	6.9	\$3,046	\$0.28
1995	0.2	1.2		0.0	0.0	1.6	2.0	0.1		1.8	0.0		0.0		0.1	1.4	1.5	0.3	2.6	2.6	5.2	0.0	\$674	\$0.13
1996	0.1	1.5		0.0	0.3	0.2	1.0	0.0		0.3	0.1		0.0		0.0	1.4	1.2	0.0	2.6	0.3	2.9	0.0	\$604	\$0.21
Mean	0.0	4.4	0.9	8.7	0.3	0.5	1.5	4.7	0.5	3.0	8.9	1.0	0.0	0.0	0.0	2.2	2.3	4.3	18.0	3.6	21.7	18.1	\$4,379	\$0.24
Mean %	0.2	20.4	4.4	40.2	1.6	2.1	7.0	21.8	2.4	14.0	41.0	4.5	0.0	0.1	0.2	10.0	10.6	19.7	83.2	16.8	100.0			

^aPercent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Table 17

Reported landings (metric tons) and landed value of sturgeon on Prince Edward Island, by statistical district, month, and gear type, 1985-1996.

Year	Statistical District				Month					Gear			Total	Percent Supp. B ^a	Landed value	Mean price/kg
	82	88	92	96	Jun	Jul	Aug	Sep	Oct	Gillnet	Rod&reel	Trapnet				
1985	0.11	0.00	0.46	0.00	0.04	0.34	0.14	0.06	0.00	0.43	0.00	0.14	0.58	NA	\$221	\$0.38
1986	0.02	0.00	0.21	0.00	0.03	0.09	0.06	0.05	0.00	0.22	0.02	0.00	0.23	0.0	\$81	\$0.35
1987	0.02	0.01	0.02	0.00	0.00	0.01	0.02	0.00	0.01	0.04	0.00	0.00	0.04	0.0	\$20	\$0.49
1988	0.03	0.00	0.10	0.05	0.00	0.00	0.05	0.02	0.10	0.13	0.00	0.05	0.17	0.0	\$80	\$0.47
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		\$0	
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		\$0	
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		\$0	
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		\$0	
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		\$0	
1994		0.00	0.02			0.00		0.02		0.02			0.02	0.0	\$13	\$0.66
1995		0.00	0.00			0.00		0.00		0.00			0.00		\$0	
1996		0.00	0.00			0.00		0.00		0.00			0.00		\$0	
Mean	0.01	0.00	0.07	0.00	0.01	0.04	0.02	0.01	0.01	0.07	0.00	0.02	0.09	0.0	\$35	\$0.47
Mean %	17.1	1.0	77.5	4.4	6.3	43.3	26.0	14.3	10.1	80.2	1.5	18.3	100.0			

^aPercent of landings recorded as Supplementary B (landings without purchase slips, as estimated by field staff)

Fig. 1
 Prince Edward Island, showing and locations and numbers of smelt shacks and nets counted in ground patrols in winter 1995. Survey coverage is not complete, particularly in eastern and western areas. Statistical Districts are also shown.

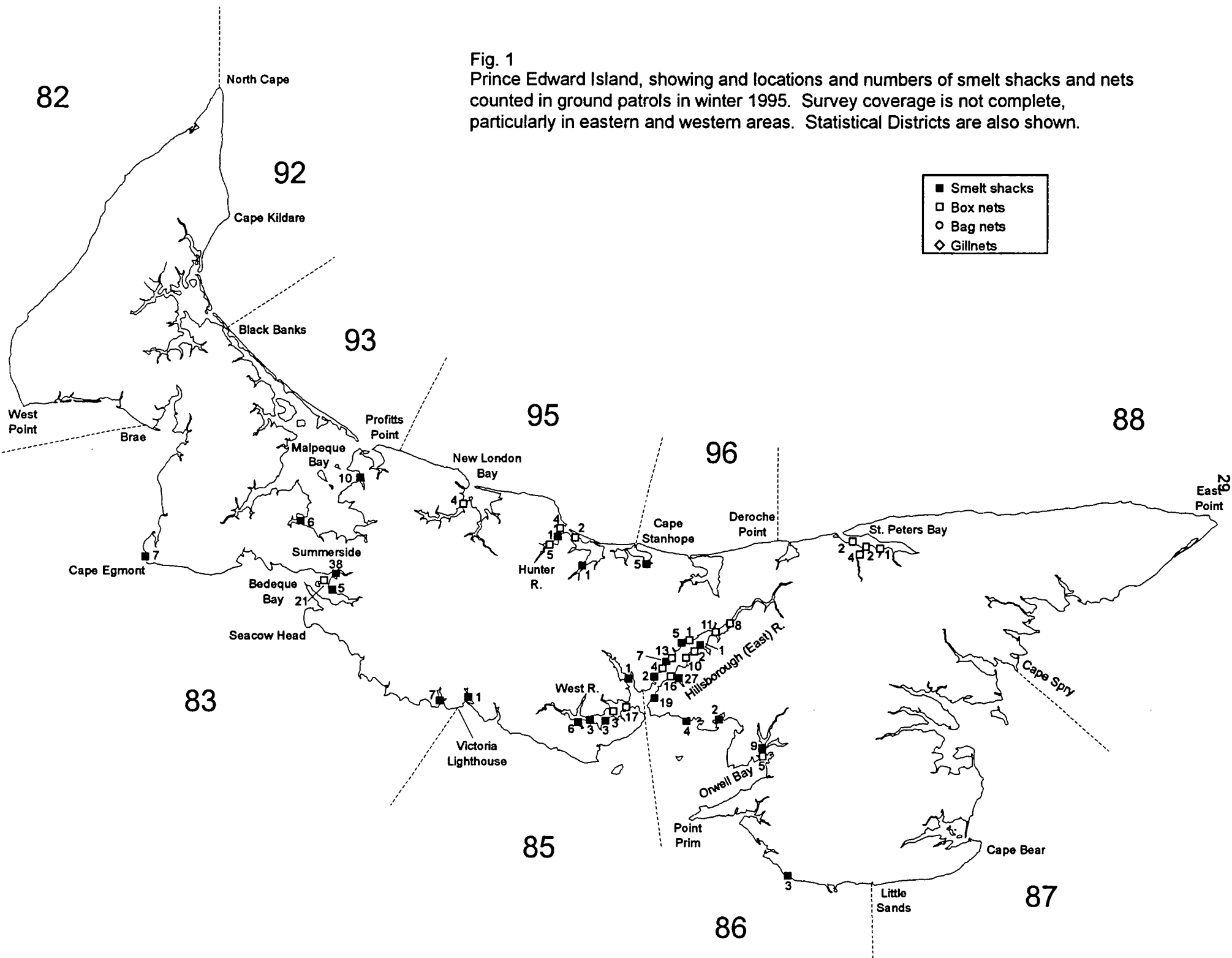
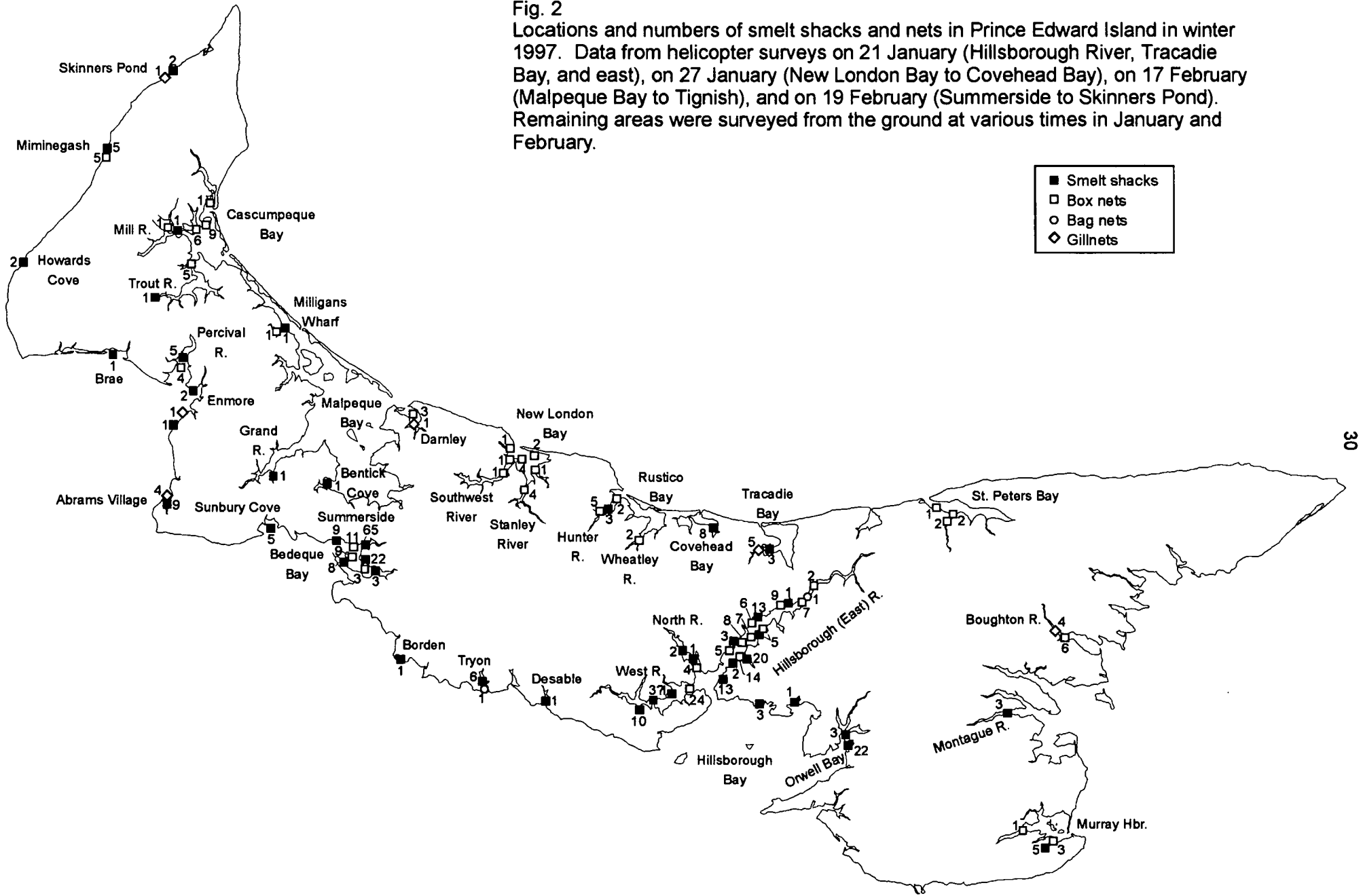


Fig. 2

Locations and numbers of smelt shacks and nets in Prince Edward Island in winter 1997. Data from helicopter surveys on 21 January (Hillsborough River, Tracadie Bay, and east), on 27 January (New London Bay to Covehead Bay), on 17 February (Malpeque Bay to Tignish), and on 19 February (Summerside to Skinners Pond). Remaining areas were surveyed from the ground at various times in January and February.



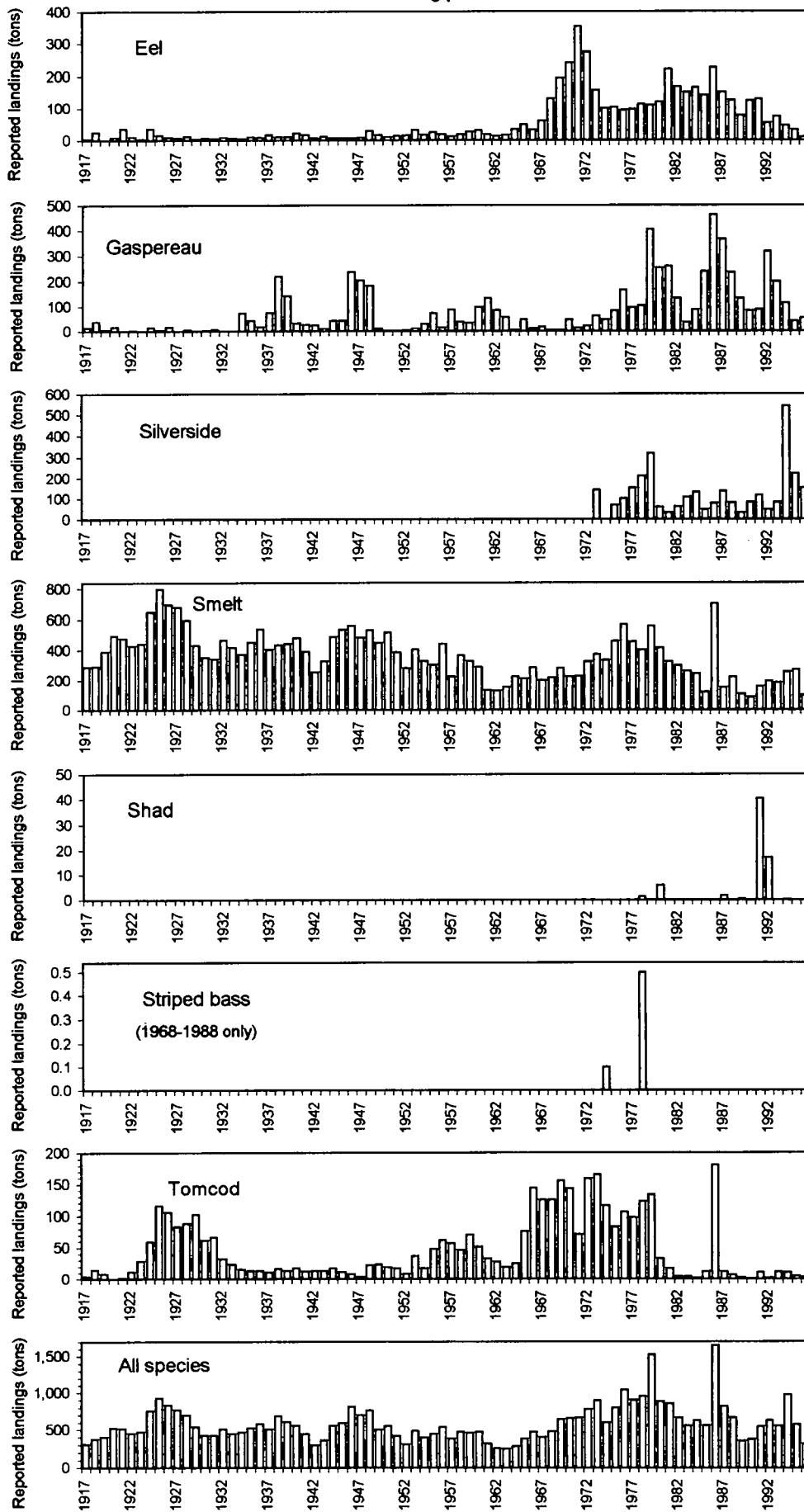


Fig. 3
Reported landings (metric tons) of commercial diadromous fishes on Prince Edward Island, 1917-1996. Data from LeBlanc and Chaput (1991) and DFO Statistics Branch.

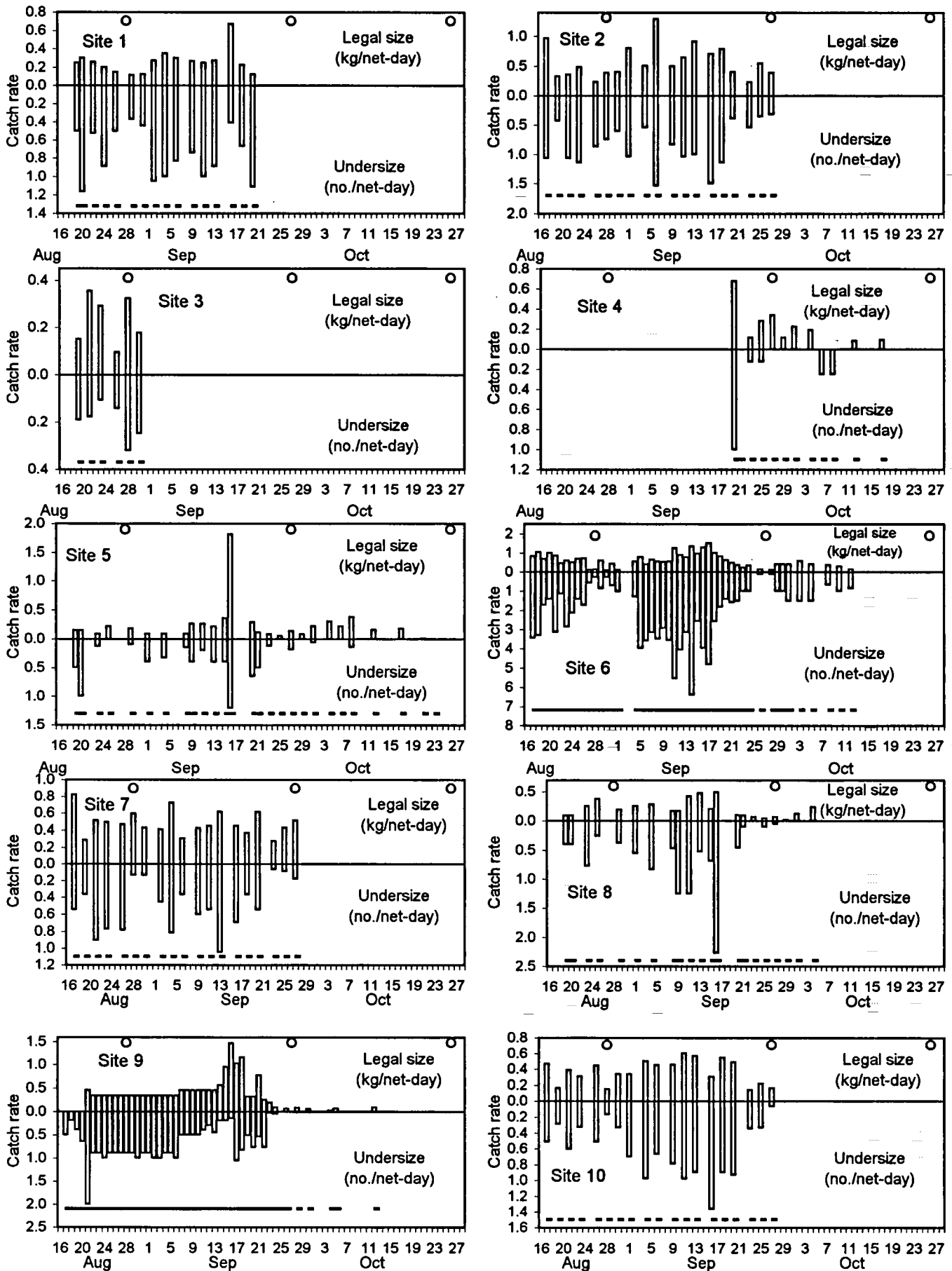


Fig. 4. Catch rates of legal (kg/net-day) and undersized (number captured/net-day) eels in trap-nets, in 1996, from log-book records. Each panels presents mean catch rates for one site. Sites contain from 3 to 35 traps each. The legal size is 46 cm. Horizontal bars indicate days when nets were hauled. Circles indicate full moon.

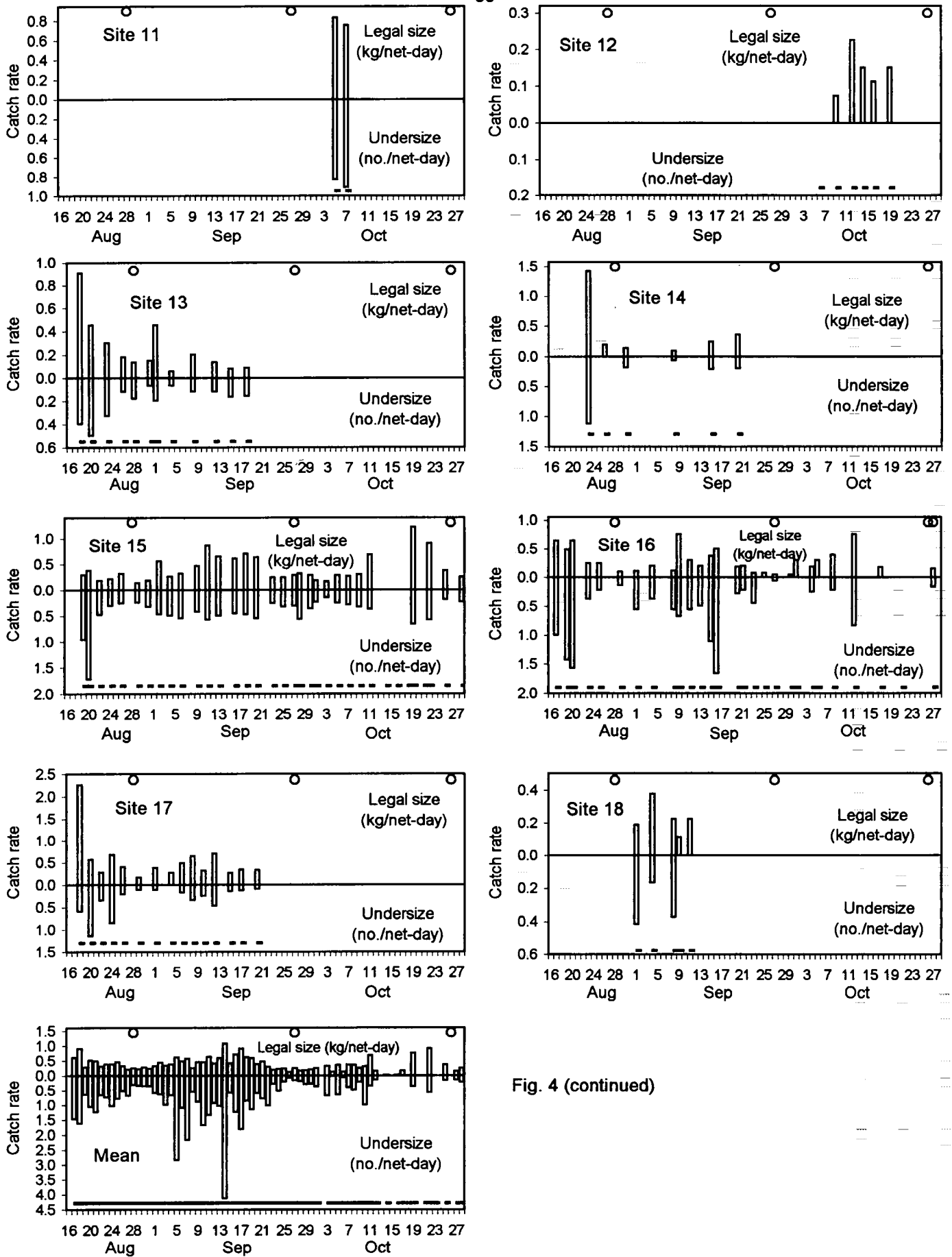


Fig. 4 (continued)

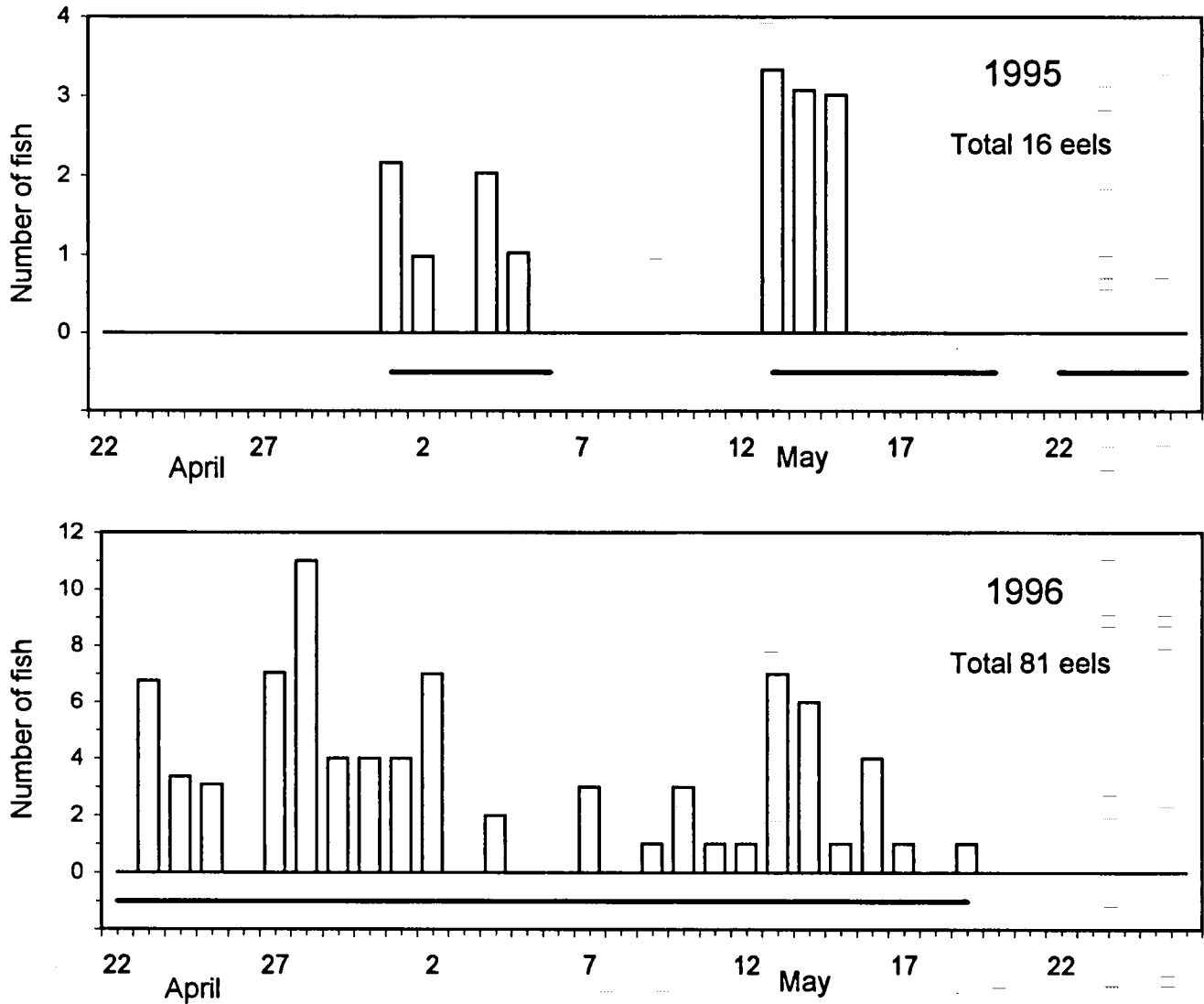


Fig. 5
Number of eels moving downstream at Indian Bridge on the Morell River through the partial smolt fence in 1995 (Cairns et al. 1997), and the full smolt fence in 1996. Horizontal bars indicate dates on which the fence was in operation.

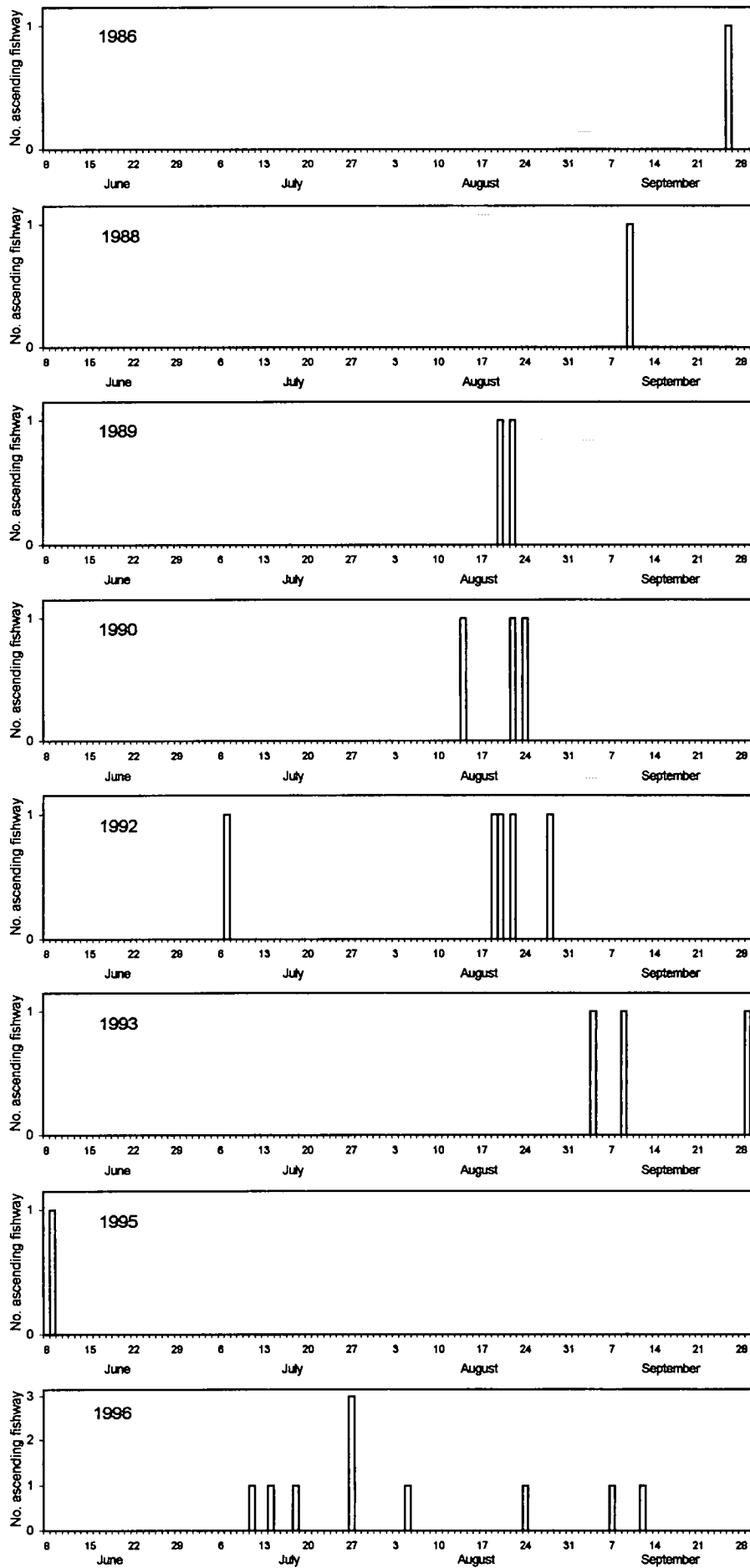


Fig. 6. Upstream movements of eels through the Leards fishway on the Morell River, 1986-1996.

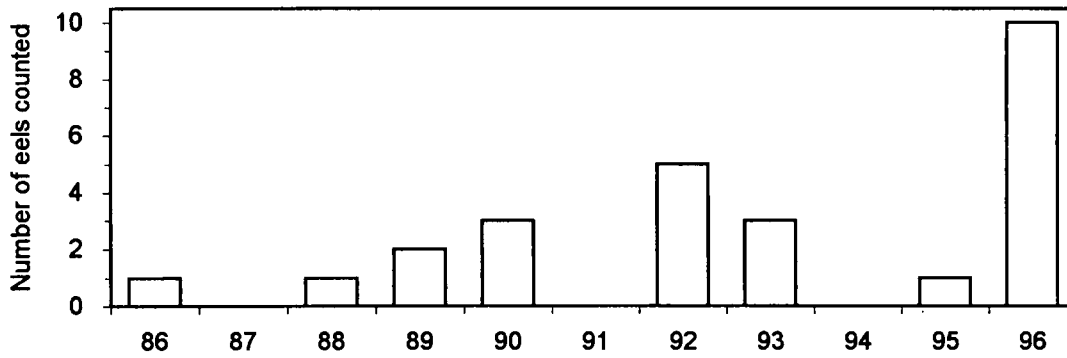


Fig. 7
Counts of eels moving upstream at the Leards Pond fishway on the Morell River, 1986-1996. A new trap was installed in 1996, which may have altered capture efficiency.

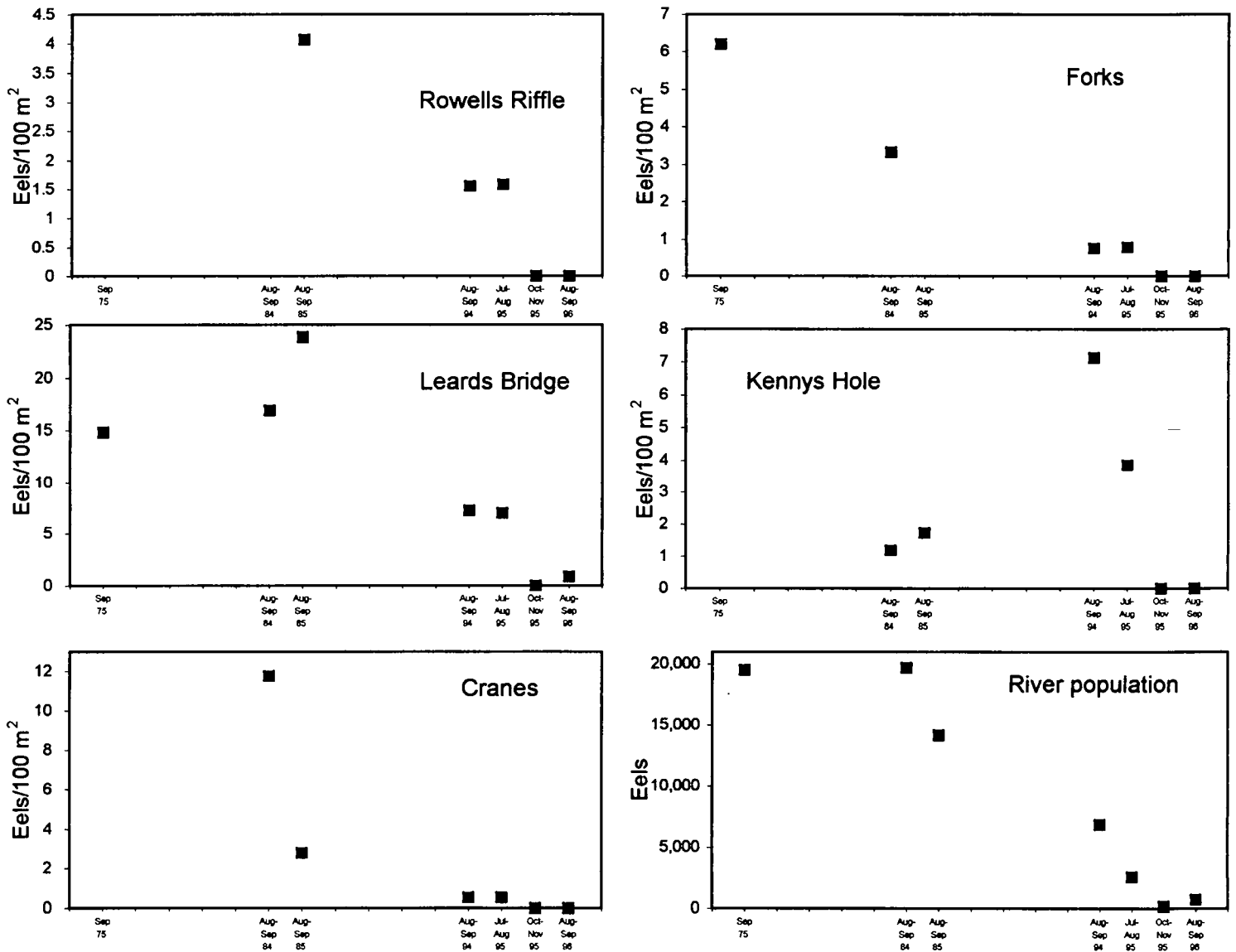


Fig. 8
Densities and river-wide populations of American eels on the Morell River, Prince Edward Island, from electrofishing surveys.

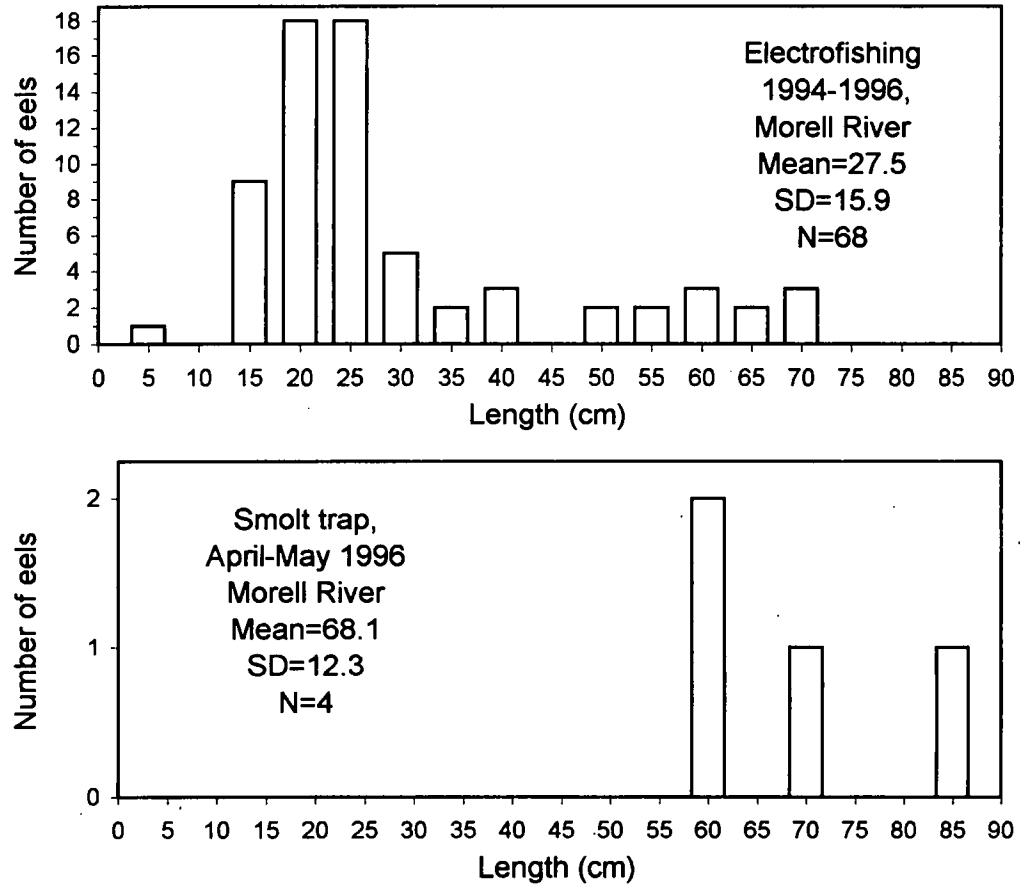


Fig. 9
Length frequency of eels captured by electrofishing and in smolt traps on the Morell River, 1994-1996.

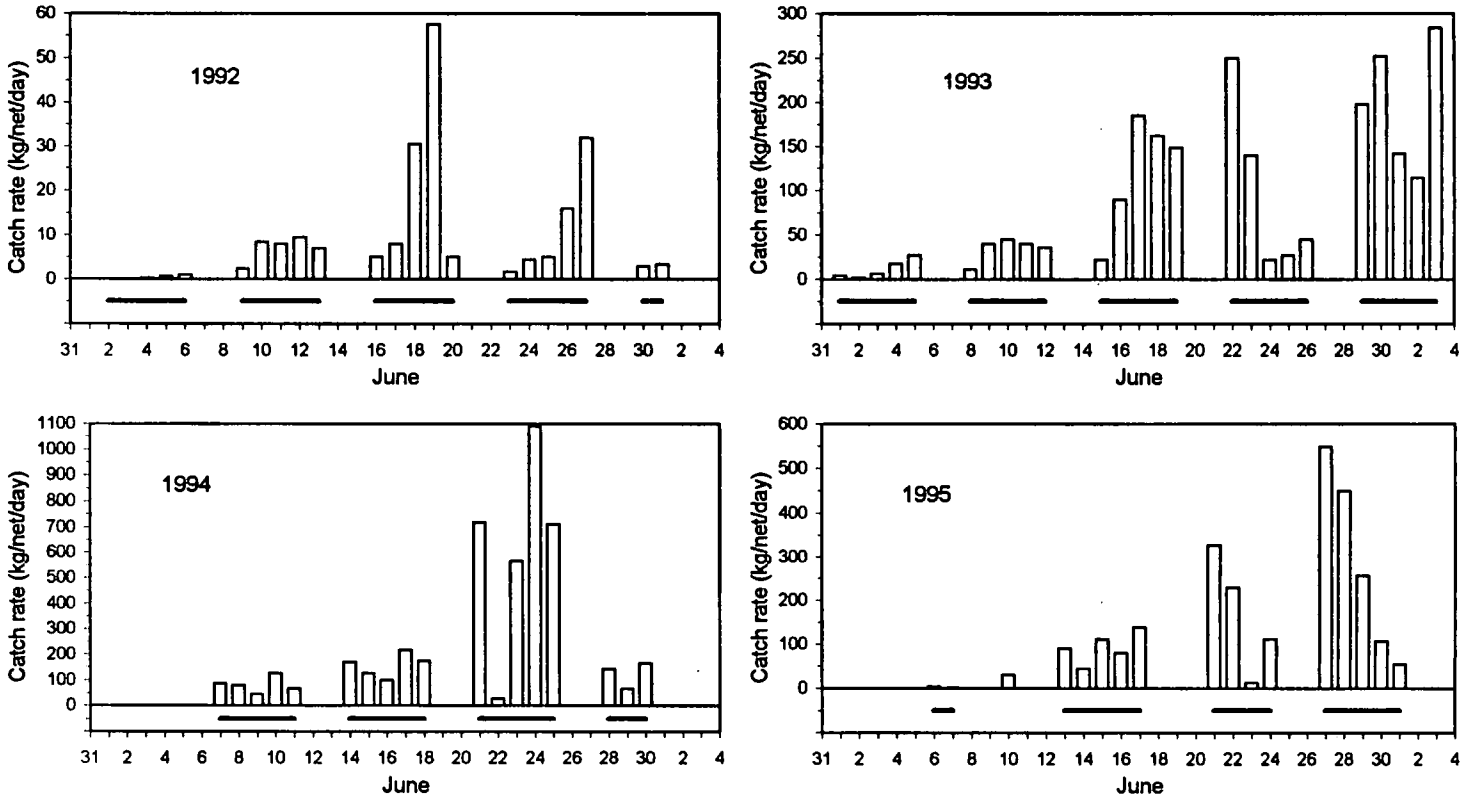


Fig. 10
Seasonal trends in gaspereau catch rates from trap-nets in Prince County, PEI, 1992-1996. Horizontal bars indicate days when traps were hauled.

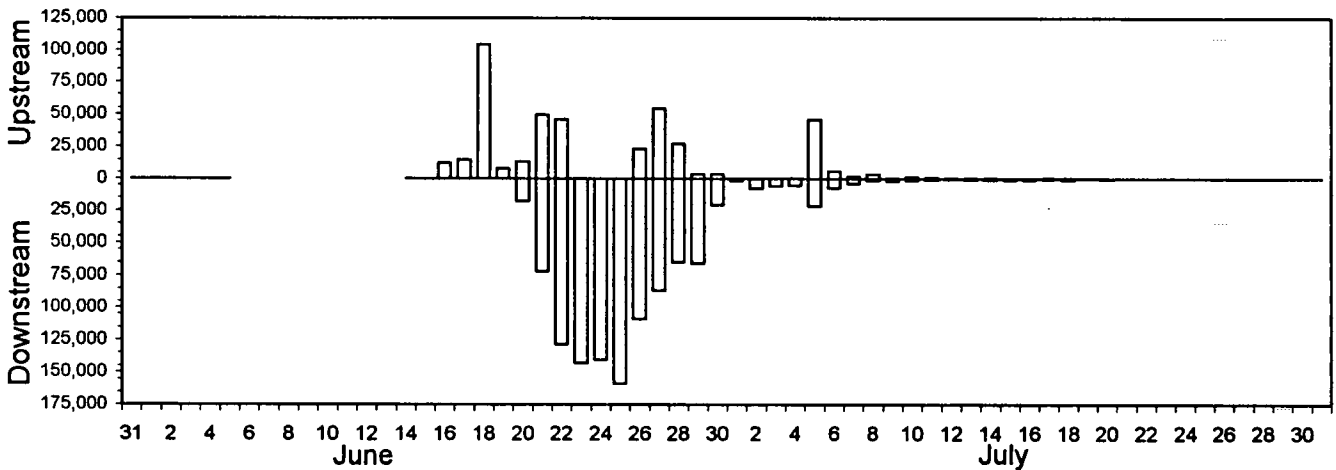
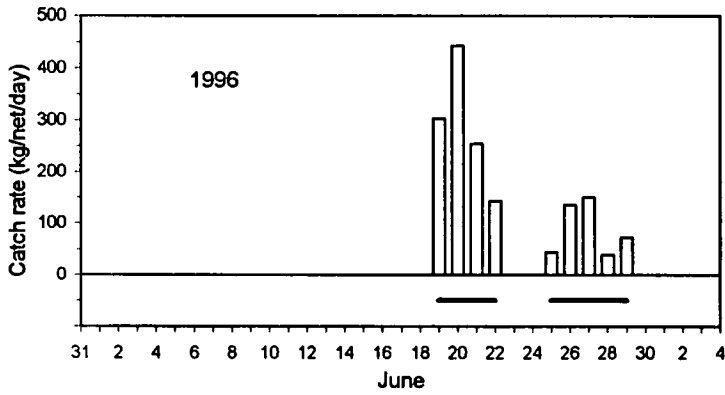


Fig. 11
Upstream and downstream movements of gaspereau through the Dunk River fish fence in 1995. Gaps in the x-axis indicate interruptions in trap records.

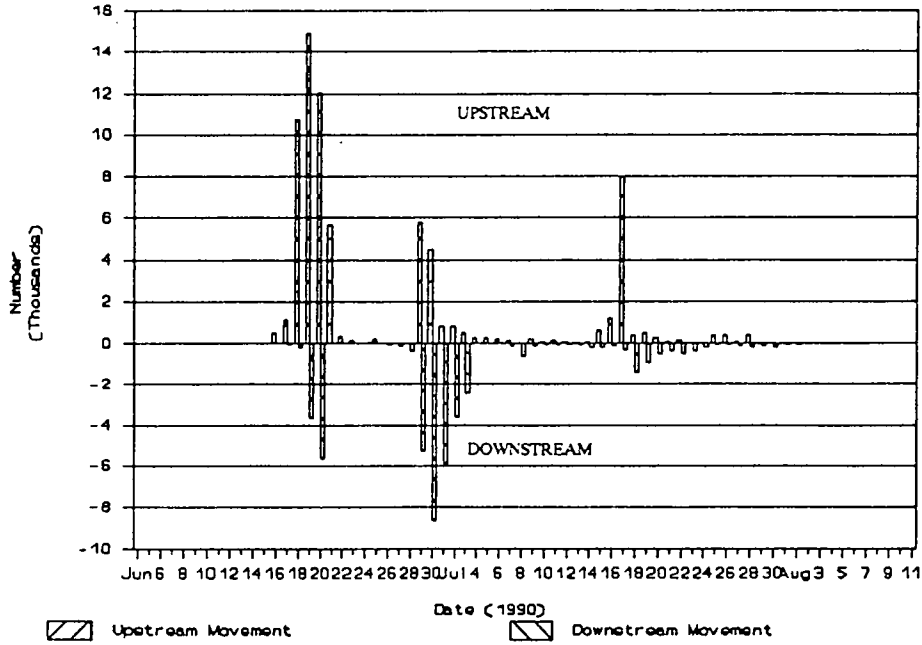


Fig. 12
Upstream and downstream movements of blueback herring at the West River counting fence, Bonshaw, 7 May - 19 November 1990. Reproduced with permission from Dupuis et al. 1991.

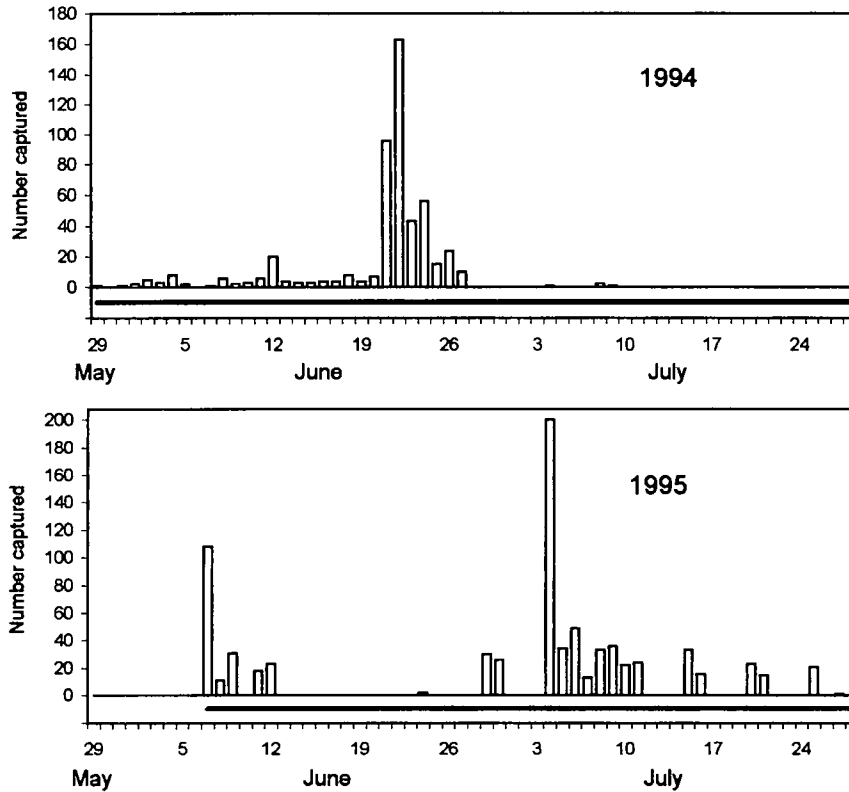


Fig. 13
Number of gaspereau heading upstream which were captured in the salmon trap on the lower Morell River, 1994-1995. Note that the conduit of the fence were widely spaced, so that capture efficiency was probably very low. Horizontal bars indicate days in which the trap was in operation.

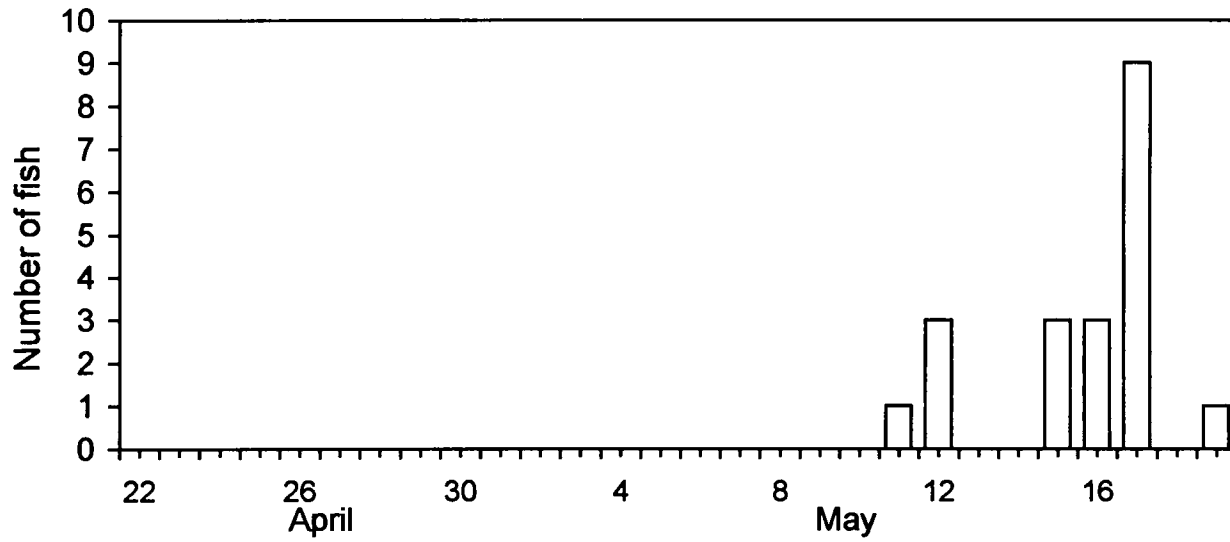


Fig. 14
Number of gaspereau moving downstream at the Indian Bridge smolt trap on the Morell River,
22 April - 19 May 1996.

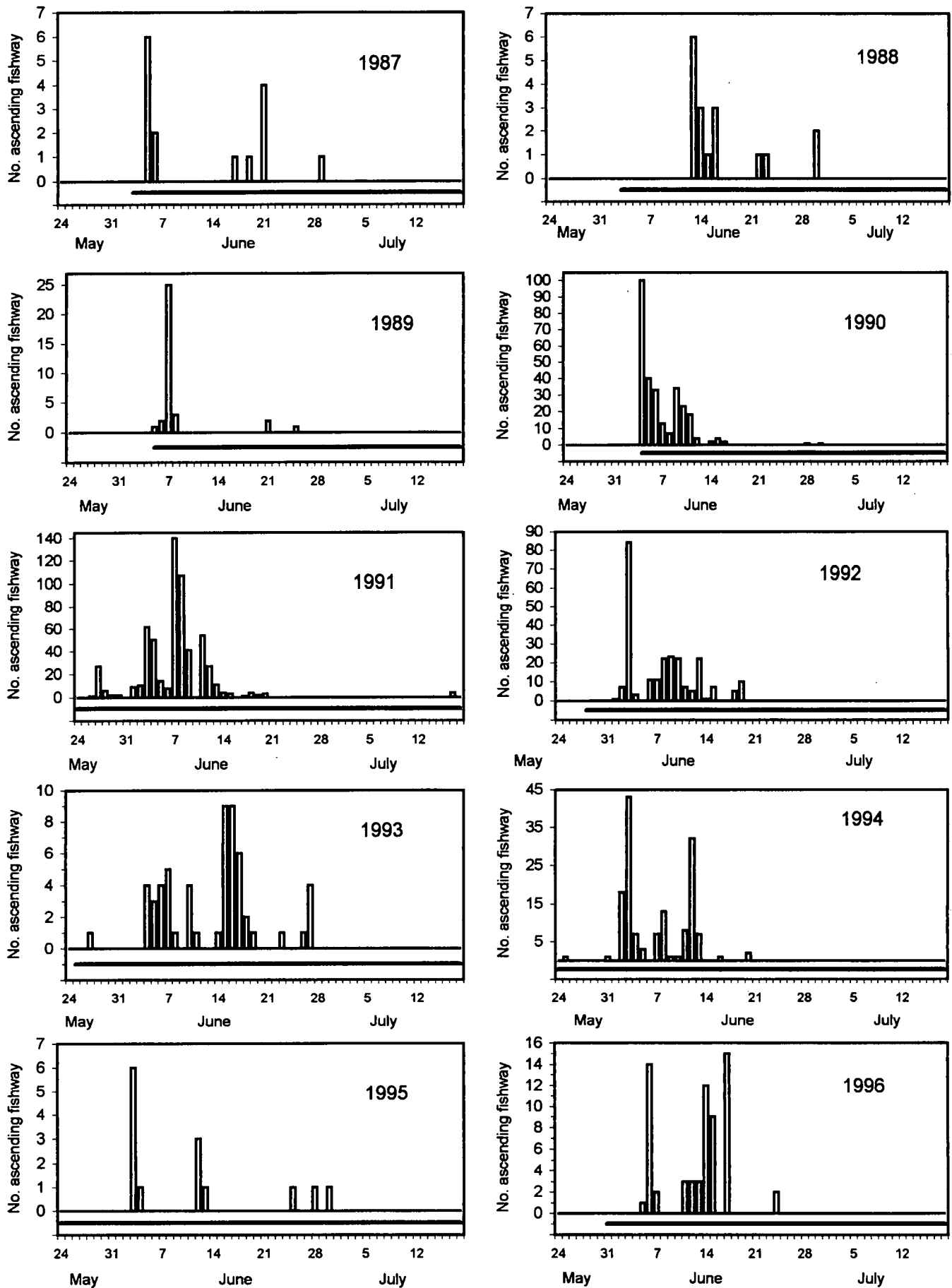


Fig. 15. Upstream movements of gaspereau through the Leards fishway, Morell River, 1987-1996. The horizontal bar indicates days when the trap was operating.

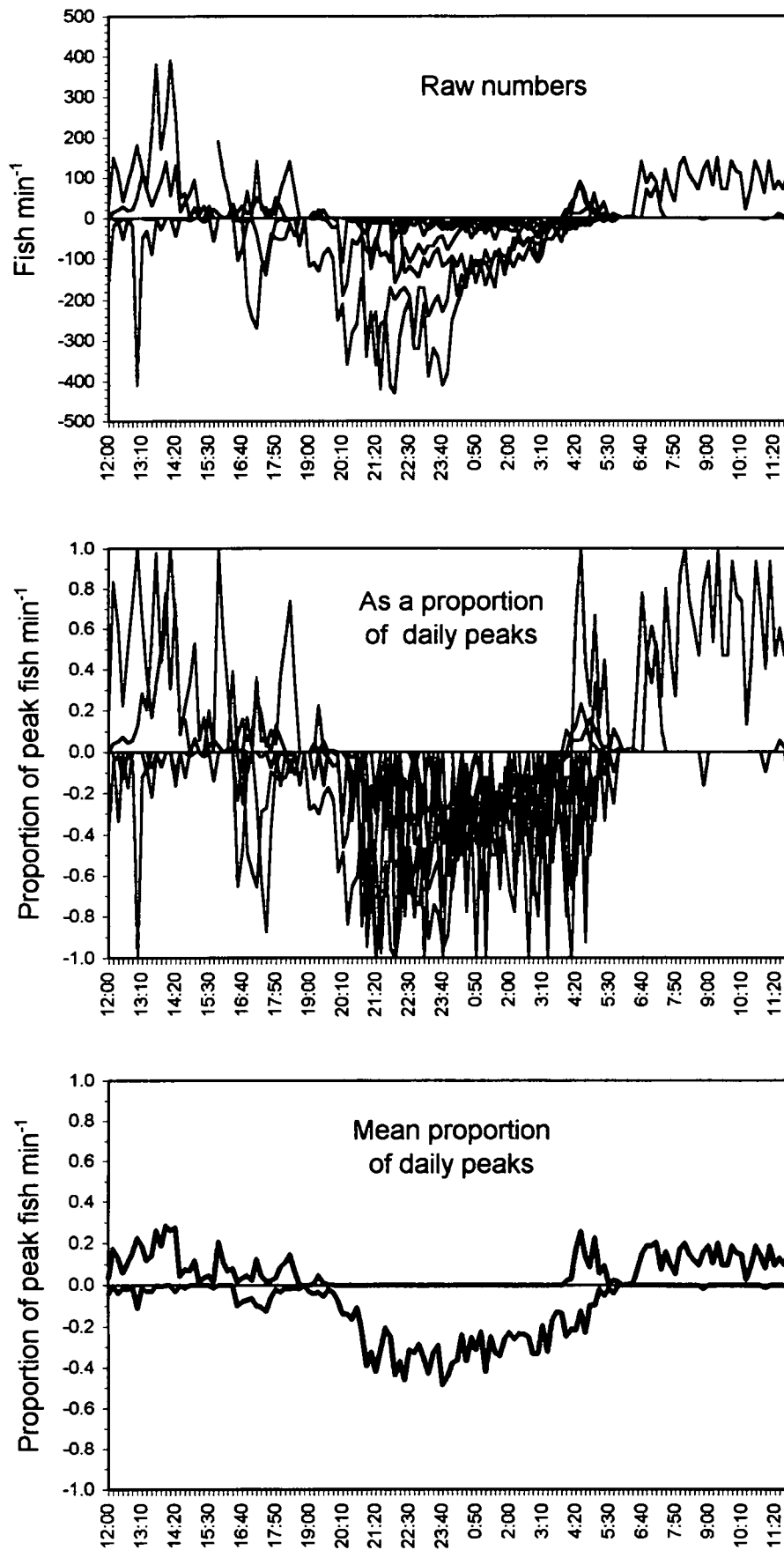


Fig. 16

Daily rhythm of upstream (positive numbers) and downstream (negative numbers) gaspereau movements at the Dunk River fish fence, 27 June - 6 July 1995. Movements are presented as direct counts per minute, counts per minute standardized to the peak daily count, and as the mean across days of counts that are standardized to the daily peak

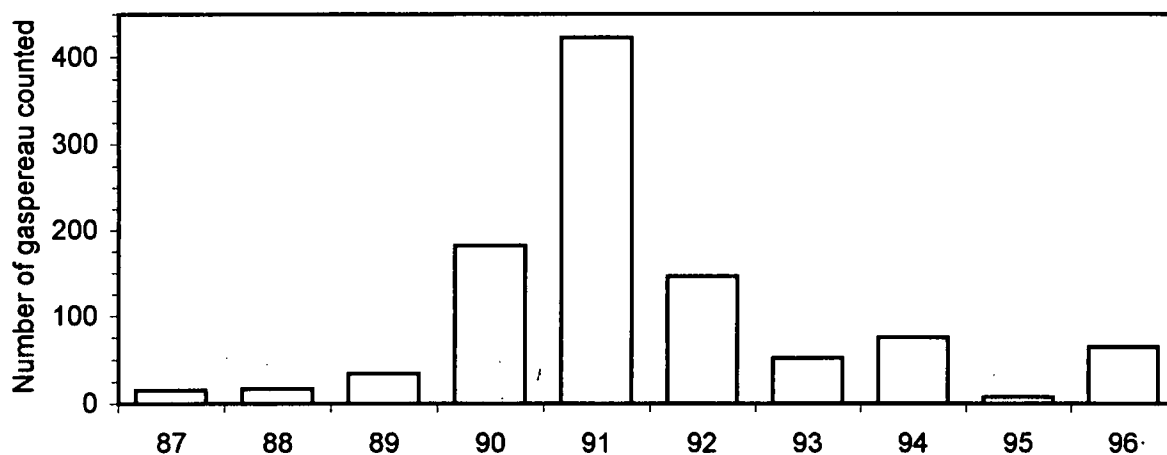


Fig. 17

Counts of gaspereau moving upstream at the Leards Pond fishway on the Morell River between 5 June and 17 July, 1987-1996.

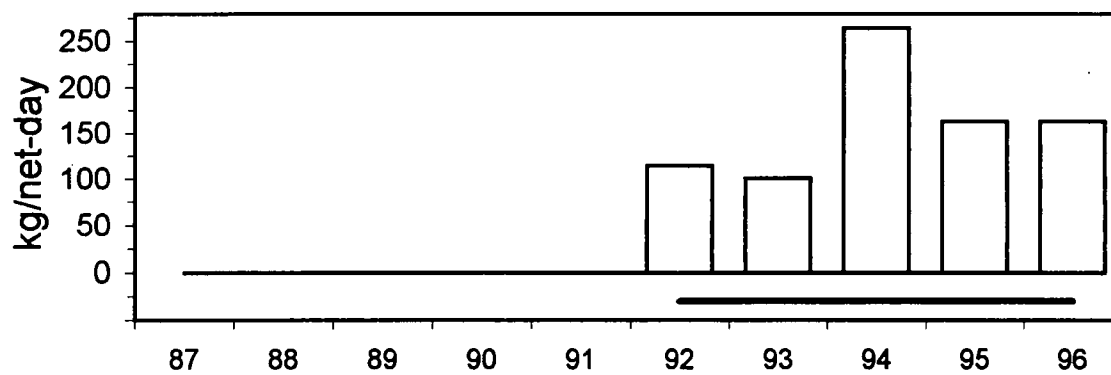


Fig. 18

Catch rates of gaspereau in commercial trap-nets at a site in Prince County. The horizontal bar indicates years for which data are available.

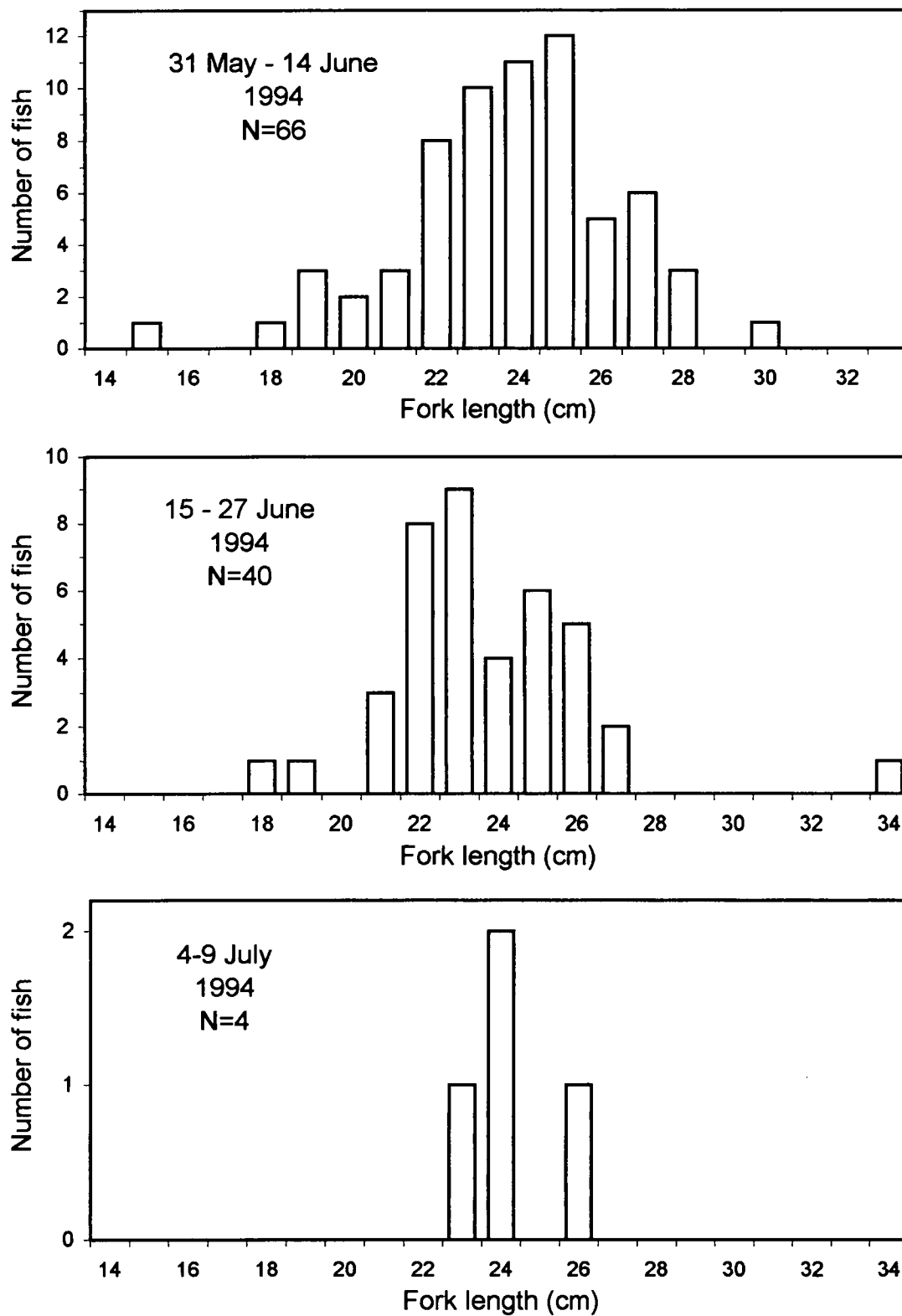


Fig. 19
Length frequencies of gaspereau captured at the fish fence on the lower Morell, May-July 1994.

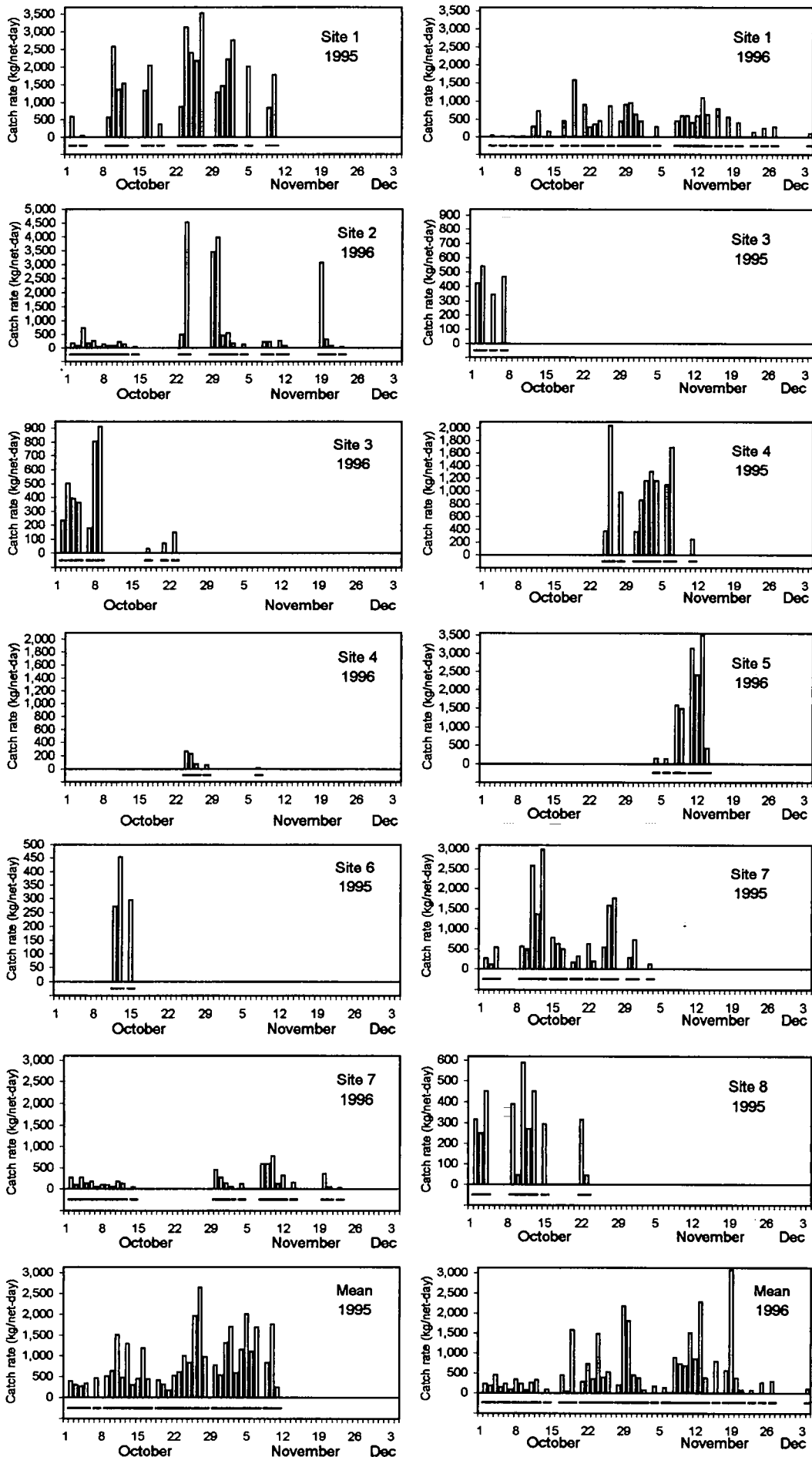


Fig. 20
Catch rates of silverside traps from logbook records.

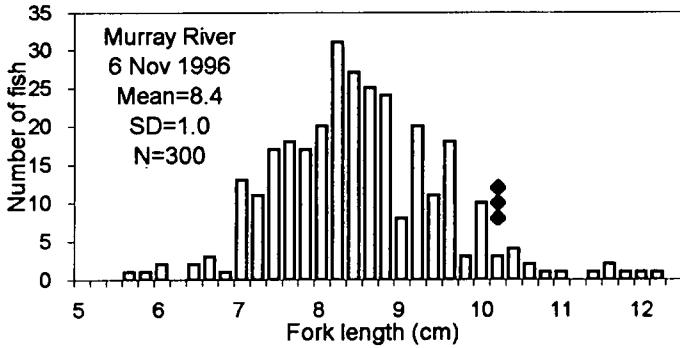
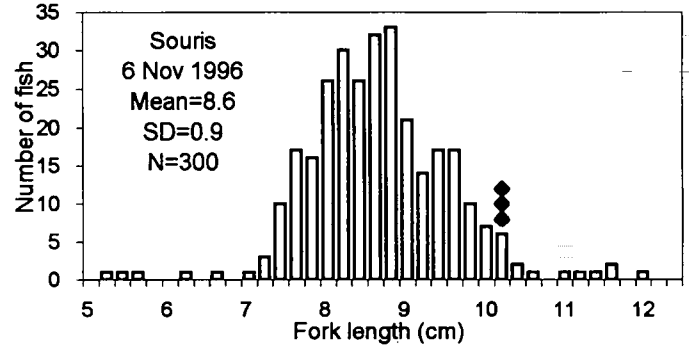
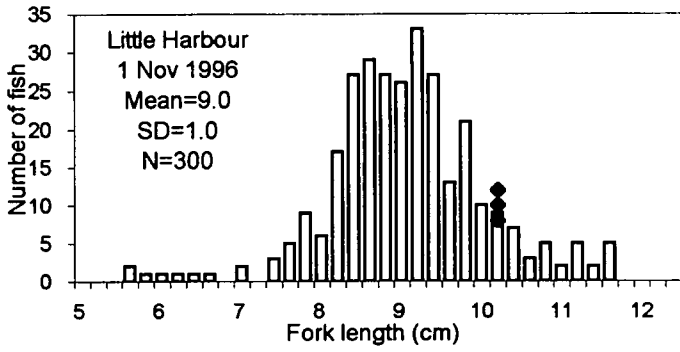


Fig. 21
Length frequencies of silversides from commercial traps, 1996. Vertical diamonds indicate the approximate length above which fish are aged 1+.

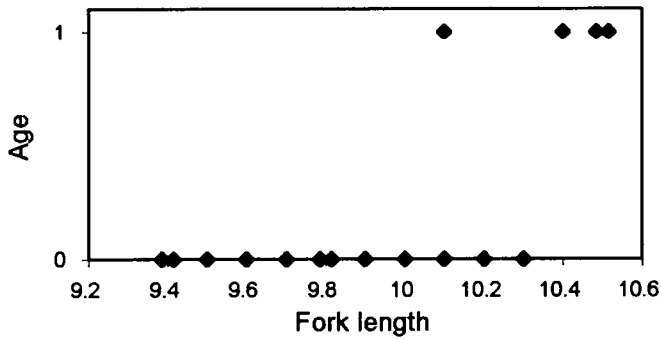


Fig. 22
Silverside length-age relationship, from a length-stratified sample from Little Harbour, 1 November 1996.

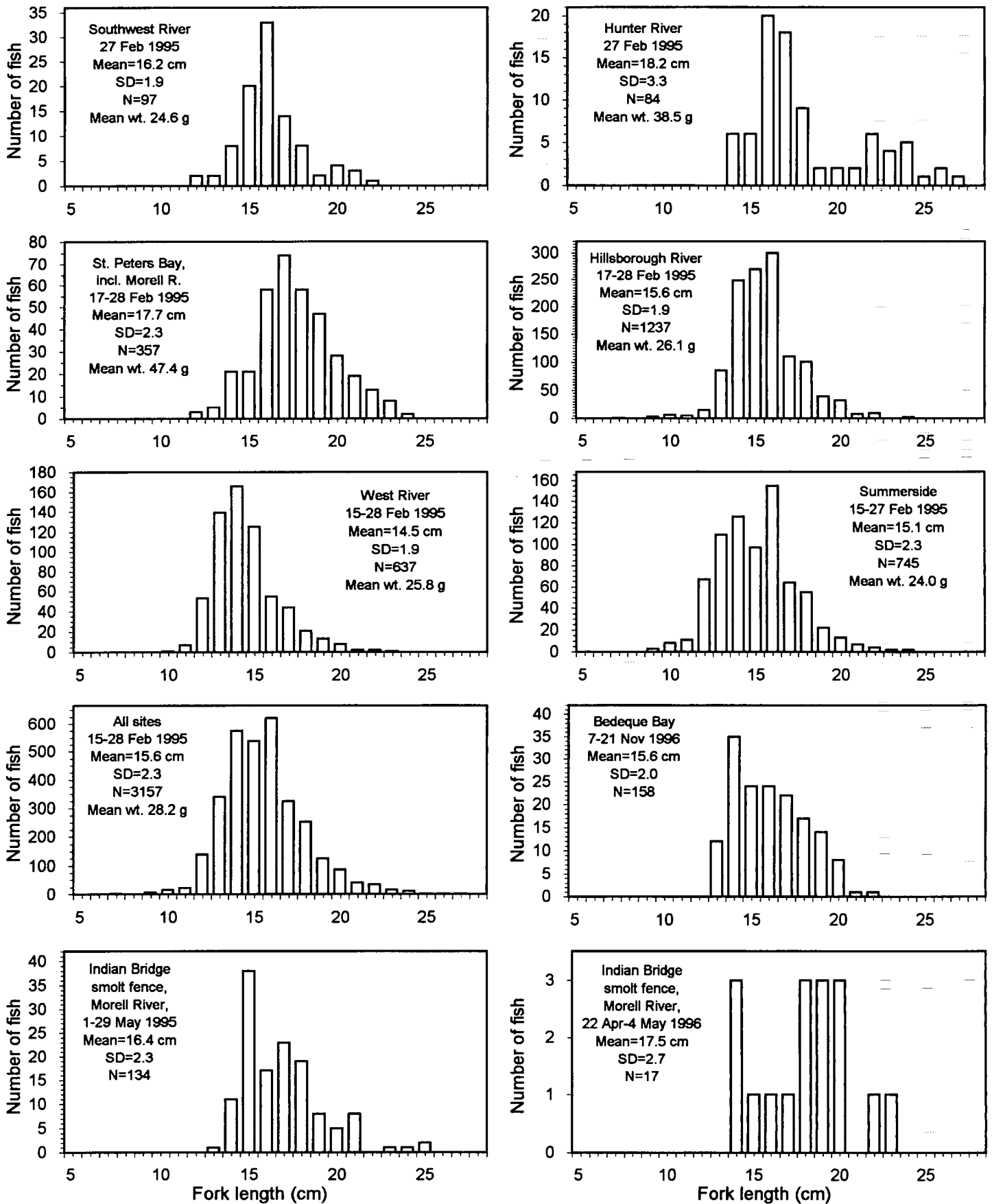


Fig. 23
Length frequencies of smelts on Prince Edward Island.

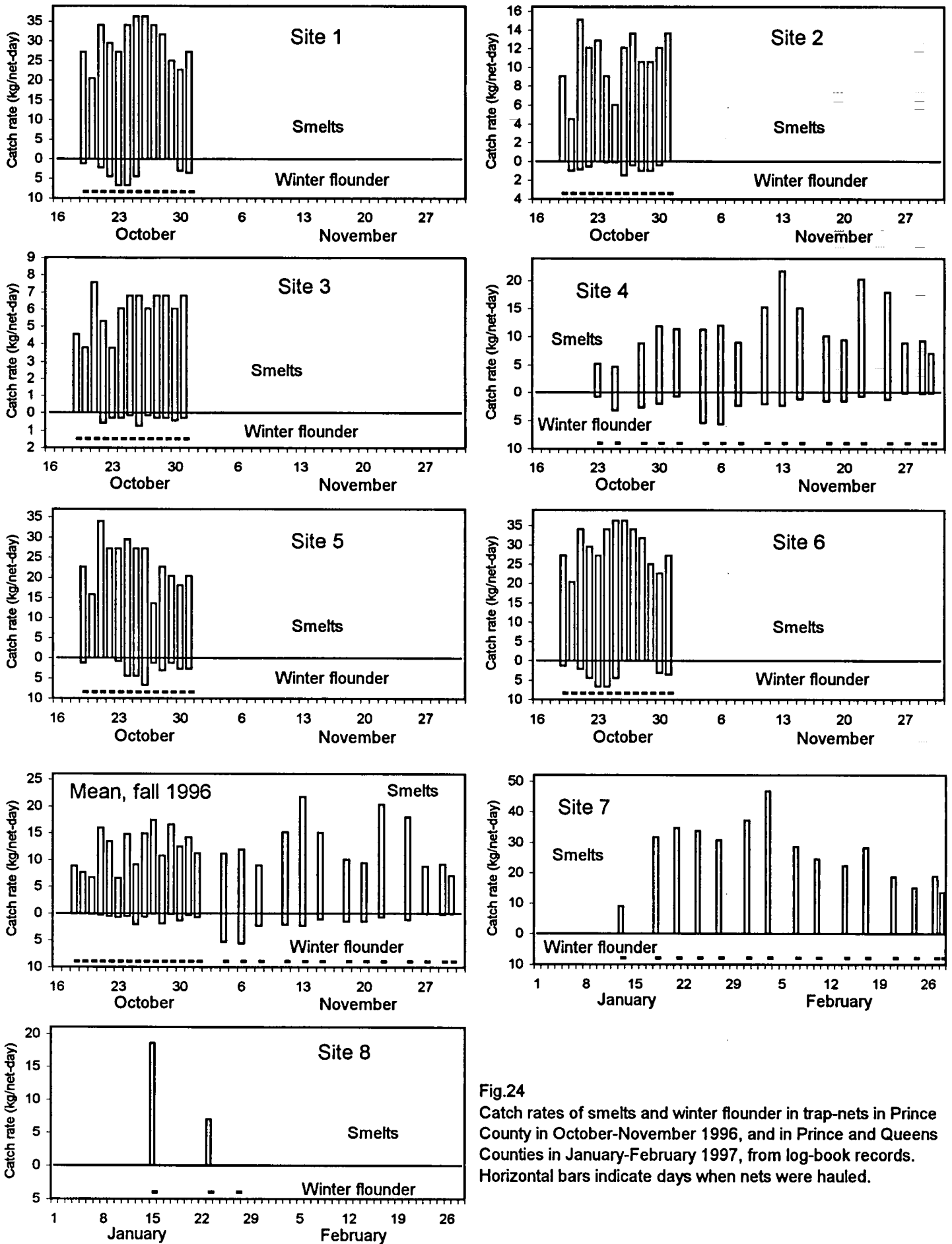


Fig.24
 Catch rates of smelts and winter flounder in trap-nets in Prince County in October-November 1996, and in Prince and Queens Counties in January-February 1997, from log-book records. Horizontal bars indicate days when nets were hauled.

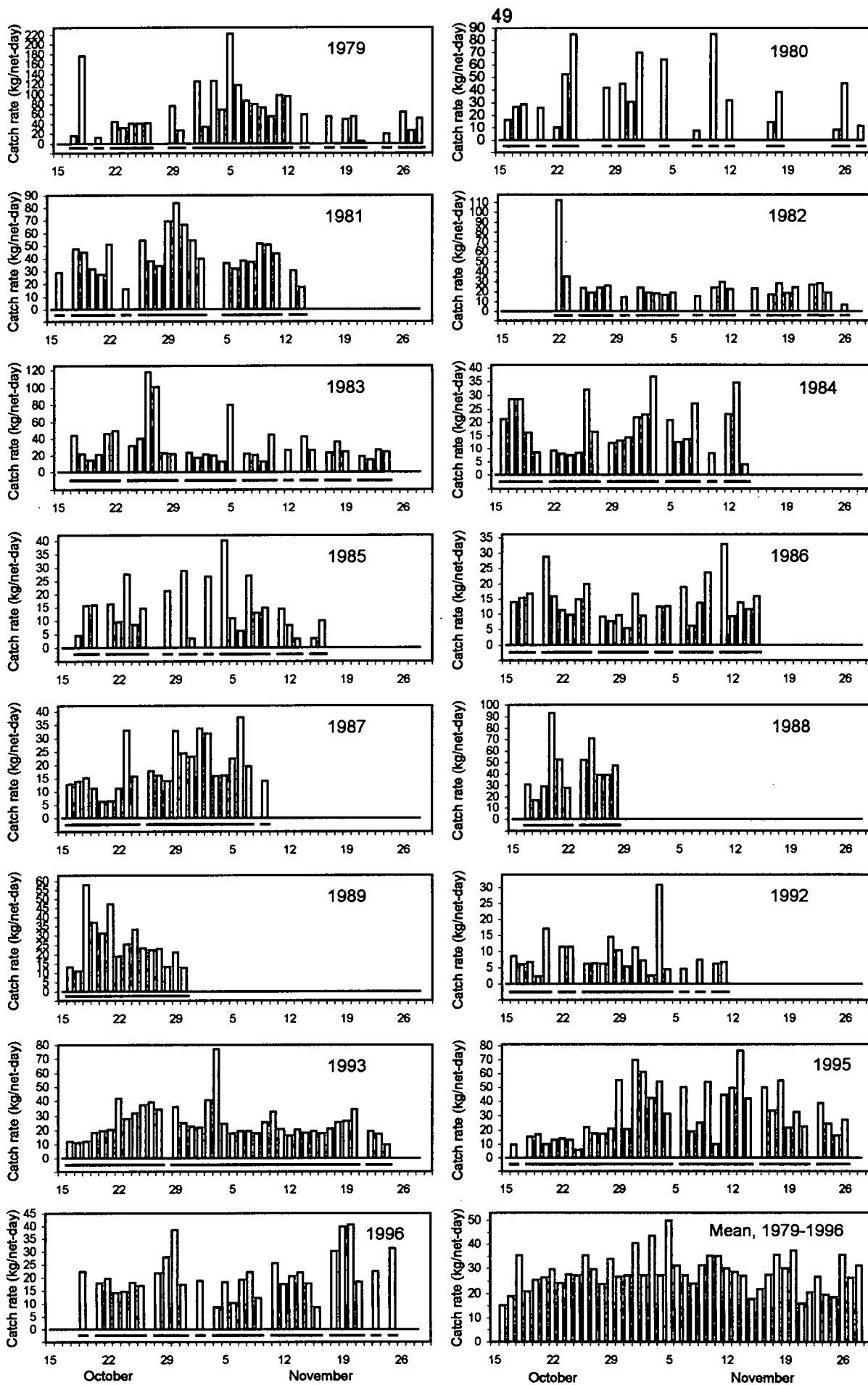


Fig. 25

Catch rates of smelts in trap-nets in Bedeque Bay, 1979-1996. Horizontal bars indicate days when the trap was hauled.

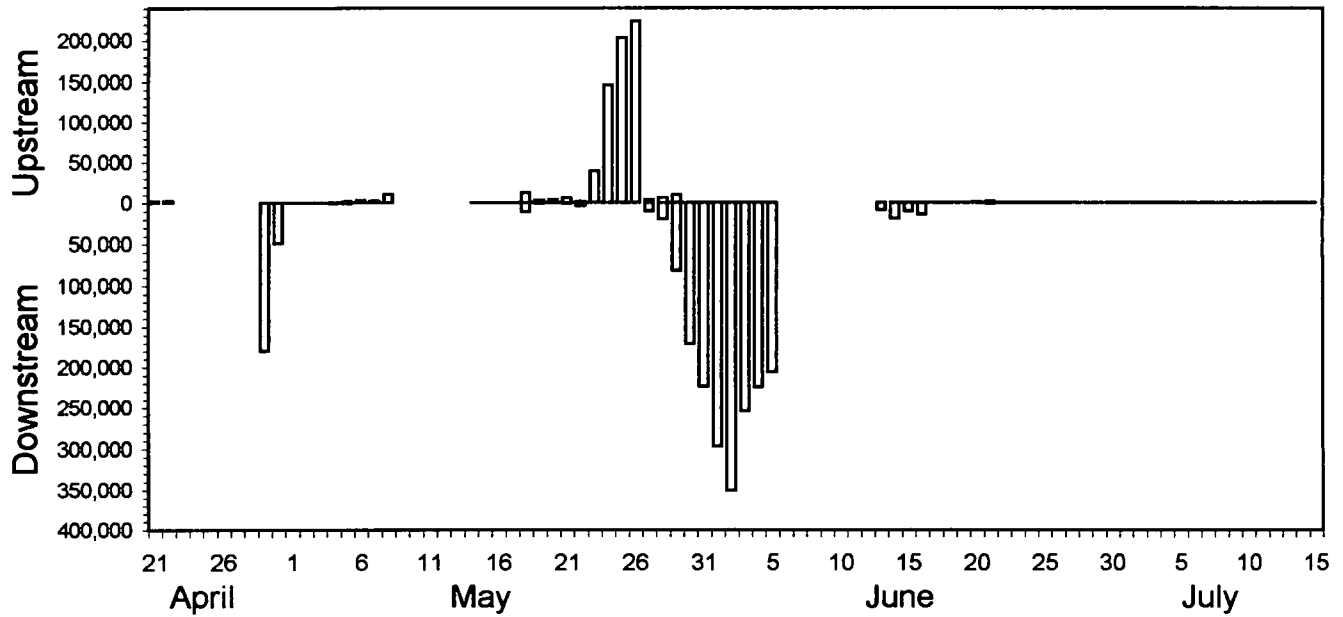


Fig. 26

Upstream and downstream movements of smelt through the Dunk River fish fence in 1995. Gaps in the x-axis indicate interruptions in trap operations.

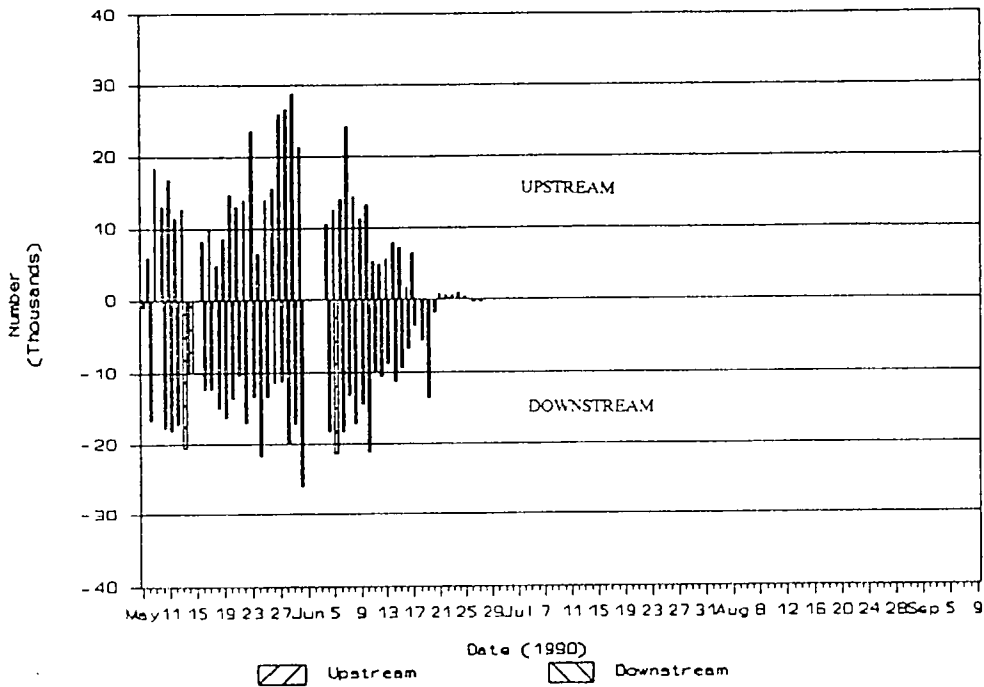


Fig. 27

Upstream and downstream movements of smelts at the West River counting fence, Bonshaw, 7 May - 19 November 1990. Reproduced with permission from Dupuis et al. 1991.

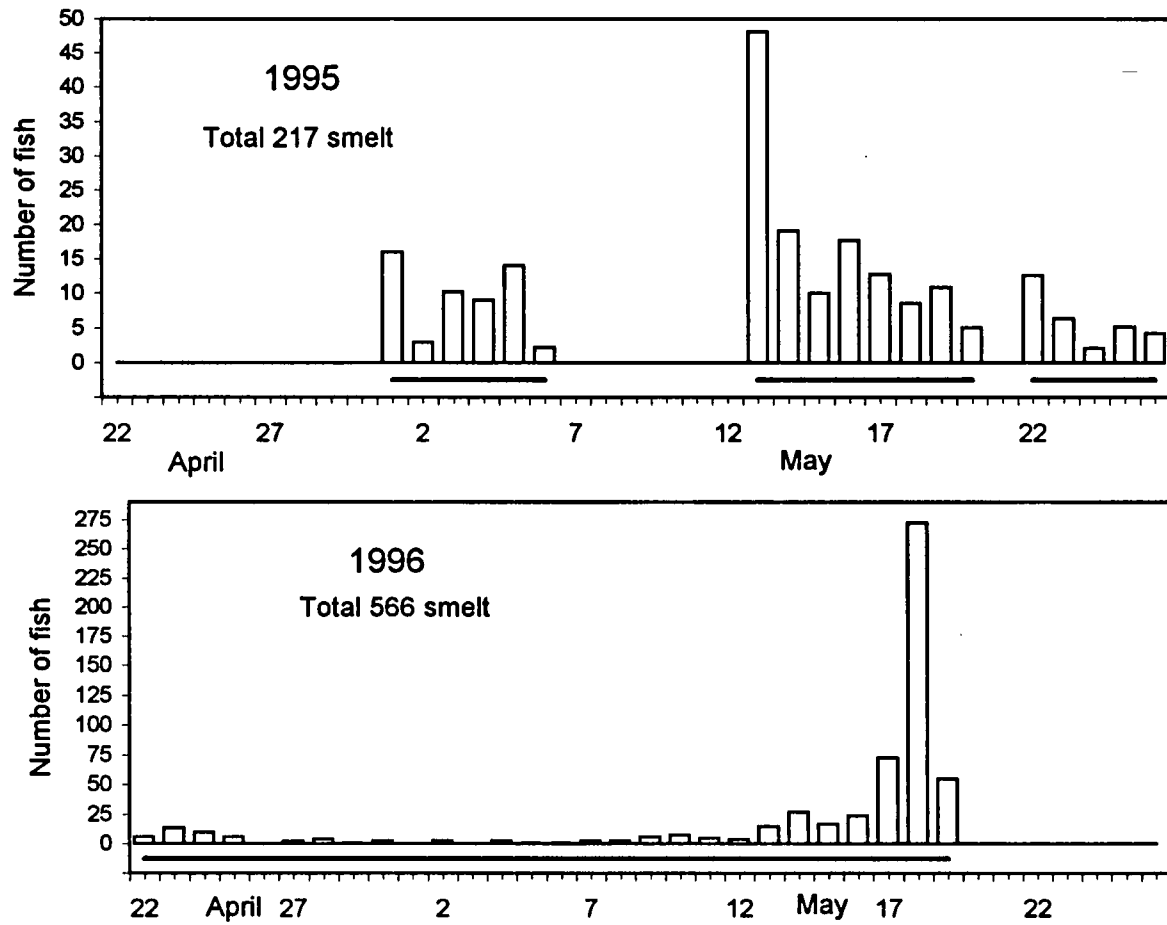


Fig. 28

Number of smelts moving downstream at Indian Bridge on the Morell River through the partial smolt fence in 1995 (Cairns et al. 1997), and the full smolt fence in 1996. Horizontal bars indicate dates on which the fence was in operation.

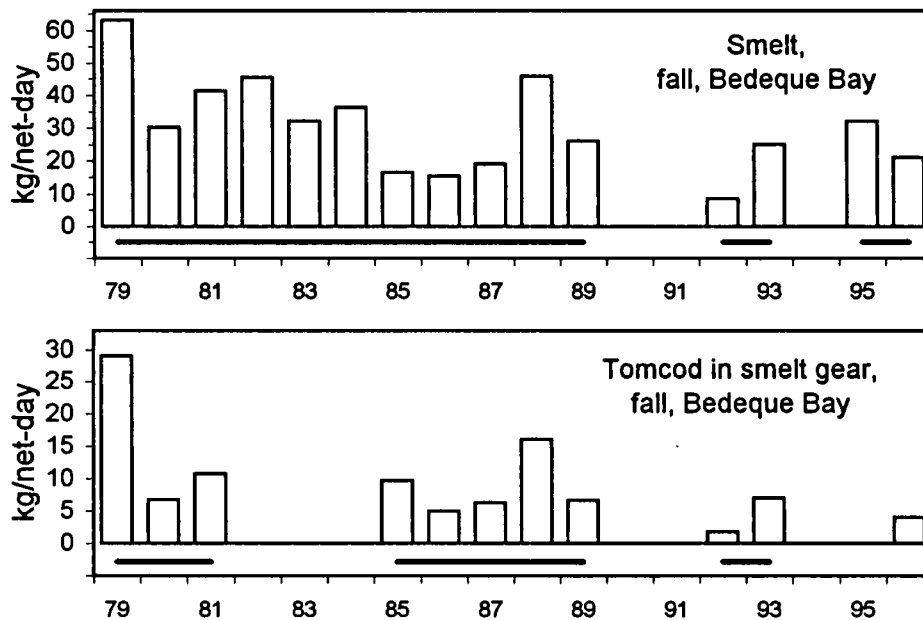


Fig. 29

Catch rates of smelt and tomcod in commercial trap-nets in fall at a site in Bedeque Bay. The horizontal bar indicates years for which data are available.

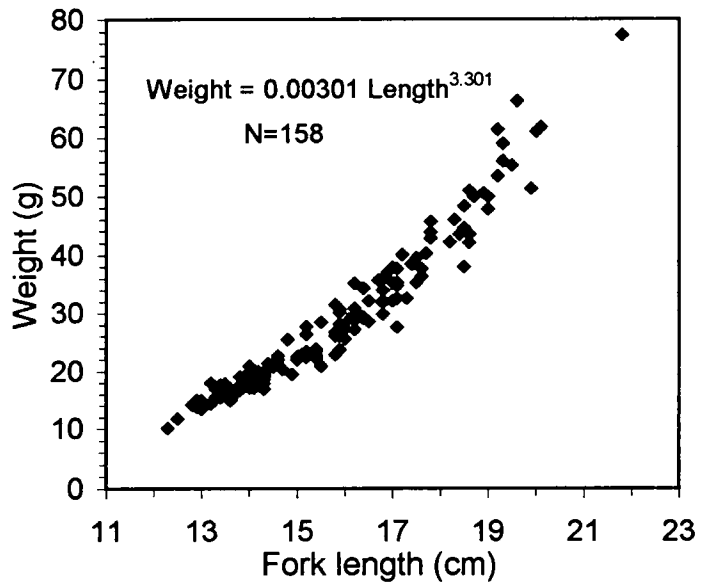


Fig. 30
Length-weight relationship of smelts sampled in commercial trap-nets in Bedeque Bay, 7-21 Nov 1996.

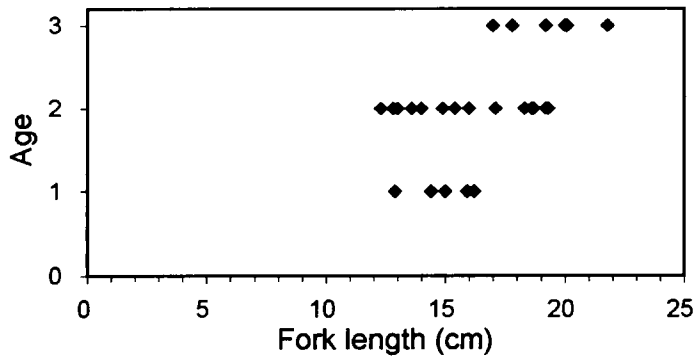


Fig. 31
Smelt age-length relationship, from a length-stratified sample from Bedeque Bay, 7 November 1996.

EEL SURVEY 1996

Use a different location for each river or bay where you fish.

For each day, indicate the number of traps that are fishing at each location.

For each day that you haul your traps, give the weight of your eel catch, and the number of undersized eels and blackbacks in your traps.

Fisherman's name and address

Return this page at the end of August to David Cairns, Department of Fisheries & Oceans, Box 1236,
Ch'town, PEI C1A 7M8 566-7825, fax 566-7848, home 569-4259, Internet cairnsd@gfc.dfo.ca

This form is confidential once completed. No information will be released that identifies the fisherman or the location of fishing.

AUGUST

Date	Day	Location _____				Location _____				Location _____				Comments, other bycatch
		Number of traps fishing at this location	Fish harvested today from this location			Number of traps fishing at this location	Fish harvested today from this location			Number of traps fishing at this location	Fish harvested today from this location			
			Pounds of legal-size eels	Number of undersize eels	Number of blackbacks		Pounds of legal-size eels	Number of undersize eels	Number of blackbacks		Pounds of legal-size eels	Number of undersize eels	Number of blackbacks	
16	Fri													
17	Sat													
18	Sun													
19	Mon													
20	Tue													
21	Wed													
22	Thu													
23	Fri													
24	Sat													
25	Sun													
26	Mon													
27	Tue													
28	Wed													
29	Thu													
30	Fri													
31	Sat													