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The Status of Striped Bass *(Morone saxatilis)* in the Southern Gulf of St. Lawrence in 1995

by

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ABSTRACT

The spawning stock of striped bass (*Morone saxatilis*) in the Northwest Miramichi in 1995 was estimated at about 40 to 60 thousand fish. The 1991 yearclass was the largest single component. Estimates of spawner abundance based on CPUE and catchability of adult striped bass were of the same magnitude as those obtained from the mark and recapture experiment.There were no indications that spawner abundance increased from the previous year as anticipated on the basis of the high abundance (40 to 50 thousand fish) of males of the 1991 yearclass in 1994 and recruitment of females from this yearclass into the spawning population in 1995. Female striped bass, predominantly virgin age 4 fish, comprised about 35% to 40% of the spawning population. The bycatch harvests in the NW Miramichi gaspereau fishery were about 9575 fish (equivalent to 8.8t) and total landings for the entire Miramichi gaspereau fishery (districts 71 to 73) were estimated at 12300 fish (equivalent to 11.3t). Average CPUE of bycaught O group in the autumn Miramichi smelt fishery was the highest observed since monitoring of this fishery was initiated in 1991. All the reported recaptures in May and June of previously tagged striped bass from the southern Gulf occurred in the Miramichi River. The known geographic range of migratory Miramichi striped bass extends from Percé, Québec to Cape Breton Island, Nova Scotia. Production of Miramichi striped bass until at least 1998 will be heavily dependent on spawner success of the 1991 yearclass.

RÉSUMÉ

Le stock de géniteurs du bar rayé (*Morone saxatilis*) de la rivière Miramichi (nord-ouest) en 1995 a été estimé entre quarante et soixante milles poissons. La cohorte de 1991 était la plus importante composante. Les estimations de géniteurs provenant d'une analyse de captures par unité d'effort et de capturabilité étaient de la même grandeur que celles de l'expérience de marquages et captures. L'abondance des géniteurs n'a pas augmenté telle que prévue : une abondance d'environ 40 à 50 milles males en 1994 ne s'est par traduit en une grande abondance de femelles de la même cohorte (1991) en 1995. Cependant, les femelles d'age 4 ans en 1995 constituaient entre 35% et 40% des géniteurs. Les prises de bar rayé dans l'affluent nord-ouest de la Miramichi se situaient à 9 575 poissons, soit environ 8,8 t. Dans la rivière Miramichi, les prises s'élevèrent à 12 300 poissons, soient 11,3 t. L'abondance des juvéniles de la cohorte de 1995, telle qu'estimée par les captures par effort de la pêche d'automne à l'éperlan, était la plus haute depuis 1991. Toutes les recaptures en mai et juin de bar rayé marqué à travers le sud du golfe du Saint-Laurent provenaient de la rivière Miramichi. L'air de distribution du bar rayé de la Miramichi s'étend depuis Percé (Québec) jusqu'au Cap Breton (Nouvelle-Ecosse). La production de bar rayé de la rivière Miramichi jusqu'en 1998 dépendra du succès de reproduction de la cohorte de 1991.

INTRODUCTION

The southern Gulf of St. Lawrence is currently the principal area of wild striped bass production in New Brunswick (Bradford et al. 1995a; Anon. 1996). Gulf striped bass are genetically distinct from Bay of Fundy fish (Wirgin et al. 1993) but stock structure within the Gulf is not known. High autumn and winter landings in southeast New Brunswick rivers (Chaput and Randall 1990) where spawning appears to have been infrequent may describe the highly migratory nature of striped bass rather than distinct spawning populations ((Bradford et al. 1995a; Hogans and Melvin 1984). Knowledge of stock structure and seasonal movements are essential for the proper long-term management of striped bass. The successful development of a striped bass recreational fishery in the province of New Brunswick depends upon the sustainability of bass production. This in turn requires the estimation of spawning stock size and expectations of recruitment.

In 1990, the Gulf of St. Lawrence striped bass stock was categorized as either reduced or declining (Chaput and Randall 1990). Conservation management was introduced with the objectives of arresting the decline in abundance and ultimately increasing the spawning escapement through reductions in fishing-induced mortality (Dept. of Fisheries and Oceans 1993). In 1993, the spawning stock in the Northwest Miramichi was estimated to have totalled about 5500 fish of which more than 90% were males (Bradford et al. 1995a). The abundance of spawners in 1993 was still considered reduced relative to the long-term average considering that the average reported landings of striped bass from the commercial fisheries were just under 5100 fish between 1981 and 1989 (Bradford et al. 1995a). The spawning stock in 1994 increased to between 40000 and 60000 fish of which again greater than 90% were males. The larger number of spawners in 1994 was the result of recruitment to the spawning population of bass from the 1991 year-class. Bass originally tagged during the spawning season in 1993 in the Northwest Miramichi were observed again in 1994 suggesting that there was some spawning site fidelity and repeat spawning of bass in the Northwest Miramichi (Bradford et al. 1995a).

Based on the work conducted in 1994, the following predictions were made for 1995:

1) higher potential egg production due to the increased abundance of adult female striped bass recruiting from the 1991 year-class (females first mature at a later age than males; Hogans and Melvin 1984),

2) low recruitment of age 3 years old striped bass to the spawning population (low abundance of the 1992 year-class as inferred from the abundance of young-of-the-year bass as bycatch in the autumn smelt fishery as compared to the abundance of the 1991 year-class),

3) reduced catches of age 2 years old striped bass in the Northwest Miramichi gaspereau fishery (low abundance of the 1993 year-class as inferred from the abundance of young-of-the-year bass as bycatch in the autumn smelt fishery), and

4) continued evidence of repeat spawning and site fidelity of striped bass in the Miramichi River estuary.

We report on the validity of the above predictions and update the data base regarding stock structure, spawner abundance and spawner success. The principal study area is the Miramichi River

(Fig. 1), currently the only site where substantial bass spawning occurs (Bradford et al. 1995a, b) and the location of well-developed fixed-gear commercial fisheries for gaspereau and smelt (Chaput 1995). Systematic sampling of bycatch in these fisheries was first initiated in 1991 (Hanson and Courtenay 1995) and has continued since to November 1995. The minutes of the Science consultation meeting are in Appendix 1.

DESCRIPTION OF FISHERIES

Commercial

There are currently no commercial fishing licenses for striped bass in the Gulf of St. Lawrence. Sweep net licenses (13 in total), which prior to 1994 were for commercial use, are now issued as recreational licenses and must conform to recreational fisheries regulations introduced in 1993 (Bradford et al. 1995a). However, most commercial fishing and sale of striped bass has occurred *de facto* since July 1994. Landings occur as, but are not limited to, bycatch in three fixed gear commercial fisheries; gaspereau (alewife, *Alosa pseudoharengus* and blueback herring, *A. aestivalis*) during May-June, American eels (*Anguilla rostrata*) during June to October and rainbow smelt (*Osmerus mordax*) from October to March. Descriptions of these fisheries and their potential impact on striped bass abundance have been dealt with previously by Bradford et al. (1995a,b). Seasons, locations, mesh size of fishing gear and distribution of effort for each fishery are summarized in Table 1.

The decline in the reported landings for 1993 and 1994 (Tables 2 and 3) was due in part to regulations that required striped bass ≥38 cm total length (TL) be released. No restrictions on landings of striped bass were imposed during 1995, although some voluntary release of spawning striped bass in the Miramichi River during May and June 1995 did occur. Purchase slip and "Supplementary B" landings data are known to be incomplete, especially for May and June 1995 when at least 5.8 t of bass were known to have been harvested from the Miramichi River (statistical districts 70 to 73; Fig. 2) (R.G. Bradford, unpublished data) but were not registered in the database of the Dept. of Fisheries and Oceans Statistics Branch.

Recreational

Recreational fishing has occurred throughout the southern Gulf of St. Lawrence. The timing of fishing was specific to location and appears to have been cued to predictable life-history events. In Chaleur Bay, angling activity focused on feeding migrants during July and August and was centred at Dalhousie, Bathurst Harbour, and the Caraquet-Shippagan Channel (Bujold 1985; Madden 1984). Similarly, angling success is reported to have been greatest during August-September in the Tabusintac (Madden 1984), Kouchibouguac, Richibucto, and Bouctouche Rivers (anecdotal information reported to R.G. Bradford). In contrast, peak angling at Newcastle (Miramichi) occurred during May-June (Watling 1985) when adult striped bass are known to spawn (Bradford et al. 1995b).

Recreational fisheries regulations introduced in 1993 remained in effect in 1994 and 1995. These management measures included season and size restrictions as well as a daily bag limit:

- season from July 1 to October 31,
- a minimum retention size of 68 cm total length, and
- a bag limit of one fish retained per day.

Recreational catch data have been collected only at Kouchibouguac National Park. These data were summarized previously by Bradford et al. (1995a) for 1992 to 1994.

First Peoples Fisheries

Little is known about past utilization of striped bass by First Peoples and whether or not these fish were directly targeted. Data collected since the inception of Aboriginal Fishing Agreements indicate that by-catches of bass are common in both gill nets and trap nets set to intercept Atlantic salmon in the Tabusintac, Miramichi, Richibucto, and Bouctouche River estuaries. A portion of this bycatch is consumed.

As was the case in 1994, First Nations harvests within food fishery agreements were regulated under similar conditions to the recreational fisheries (size and season restrictions). Allowable harvest was based on communal needs of individual First Nations.

TARGET

Conventional conservation targets based on a relationship between spawner population and recruitment may not be appropriate for striped bass. Research in the eastern United States indicates that density-independent factors affect recruitment of striped bass to a greater extent than does spawning stock biomass (Rago and Goodyear 1987). Full protection of spawners and potential spawners is the interim target specified in the 1993 New Brunswick Striped Bass Management Plan (Dept. of Fisheries and Oceans 1993). Major elements of the plan are:

- arrest the decline in abundance
- increase abundance
- sustain abundance at levels corresponding to the supporting habitat.

The management plan is intended to increase spawning escapement through reductions in fishing-induced mortality in commercial, recreational and aboriginal food fisheries.

FISHERY DATA

Two sources of fishery data are available: landings statistics and logbook reports. Purchase slip and supplementary 'B' data (Tables 2 and 3) provide indications of the levels of catch by statistical district and month. Purchase slips are the record of the catch purchased by the buyer whereas supplementary 'B' slips are estimates by DFO Conservation and Protection personnel of the catch which is consumed or sold locally and which otherwise does not appear on purchase slips. These data, although generally felt to underestimate the total harvests, provide an indication of the timing of fisheries geographically and are available for the period 1968 to 1995. The time series from 1968 to 1990 has been previously described (Chaput and Randall 1990; LeBlanc and Chaput 1991).

Bycatch of striped bass in the Miramichi gaspereau fishery in 1995 was also documented through logbook programs and from directed monitoring of catches. No directed sampling of the eel fishery was conducted in 1995. Sampling of the eel fishery in previous years has been described by Bradford et al. (1995b). The open-water smelt fishery was sampled in 1995 in a manner similar to 1993 and 1994 (Bradford et al. 1995a). Further details regarding sampling of the smelt fishery are provided in a subsequent section (Spawner Success).

ESTIMATION OF STOCK PARAMETERS

Spawner Abundance

Mark-Recapture Based Estimates

Population estimates were obtained using mark and recapture experiments and the method has been described previously in Bradford et al. (1995a). During May and June, 1995, one to seven gaspereau traps in the Northwest (NW) Miramichi River estuary (Fig. 1) were sampled daily. Striped bass from these nets were counted and measured to length (fork length (FL) and total length (TL) to the nearest 0.1cm). Following the convention established in 1993 (Bradford et al. 1995a), striped bass >38 cm TL were tagged before release with individually numbered, yellow T-bar tags (length 3.2 cm) inserted between the first two spines of the anterior dorsal fin. The 38 cm TL criterion was used in 1995 to correspond to the maximum length of bass which could be retained in the gaspereau fishery in 1994. Fishers kept recaptured tags separate for each day fished by placing tags in sealed plastic bags together with a note stating date, trap, and fisher. Marked fish that were recaptured when the sampler was present were released after first recording the tag number and the date of capture.

Inputs for population size estimates were: number of fish marked and released each trapping event (M), observed number of fish that had been marked in a previous trapping event (R), and number of unmarked fish (U) (Ricker 1975). Total number of marked fish available for each trapping event were corrected for those removed and reported by fishers. Spawner abundance in 1995 was based on a sequential Bayes algorithm as described by Gazey and Staley (1986).

The change in the estimated population estimate and its associated distribution from one sampling event to the other is a measure of the information added by the sample. A continuous trend towards larger or smaller population size provides strong evidence that the population is not closed (either increasing or decreasing over the period of study) (Gazey and Staley 1986). In 1995, fewer

than 350 adult bass were marked and released by May 31 even though fishing began on May 20. Most of the bycatch of striped bass was landed and sold. No tags were recovered before May 31. Sequential population estimates of spawner abundance were based on 11 sampling events (individual days) in 1995 as compared to the 18 sampling events available in the 1994 mark and recapture experiment (Table 7) (Bradford et al. 1995a).

Stratified Catch and Catchability Based Estimates

From the 1994 experiment, Bradford et al. (1995a) noted the following:

1) the catch per unit of effort (CPUE) of striped bass in the gaspereau trapnet fishery varied with time similar to the mark-recapture based estimates of population size, and

2) the cumulative recapture histories from the independent tagging events suggested that striped bass catchability in the gaspereau trapnets in 1994 was constant at about 1.3% per day over the duration of the Miramichi gaspereau fishery (about 1.01% for the NW Miramichi gaspereau trapnets) (Fig. 1).

These observations from 1994 suggested that catch rates (CPUE) may provide a basis for the estimation of spawner abundance. The spawner abundance was estimated for 1993 to 1995 using the catch rate values as estimated below and compared to the abundance estimated using the mark-recapture experiment data.

The stratified mean CPUE of bass (fish per trap per day) was calculated following the formula in Cochran (1977):

$$\bar{y}_{st} = \sum_{h=1}^{H} \frac{N_h \bar{y}}{N} \qquad (1)$$

where N_h = number of traps in stratum h with a stratum representing a fishing day,
N = number of possible trap samples in fishing season (traps fishing per day x days fished)

and

$$\bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{hi}}{n_h} \qquad (2)$$

where y_{hi} = number of fish per trap per 24 hours of fishing time, and
n_h = number of traps sampled per day.

Estimated variance of the stratified mean is described by Cochran (1977):

$$v(\bar{y}_{st}) = \frac{1}{N^2} \sum_{h=1}^{H} N_h (N_h - n_h) \frac{s^2_h}{n_h} \qquad (3)$$

with $$s^2_h = \frac{1}{n_h - 1} \sum_{i=1}^{n_h} (y_{hi} - \bar{y}_h)^2 \quad (4)$$

The population estimates were obtained by weighting the stratified mean CPUE of bass (equation 1) by the total number of traps fishing in the Northwest Miramichi (13) and dividing by 0.0101 (the daily exploitation rate estimate of striped bass in the 1994 gaspereau trapnets from the NW Miramichi fishery; Bradford et al. 1995a). The individual daily estimates of population size were estimated in a similar manner but substituting the stratified mean CPUE by the mean stratum (daily) catch rates (equation 2).

Spawner Success

The smelt fishery is conducted during two distinct seasons, an open water fishery from 15 October until freezing (usually early December) and a winter fishery conducted through the ice from about 1 January until February 28 or early March (closure is subject to variation orders). In 1995, two fishers were each visited twice weekly between October 15 and November 21. During each visit, bass were sorted from a minimum of 3 crates (58kg each) of catch, counted, measured (fork length (cm)), and weighed. Estimated total daily catch was obtained by scaling upward to the total number of crates of unsorted catch. The number of nets fished and the total hours of fishing effort since last haul were also recorded.

Bycatch of striped bass, by either age or size group, in the gaspereau and open-water smelt fisheries was standardized to catch per unit effort (CPUE) units of number of fish per net per day. For summary purposes, the bycatch data for all years were separated into juvenile and adult components. All fish were assigned an arbitrary birth date of January 1. Under the categorization convention, all fish showing two annuli or less on the scales and sampled before May 15 are considered to be juveniles. All fish with more than two annuli and sampled before May 15 are considered adults. The minimum observed age at first maturity has been three years (Bradford et al. 1995a).

Coastal Migrations

Bass caught during May and June in trap nets operated by the Department of Fisheries and Oceans in the Northwest Miramichi were examined for tags and marked as described in the previous section. Between May and November 1995, food fishery traps located in both the Northwest and Southwest branches of the Miramichi River were also used as marking and recapture sites. Striped bass sampled as bycatch from the Richibucto and Bouctouche gaspereau fisheries (May to June) were examined for tags. A $4.00 reward was offered for each tag returned with information on date and location of capture. Each tag carried the address of the Gulf Fisheries Centre in Moncton.

Bass were also marked in the Kouchibouguac River estuary using the same technique as in the Miramichi River. Among season and among year movements of striped bass marked in the Kouchibouguac River estuary are summarized for the years 1991 to 1995. Recapture histories for bass tagged prior to 1991 in Kouchibouguac National Park were summarized by Bradford et al. (1995a).

ASSESSMENT RESULTS

Spawner Abundance

The 1995 spawning population was dominated by the 1991 year-class (Fig. 2; length range 38-60cm) as was the case for the 1994 spawning population. The 1992 year-class appeared to be stronger (Fig. 2; length range 30-38cm) than anticipated from the abundance estimates of the 1992 young-of-the-year striped bass in the 1992 autumn smelt fishery but consistent with a comparatively high CPUE at age 2+ in the 1994 Miramichi gaspereau fishery (Table 4).

The 1995 mark-recapture based estimate of 37500 striped bass is comparable to the 1994 estimate of 40000 fish, and an order of magnitude greater than the 1993 estimate of 5500 fish (Table 5). Spawner abundance estimates based on CPUE and catchability were 4603, 88400, and 47400 fish for the 1993, 1994, and 1995 spawning years respectively (Table 5). Population estimates derived from the two methods were of the same order of magnitude but differed by a factor of two for 1994. The reliability of the estimates obtained by either procedure is likely compromised by a decline in CPUE over the gaspereau fishing season (Table 6). This suggests that the population is not "closed". as evidenced by the decline with time in the sequential estimates of spawner abundance (Fig. 3; Table 7). In the case of the mark-recapture based estimate, an end of season estimate when both CPUE and recapture of marked fish are low, the assumption was made that the marks available for recapture remained high. An examination of the cumulative recapture histories for fish marked on May 28 (n =252) and May 30 (n =85) indicates that marked fish were not available for recapture during the entire duration of the gaspereau fishery in 1995. Prior to about June 10, recaptures occurred at a rate of about 1.1% per day but declined sharply thereafter (Fig. 4). A possible interpretation of this decline is that spawning occurred during the first or second week of June with spent fish (including marked individuals) leaving the spawning area shortly thereafter. Similarly, since the catchability based method uses an average for the fishing season, a decline in abundance in the latter part of the season would negatively bias the estimate of total spawner abundance.

The reduced CPUE of adult striped bass in 1995 relative to 1994 was unexpected. The appearance of females from the 1991 year-class spawning for the first time at age 4 should have led to an increase in spawner abundance. Spawning by bass of Miramichi origin in estuaries elsewhere in the southern Gulf of St. Lawrence cannot explain the reduction. The CPUE of striped bass in the Richibucto-Bouctouche gaspereau fisheries was lower in 1995 than in 1994 (Fig. 5). Furthermore, few young-of-the-year bass have been reported from the Kouchibouguac, Richibucto or Bouctouche rivers although young-of-the-year bass were reported as bycatch in the Tabusintac River autumn smelt fishery for the first time since 1992 (Bradford and Chaput unpublished data).

Unregulated and directed commercial fishing for striped bass since July 1994 could have been a factor in the estimated decline in the striped bass spawning stock in 1995. Bass of southern Gulf origin were readily available in local fish markets throughout the summer and autumn of 1994 (Fred Wheaton, New Brunswick Wildlife Federation, personal communication) and 12.6 t of overwintering bass were reported landed in Statistical District 75 in the fall 1994 and the winter of 1995 (Tables 2 and 3).

Spawner Success

The CPUE of young-of-the-year (age-0) striped bass in the 1995 open-water smelt fishery of the Miramichi averaged 475 fish per trap per day (standard deviation 539; sampled over 21 days and representing 126 net-days of effort), the highest recorded since sampling of this fishery was initiated in 1991 (Table 4). These data indicate that spawner success was higher during 1995 than in previous years, an interpretation consistent with the increased number of mature females during May and June in 1995. The estimated total bycatch of age-0 bass in the 1995 autumn smelt fishery was about 500 thousand fish, a 10 fold increase over both 1993 and 1994 (Bradford et al. 1997). The impact of bycatch related mortality on total mortality in the first year remains an open question because the exploitation rate for striped bass in autumn smelt nets has not been estimated. The average length of age-0 bass in October and November (13 cm FL) was comparable to the previous large bass observed in 1991 (Fig. 6).

Stock Structure

Available evidence indicates that production of the southern Gulf of St. Lawrence striped bass remains dependent on spawning in the Miramichi River estuary and that southern Gulf striped bass should be considered a single biological unit (stock) for management purposes. A summary of recapture data (Figs.7 to 9) shows that all bass recaptured during May and June (1991 to 1995) occurred in the Miramichi regardless of the season and the location of marking within the New Brunswick portion of the southern Gulf of St. Lawrence. Furthermore, the geographic range of striped bass which spawn in the Miramichi extends from Percé, Québec to the Margaree River, Cape Breton Island, Nova Scotia (Figs. 7 to 9). Overwintering sites appear to be selected opportunistically with no indication that adult striped bass which will spawn in the Miramichi the following spring migrate to the Miramichi before the onset of winter. This latter interpretation is supported by the infrequent occurrence of adult striped bass in the autumn smelt fishery in the Miramichi River (Table 4).

The extensive feeding migrations undertaken by striped bass in combination with opportunistic selection of overwintering sites challenges several common perceptions regarding production of striped bass in the southern Gulf of St. Lawrence: 1) that striped bass are abundant, 2) that spawning is widespread, and 3) that discrete populations are distributed throughout the southern Gulf of St. Lawrence. "Spring runs" of striped bass in many of the smaller rivers of the southern Gulf may simply represent the movement of striped bass from overwintering areas towards the Miramichi for spawning and/or the continuation of the wide-ranging feeding migrations of immature bass throughout the southern Gulf.

Sources of Uncertainty

Catchability of Striped Bass With Time

The declines in both CPUE and sequential mark-recapture population estimates indicate that seasonal arithmetic averages and end of season estimates of spawner abundance, as reported in this document, are both likely to be underestimates of the actual spawner population size. Procedures to estimate spawner abundance with both accuracy and precision at the most appropriate time of the run are required regardless of method. The greatest uncertainty for both methods lies in the relationship

between CPUE and abundance at the onset of gaspereau fishing in the NW Miramichi. Therefore, there would appear to be considerable benefit in having a marked population of adult bass available for capture from the onset of gaspereau fishing.

Sex Ratio of Spawners and Age of First Maturity

Observations of the sex ratios of spawning striped bass during 1995 confirm the 1994 prediction that age-at-maturity differs between sexes (Bradford et al. 1995a). Precise estimates of the sex ratio of spawning fish during 1995 were not possible. Tagging fish to estimate population size was the first priority, and few fish surplus to this were made available by fishers for detailed biological sampling. However, external examination of spawners showed that ripe and running males comprised 62% of all fish ≥40cm FL (n =477; 24-31 May). This represents a substantial decline from the >90% male component estimated for both the 1993 and 1994 spawning populations (Bradford et al. 1995a). The increased abundance of adult females in 1995 corresponds to the expectation from the 1994 spawning run. This suggests that catchability is likely to be about equal for male and female spawning bass of the same age in gaspereau traps. Bycatch-based indices of abundance therefore would not appear to be biased on the basis of sex-linked behavioural differences which may produce unequal catchability.

ECOLOGICAL CONSIDERATIONS

Commercial Fisheries-Striped Bass Interactions

Gaspereau Fishery

The results of the 1995 mark-recapture experiment support the suggestion of Bradford et al. (1995a) that cumulative recapture histories provide a better measure of potential exploitation rate for adult striped bass intercepted in gaspereau traps than do average recapture rates. In 1994, the potential total exploitation rate (PER) on bass present from the beginning to the end of the gaspereau fishery (25 days) in the Miramichi River was 35%. In 1995, the PER was 15% over a period of 14 days as a result of the departure of bass from the Northwest Miramichi upon completion of spawning sometime after the first week of June. The extrapolated stratified mean catch in the NW Miramichi fishery indicated that the number of intercepted spawners was 745, 17000, and 9576 during the 1993, 1994, and 1995 gaspereau fisheries respectively (Table 5). The 1995 estimate, equivalent to 8.8 t of landed fish (average weight of 0.92kg per fish), reflects the number of spawners landed and sold from the NW Miramichi fishery alone. Total landings from the entire Miramichi gaspereau fishery were estimated at 12325 fish (11.3t). This was estimated on the basis that the daily exploitation rate on striped bass for the entire Miramichi River gaspereau fishery was 0.013 with 78% of all interceptions occurring in the NW Miramichi fishery (Bradford et al. 1995a). These landings of bass from the Miramichi gaspereau fishery were not recorded in the D.F.O. Statistics Branch database. Landings of bass from the Miramichi gaspereau fishery typically accounted for less than half of the total annual landings reported from the southern Gulf of St. Lawrence (LeBlanc and Chaput 1991).

Smelt Fisheries

The estimated total bycatch of age-0 bass in the 1995 autumn smelt fishery was about 500 thousand fish, a 10 fold increase over both 1993 and 1994 (Bradford et al. 1997). Some of these age-0 bass are culled immediately and the survival rate of these releases is unknown. The impact of bycatch related mortality on total mortality in the first year remains an open question because the exploitation rate for striped bass in autumn-set smelt nets has not been estimated.

Other Fisheries

Despite restrictions detailed in the 1993 management plan (Dept. Fisheries and Oceans 1993), sales of striped bass ≥38 cm TL have continued into the autumn of 1995 (Fred Wheaton, New Brunswick Wildlife Federation; pers. comm.). Anecdotal information indicated that harvests of striped bass occurred throughout the southern Gulf using various methods including fish traps, gillnets, and hook-and-line fishing. These reports were not directly corroborated but landings reported on purchase slips are to be considered unreliable. Nonetheless fresh, whole, adult striped bass were both readily and widely available in fish markets throughout the summer and late autumn of 1995. The timing of their availability indicates that feeding migrant bass, likely of Miramichi origin, were being targeted.

FORECAST/PROSPECTS

The categorization in 1990 of the status of the striped bass stock of the southern Gulf of St. Lawrence as reduced or declining (Chaput and Randall 1990) remains appropriate. Production remains largely dependent on the 1991 year-class which has continued to be targeted commercially beyond June 1995. It is not known if the spawning success in 1996 and beyond will be comparable to 1995 levels; i.e., will increasing egg production by individual females as accrued through annual growth, offset the loss in the number of spawners through fishing-related mortality? Recruitment of first-time spawning females of the 1992 year-class should occur in 1996, but as is the case with the 1991 year-class, the number of survivors through to May 1996 is unknown. It is recommended that, for the next three years, a change in the designation of the status of the southern Gulf striped bass stock be dependent on spawner success rather than estimates of spawner abundance. The magnitude of production of age-0 bass and its corresponding annual variability are the recommended basis for assessing the health of the stock for the years 1996 to 1999. In 1999, male and female striped bass of the 1995 strong year-class are expected to recruit to the spawning population in the Northwest Miramichi.

Continued Improved Spawning Potential for Miramichi; May-June, 1996

Good recruitment of female striped bass of the 1991 year-class to the spawning population occurred during 1995. The occurrence of 4 year-old immature females in the bycatch of the 1995 Miramichi gaspereau fishery indicates that some further recruitment of first-time spawners will occur in 1996. Repeat, consecutive-year spawning by both sexes is expected to be revealed through recapture of spawning males and females in May and June 1996 in the Northwest Miramichi River estuary. Thus, even though directed fishing has reduced the spawner biomass of the 1991 year-class, potential egg production in 1996 is likely to be higher than in 1993 to 1995.

Reduced Recruitment of Spawners From 1993 Yearclass in 1996

The low CPUE of age-0 bass in the autumn smelt fishery of 1993, the virtual absence of age 1+ bass in autumn 1994, and the low CPUE of age 2+ bass in the 1995 gaspereau fishery indicate that the 1993 year-class is much less abundant than the 1991 and 1992 year-classes.

MANAGEMENT CONSIDERATIONS

Exploitation Opportunities and Strategies

Although long-term prospects for the striped bass population of the Miramichi river are improved over previous years, spawning success remains highly dependent on the 1991 year-class. A substantial component of this year-class is anticipated to be of legal retention size (≥68cm TL) for striped bass under the regulations currently in effect for recreational fishing. An increased retention limit (i.e., >100cm TL) or fishing on a catch-and-release basis only should be given serious consideration. There are no guarantees that spawner success will be comparable to or improve beyond levels observed in 1995, at least until full recruitment of the 1995 year-class to the spawning population is achieved in the years 1999 and 2000. The documented recent history of this population (Chaput and Randall 1990; Bradford et al. 1995a,b; this study) shows that luck is the single largest determinant of striped bass abundance in the absence of meaningful conservation measures.

RESEARCH RECOMMENDATIONS FOR 1996

Continue Miramichi sampling, mark and recapture experiments: May-June

Objectives:

1) establish catchability and abundance estimates for the entire duration of the NW Miramichi River gaspereau fishery by tagging a large group of adult striped bass before May 20,

2) establish conservation definition of spawner abundance for regulation and development of recreational fishery,

3) verify presence of first-time female spawners of the 1992 year-class,

4) estimate the abundance of the female component of the spawning population,

5) continue migration/stock structure studies through the tagging program.

Sample Miramichi smelt bycatch: October-December

Objectives:

1) assess spawning success in the Miramichi for 1996 given the expectation of a decline in spawner abundance but potentially increased egg production,

2) determine pre-winter abundance and body size of age-0 bass from the 1996 spawning.

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Table 1. Seasons, location, licensed gear number, type and stetched mesh size (cm) for fixed-gear commercial fisheries of the Miramichi River estuary.

Fishery	Duration	Location	Gear	Nets	Mesh Size (cm)
Gaspereau	15 May to 15 June	NW Miramichi	Box	13	3.1
		Chatham		11	
		Loggieville		6	
		Napan River		6	
Eel	No Closure	NW Miramichi	Fyke	44	2.4
		Loggieville		15	
		Napan River		24	
Smelt	15 October to December	Chatham to Napan River	Bag	21	2.4
	January to March	Miramichi Bay	Bag Box	>300	2.4

Table 2. Purchase slip and "Supplementary B" landings (t) of striped bass from the Gulf New Brunswick statistical districts, 1917 to 1994. Statistical districts are shown in Figure 2. Data for 1917 to 1988 are from LeBlanc and Chaput (1991). Data for 1989 to 1995 are from Statistics Branch, DFO. Landings for 1935 to 1967 were not recorded in statistical reports (LeBlanc and Chaput 1991). A period means no landings were registered, a value of 0.0 means landings were less than 50 kg.

	Statistical Districts								
Year	64	68	70	71	72	73	75	76	Gulf NB
1917	1.2	8.2	.	4.0	0.4	1.5		35.7	61.4
1918	0.9	7.2	.	1.1	4.5	1.5		16.6	54.4
1919	.	4.1	0.5	1.2	2.3	3.6	15.4	2.3	33.7
1920	.	17.3	.	2.2	0.5	4.2	0.9	2.7	28.3
1921	.	1.1	.	1.5	.	2.7		7.4	15.9
1922	.	1.4	.	1.2	.	.		16.3	19.1
1923	.	0.9	.	0.2	.	5.4		18.0	25.5
1924	.	.	.	0.9	7.2	.		30.6	39.8
1925	.	0.9	.	0.7	0.4	4.1			22.1
1926	.	.	.	1.9	0.4	.		14.6	20.0
1927	.	.	.	.	.	6.5		15.4	22.8
1928	.	.	.	0.2	.	3.7	5.4		10.3
1929	.	.	.	.	.	1.7	3.0	0.9	5.8
1930	.	.	.	0.5	0.5	0.9	0.4	1.8	4.0
1931	.	.	.	.	0.5	0.9		1.8	3.2
1932	.	.	0.8	.	0.5	1.1		1.5	3.9
1933	.	.	0.2	.	0.1	.		0.4	0.7
1934	.	.	.	.	0.3	.		0.0	0.4
.	.	.	.	.	.	.	.	.	.
1968	.	.	0.4	1.8	1.1	0.1	1.2	3.6	8.2
1969	.	.	0.1	0.4	1.6	0.1	4.8	2.4	9.4
1970	.	0.1	2.6	0.9	3.4	0.4	2.7	0.6	10.6
1971	.	.	0.7	1.4	8.5	0.4	2.0	0.4	13.3
1972	.	.	0.1	1.8	3.4	0.5	3.1		8.8
1973	.	.	0.2	0.1	3.8	.	2.0	0.0	6.1
1974	.	0.1	.	0.3	3.6	.	1.5		5.4
1975	.	0.7	3.2	1.0	.	.	2.2		7.2
1976	0.1	0.1	1.9	1.6	3.1	.	1.9		8.6
1977	.	.	0.9	1.2	.	.	3.0		5.1
1978	.	.	1.5	.	.	.	3.2		5.1
1979	.	0.1	2.2	1.2	.	.	3.3		6.8
1980	0.2	0.1	9.7	2.9	.	.	2.2		15.3
1981	0.2	0.9	5.5	4.7	.	.	1.2	16.4	47.8
1982	.	1.0	3.8	2.4	.	.	1.9	17.4	32.4
1983	.	2.0	3.0	6.9	.	0.1	4.7	3.6	23.4
1984	.	0.1	9.9	2.2	.	.	0.3	43.0	17.3
1985	.	0.8	2.3	8.0	.	.	0.0	9.7	22.0
1986	1.0	2.2	3.5	.	.	.		5.5	12.5
1987	.	.	0.6	.	.	0.1	1.0	0.6	2.3
1988	.	0.1	2.0	0.9	.	.	1.0	0.2	4.1
1989	.	.	.	0.1	.	.		3.8	4.0
1990	.	.	.	0.0	.	.		0.8	1.0
1991	.	.	.	0.0	.	.	0.2	1.1	1.3
1992	.	.	.	0.2	.	.	0.3	8.4	8.9
1993	.	.	.	0.0	.	.	0.0	0.6	0.6
1994	.	.	.	.	.	.	.	1.0	1.0
1995	0.5	0.5	.	.	.	.	15.5	.	17.3
Average 89-94	0.0	0.0	0.0	0.1	0.0	0.0	0.2	2.9	3.2

Table 3. Striped bass landings (t) from Gulf New Brunswick statistical districts by season, 1968 to 1995. Data sources as in Table 2. Statistical districts are shown in Fig. 2. A period means no landing registered. A value of 0.0 means landings were less than 50 kg.

	Year	January to March	April to June	July to September	October to December	Total
Northeast NB Districts 65-68	1975	.	.	0.7	0.1	0.8
	1976	.	.	0.2	.	0.2
	1980	.	.	0.3	0.2	0.5
	1981	.	.	1.0	0.2	1.2
	1982	.	0.2	0.5	0.3	1.0
	1983	.	.	0.0	1.9	1.9
	1984	.	.	0.5	0.2	0.7
	1985	.	.	1.4	0.4	1.8
	1986	.	.	1.8	1.7	3.5
	1988	.	.	0.1	.	0.1
	1995	.	1.0	.	.	1.0
Central NB Districts 71-73	1968	.	3.0	0.3	0.1	3.4
	1969	.	2.0	0.1	.	2.1
	1970	.	4.8	2.5	0.1	7.4
	1971	.	10.3	0.7	.	11.0
	1972	.	5.7	.	.	5.7
	1973	.	4.1	.	.	4.1
	1974	.	3.9	.	.	3.9
	1975	.	1.0	2.7	0.5	4.2
	1976	.	4.7	1.9	.	6.6
	1977	.	1.2	0.7	0.2	2.1
	1978	.	.	0.9	0.5	1.4
	1979	.	1.4	1.8	0.2	3.4
	1980	.	3.1	9.3	0.1	12.5
	1981	.	4.8	5.3	0.1	10.2
	1982	.	2.4	2.7	1.0	6.1
	1983	.	6.9	1.5	1.5	9.9
	1984	.	2.3	3.1	6.6	12.0
	1985	.	8.4	0.8	1.2	10.4
	1986	.	.	3.5	.	3.5
	1987	.	.	0.6	.	0.6
	1988	.	0.9	1.4	0.6	2.9
	1989	.	0.1	.	.	0.1
	1990	.	.	.	.	0.0
	1991	.	.	.	.	0.0
	1992	.	0.2	.	.	0.2
	1993	.	.	.	.	0.0
	1994	.	.	.	.	0.0
	1995	.	.	.	.	.
Southeast NB Districts 75-80	1968	3.0	0.3	.	1.5	4.8
	1969	5.3	0.2	.	1.8	7.3
	1970	2.5	0.3	.	0.5	3.3
	1971	2.2	.	.	0.2	2.4
	1972	2.6	0.2	.	0.3	3.1
	1973	1.1	1.0	.	.	2.1
	1974	0.7	0.1	.	0.7	1.5
	1975	1.7	.	.	0.5	2.2
	1976	1.6	.	.	0.3	1.9
	1977	1.5	.	0.7	0.8	3.0
	1978	2.0	.	0.7	0.6	3.3
	1979	2.0	.	0.7	0.5	3.2
	1980	1.6	.	0.6	.	2.2
	1981	1.1	29.2	2.0	4.0	36.3
	1982	2.3	16.7	2.2	4.0	25.2
	1983	2.5	7.0	0.6	1.1	11.2
	1984	.	3.1	0.4	1.1	4.6
	1985	.	3.1	4.1	2.6	9.8
	1986	0.1	2.5	2.1	0.8	5.5
	1987	0.1	1.3	0.3	.	1.7
	1988	.	1.1	.	.	1.1
	1989	.	.	1.9	1.9	3.8
	1990	.	0.4	0.3	.	0.7
	1991	1.2	0.0	.	0.0	1.2
	1992	0.1	8.0	.	0.5	8.6
	1993	0.5	.	0.0	0.1	0.6
	1994	0.2	0.8	.	.	1.0
	1995	12.6	1.2	.	2.2	15.7

Table 4. Summary of abundance indices expressed as the catch of fish per net per day of fishing effort (mean ± standard deviation) by age class for striped bass from the Miramichi River estuary. Age-0 and age-1 bass abundance estimates are from sampling the bycatch in the October to November open water smelt fishery. The age-2 and spawners abundance estimates are from sampling the bycatch in the May and June gaspereau fishery of the Northwest Miramichi. NS means not sampled.

	Sampling Year				
	1991	1992	1993	1994	1995
Abundance indices from the open water smelt fishery of the Miramichi River					
Sample size	21	23	25	16	21
Age-0	380.1 ± 726.6	62.6 ± 75.9	28.8 ± 29.0	98.2 ± 233.7	474.5 ± 539.2
Age-1	0.5 ± 1.1	1.1 ± 3.8	6.1 ± 10.3	0.1 ± 0.1	1.2 ± 2.1
Abundance indices from the gaspereau fishery in the Northwest Miramichi River					
Sample size	23	NS	46	50	64
Age-2	0.02		5.6 ± 0.3	8.0 ± 3.2	0.3 ± 0.01
Spawners	1.5		3.6 ± 0.3	68.7 ± 17.4	36.8 ±5.0

Table 5. Summary of catch data, spawner abundance estimates and exploitation estimates for striped bass from the Miramichi River for 1993 to 1995.

	Year of sampling		
	1993	1994	1995
Catch data			
Number of strata (days)	16	19	20
Traps per stratum	13	13	13
Sampled traps	46	50	64
Total trap-days	208	247	260
Stratified Mean Catch/Trap/Day	3.58	68.69	36.83
Standard Deviation	0.25	17.44	5.01
Population estimates			
Catchability estimates (assuming a daily exploitation rate of 0.0101 for the 13 Northwest Miramichi gaspereau traps)			
Estimated spawners	4603	88418	47402
Sequential Bayes estimate using mark and recapture experiment			
Estimated spawners	5500	40000	37500
Exploitation			
NW Miramichi			
Estimate of intercepted spawners	745	16966	9576
Standard Deviation	1	1198	185
Number of spawners removed	0	0	9576
Biomass of spawners removed (t)	0	0	8.8
Miramichi estuary			
Number of spawners removed	0	0	12324
Biomass of spawners removed (t)	0	0	11.3

Table 6. CPUE of bass (> 38 cm TL) per trap and average (± standard deviation) CPUE for the day from the Northwest Miramichi gaspereau fishery for 1993 to 1995. CPUE expressed as number of bass•trap^{-1}•day^{-1}. N = number of traps sampled for that day. SD = standard deviation.

	CPUE in individual fisher samples							CPUE per day		
Day-Month-Year	1	2	3	4	5	6	7	N	Mean	SD
28 May 1993	11.0							1	11.0	
01 June 1993	2.5							1	2.5	
02 June 1993	0.0							1	0.0	
04 June 1993	0.5	1.0	0.5					3	0.7	0.3
05 June 1993	0.0	2.0	0.0					3	0.7	1.2
06 June 1993	1.0	0.0						2	0.5	0.7
07 June 1993	5.0							1	5.0	
08 June 1993	3.0	2.0	2.0					3	2.3	0.6
09 June 1993	0.0							1	0.0	
10 June 1993	4.0	2.0						2	3.0	1.4
12 June 1993	0.0	1.0	0.0	2.0	0.0			5	0.6	0.9
14 June 1993	13.0	22.0	11.0	2.0	3.0			5	10.2	8.2
15 June 1993	11.0	9.0	5.0	15.0	13.0			5	10.6	3.8
16 June 1993	7.0	15.0	4.0	10.0				4	9.0	4.7
17 June 1993	1.0	0.0	0.0	0.0	1.0			5	0.4	0.5
18 June 1993	0.0	0.0	2.0	1.0				4	0.8	1.0
24 May 1994	394.2	60.0	84.0					3	179.4	186.4
26 May 1994	806.4	134.7						2	470.6	475.0
27 May 1994	17.5							1	17.5	
01 June 1994	25.0	19.0	22.5					3	22.2	3.0
03 June 1994	201.0	127.1	51.3					3	126.5	74.8
05 June 1994	102.7	70.7	45.2					3	72.8	28.8
06 June 1994	62.0	44.0	18.0					3	41.3	22.1
07 June 1994	42.0	13.0						2	27.5	20.5
08 June 1994	27.0	7.0						2	17.0	14.1
09 June 1994	57.0	88.0	30.0					3	58.3	29.0
10 June 1994	83.0	8.0						2	45.5	53.0
11 June 1994	11.0	28.0	16.0					3	18.3	8.7
12 June 1994	4.0	13.0	25.0					3	14.0	10.5
13 June 1994	20.0	14.0	48.0					3	27.3	18.1
14 June 1994	115.0	3.0	72.0					3	63.3	56.5
15 June 1994	89.0	6.0	47.0					3	47.3	41.5
16 June 1994	58.0	7.0						2	32.5	36.1
17 June 1994	18.0	2.0						2	10.0	11.3
18 June 1994	23.0	7.0	5.0	20.0				4	13.8	8.3
24 May 1995	37.0	20.5	53.0					3	36.8	11.6
26 May 1995	12.0	27.0						2	19.5	7.5
27 May 1995	10.0	13.0	19.0					3	14.0	4.6
28 May 1995	47.0	35.0	193.0					3	91.7	88.0
30 May 1995	298.0	32.5	201.0					3	177.2	134.3
01 June 1995	51.0	102.0	12.5	4.0				4	42.4	44.7
02 June 1995	19.0							1	19.0	
05 June 1995	186.0	96.0	293.0					3	191.7	98.6
06 June 1995	9.0	5.0	2.0	40.0	49.0			5	21.0	21.8
08 June 1995	19.3	0.7	2.7					3	7.6	10.2
09 June 1995	7.0	13.0	49.3					3	23.1	22.9
10 June 1995	3.0	36.0	0.0	2.0	11.0	32.0	16.0	7	14.3	14.6
11 June 1995	4.0	3.0	51.0	4.0				4	15.5	22.7
12 June 1995	5.0							1	5.0	
14 June 1995	13.0	11.0						2	12.0	1.4
15 June 1995	5.0	0.0	6.0	4.0	4.0			5	3.8	2.3
17 June 1995	5.0	35.0						2	20.0	21.2
18 June 1995	20.0	14.0	7.0	8.0				4	12.3	6.0
19 June 1995	9.0	4.0	4.0					3	5.7	2.9
21 June 1995	3.5	3.0	6.0					3	4.2	1.6

Table 7. Estimated number of striped bass spawners for each day of sampling for 1993 to 1995 based on a daily exploitation rate in gaspereau traps from the Miramichi River of 0.013 and a sequential Bayes algorithm from the mark and recapture experiment. Daily exploitation rate estimates are based on the mean catch per trap values weighted by the number of traps fishing. Sequential Bayes algorithm estimates are expressed as the median of the estimates and are not available for 1993. Width of the 95% C.I. represents the upper limit (97.5th percentile) minus the lower limit (2.5th percentile).

	Daily exploitation rate = 0.013		Sequential Bayes algorithm	
Day-Month Year	Mean	Width of 95% C.I.	Median	Width of 95% C.I.
28 May 1993	11000		NA	
1 June 1993	2500		NA	
2 June 1993	0		NA	
4 June 1993	667	919	NA	
5 June 1993	667	3674	NA	
6 June 1993	500	3043	NA	
7 June 1993	5000		NA	
8 June 1993	2333	1837	NA	
9 June 1993	0		NA	
10 June 1993	3000	6085	NA	
12 June 1993	600	2300	NA	
14 June 1993	10200	20997	NA	
15 June 1993	10600	9891	NA	
16 June 1993	9000	13021	NA	
17 June 1993	400	1408	NA	
18 June 1993	750	2658	NA	
24 May 1994	179389	593095		
26 May 1994	470561	2043837	127500	52500
27 May 1994	17500		110000	42500
1 June 1994	22167	9590	92500	30000
3 June 1994	126475	238093	80000	20000
5 June 1994	72845	91689	60000	10000
6 June 1994	41333	70389	57500	10000
7 June 1994	27500	88238	52500	7500
8 June 1994	17000	60854	52500	7500
9 June 1994	58333	92351	52500	7500
10 June 1994	45500	228201	50000	5000
11 June 1994	18333	27801	47500	5000
12 June 1994	14000	33524	47500	5000
13 June 1994	27333	57745	47500	5000
14 June 1994	63333	179785	45000	5000
15 June 1994	47333	132056	45000	2500
16 June 1994	32500	155177	40000	2500
17 June 1994	10000	48683	40000	2500
18 June 1994	13750	23097	40000	2500
24 May 1995	36833	36752		
26 May 1995	19500	32273	257500	237500
27 May 1995	14000	14582		
28 May 1995	91667	279895		
30 May 1995	177167	427486	257500	152500
1 June 1995	42375	124092	95000	35000
2 June 1995	19000		82500	30000
5 June 1995	191667	313816	75000	22500
6 June 1995	21000	56122	52500	12500
8 June 1995	7578	32551		
9 June 1995	23100	72827		
10 June 1995	14286	34562	42500	7500
11 June 1995	15500	63074	40000	5000
12 June 1995	5000			
14 June 1995	12000	6085	40000	7500
15 June 1995	3800	5863		
17 June 1995	20000	91280	37500	5000
18 June 1995	12250	16714		
19 June 1995	5667	9186	37500	5000
21 June 1995	4167	5114		

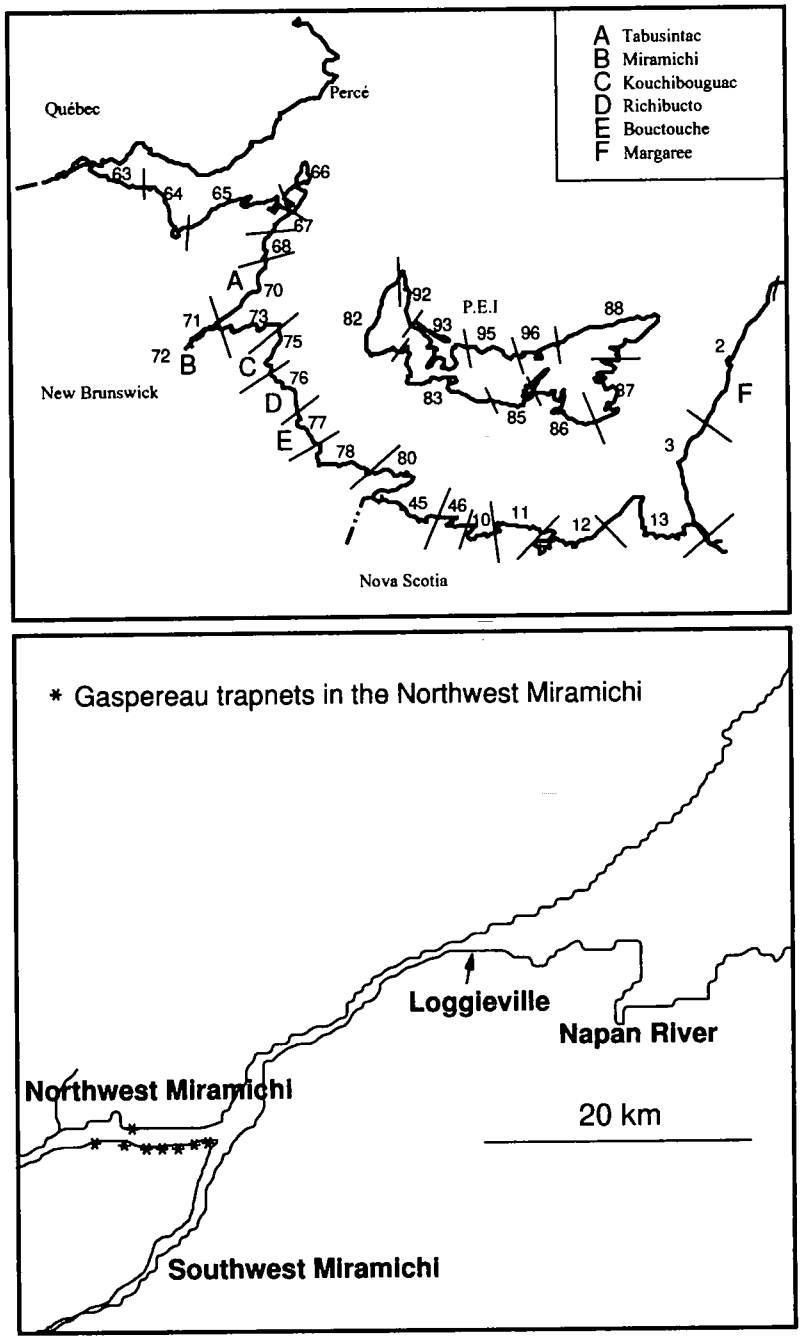

Figure 1. Place names and locations sampled for assessing the status of striped bass stock of the southern Gulf of St. Lawrence.

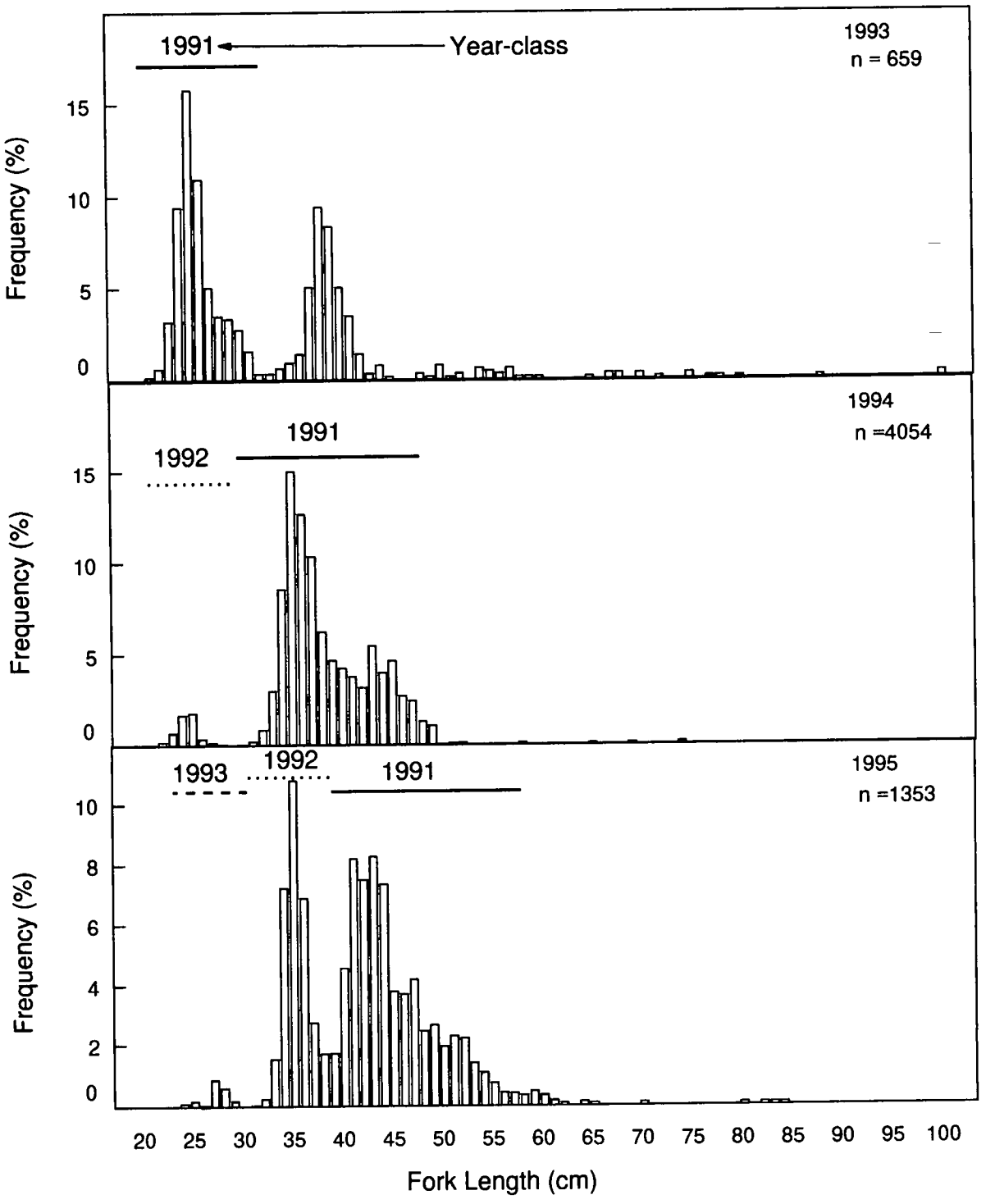

Figure 2. Length frequency distributions of striped bass sampled from gaspereau trapnets in the NW Miramichi during May and June, 1993 to 1995. Approximate length ranges corresponding to the 1991 to 1993 year-classes are represented by horizontal lines.

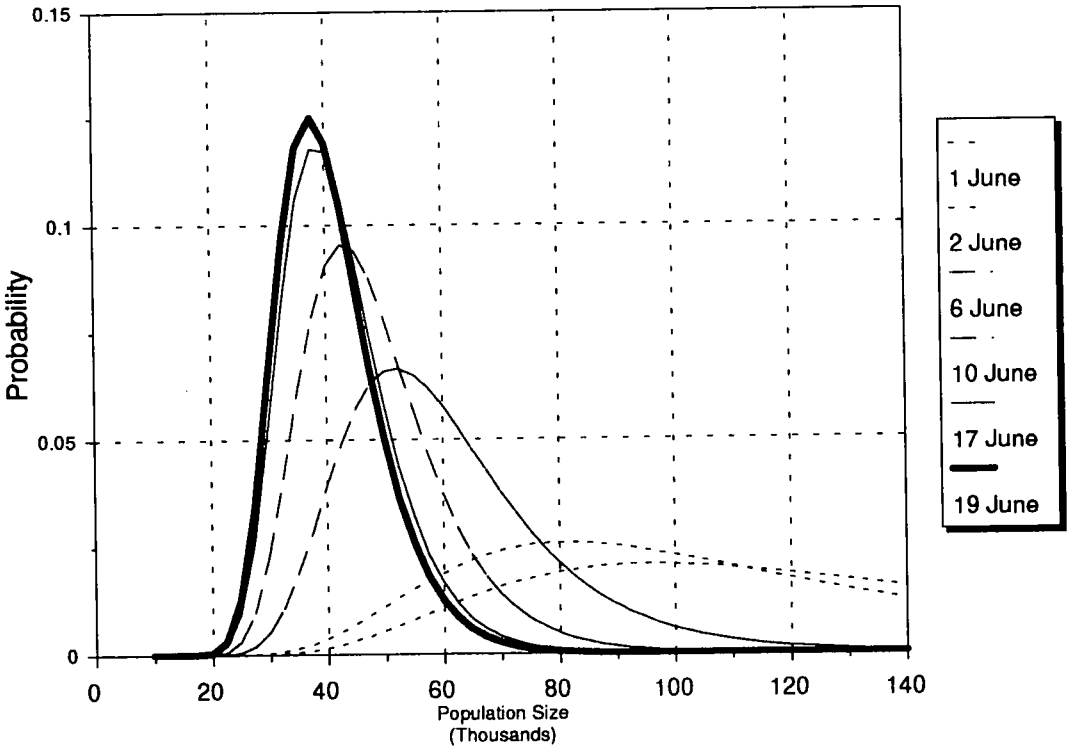

Figure 3. Sequential Bayes estimates of the population size of striped bass spawners in the NW Miramichi in 1995. Thick black line is the final Bayes estimate for all recapture data up to and including June 19, 1995.

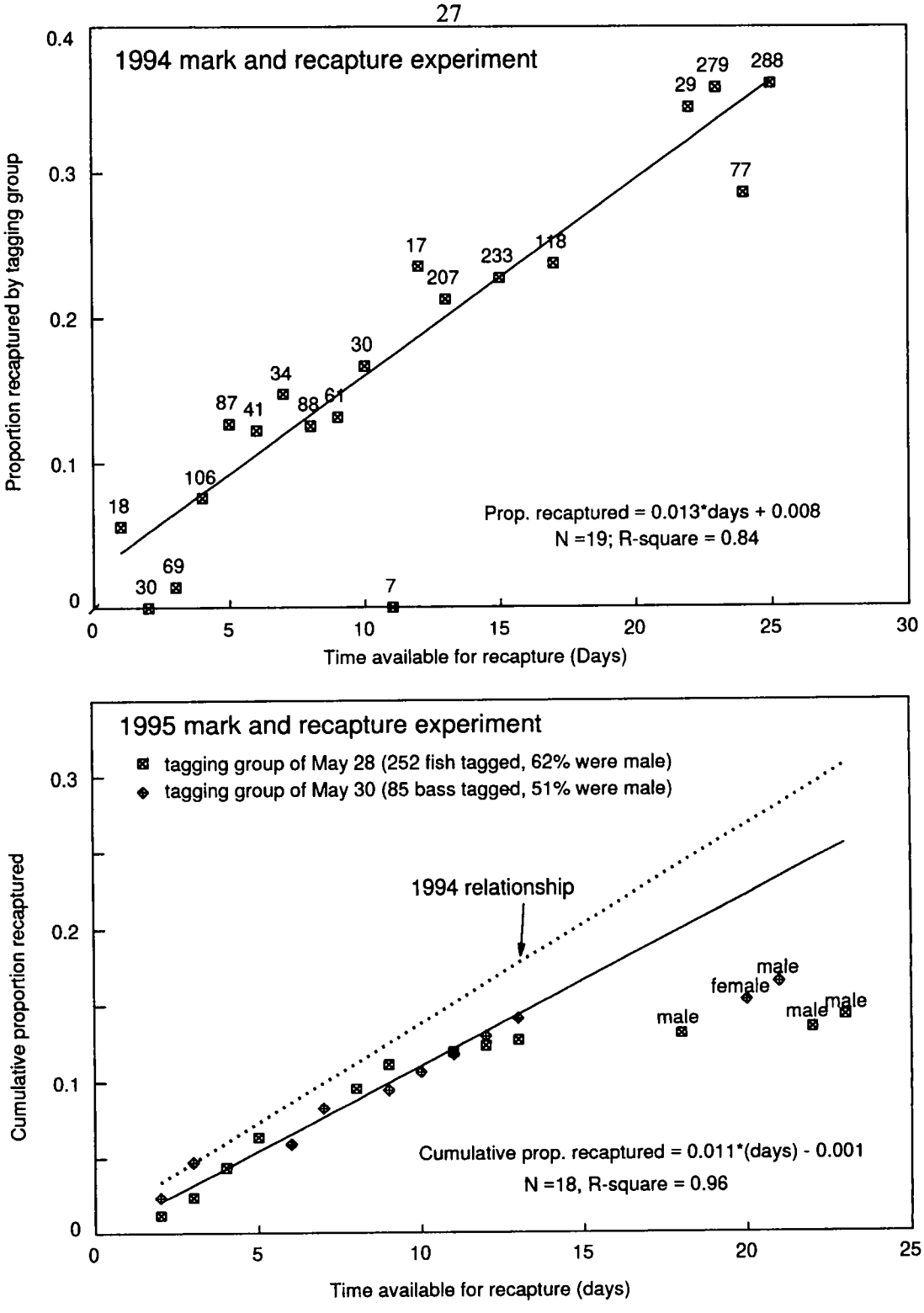

Figure 4. Recapture histories of tagged striped bass in the Miramichi River, in 1994 and 1995. Upper panel: proportion recaptured by tagging group relative to the days available for recapture. Lower panel: cumulative recapture history for bass tagged on May 28 and 30. The 1994 relationship is shown for comparison.

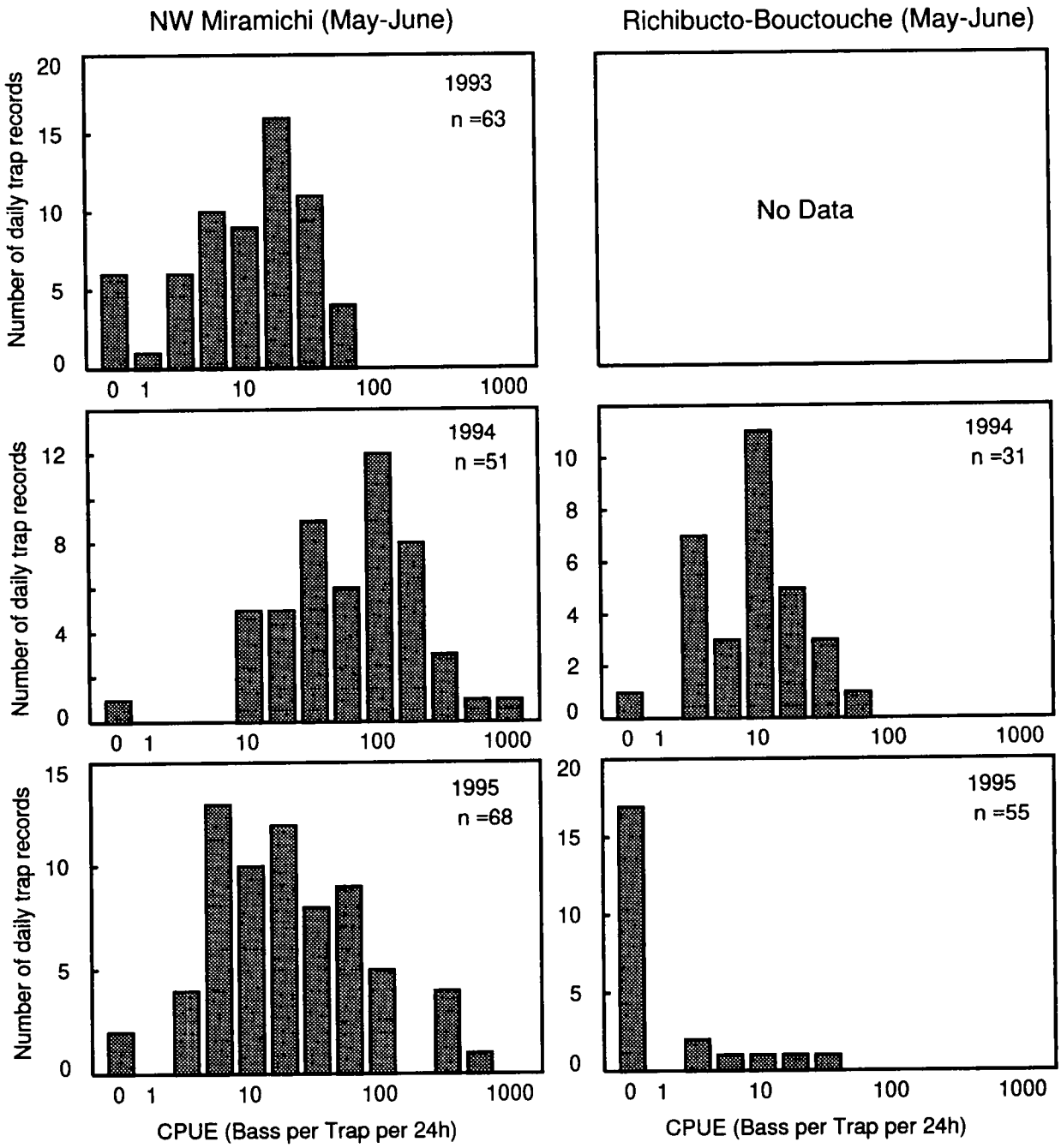

Figure 5. Frequency distribution of the catch per unit of effort (CPUE) from individual gaspereau fishery trap records for the NW Miramichi in1993 to 1995 and in the gaspereau fishery from Richibucto and Bouctouche, 1994 and 1995. CPUE is expressed as the number of bass per trap per 24 hour period of fishing.

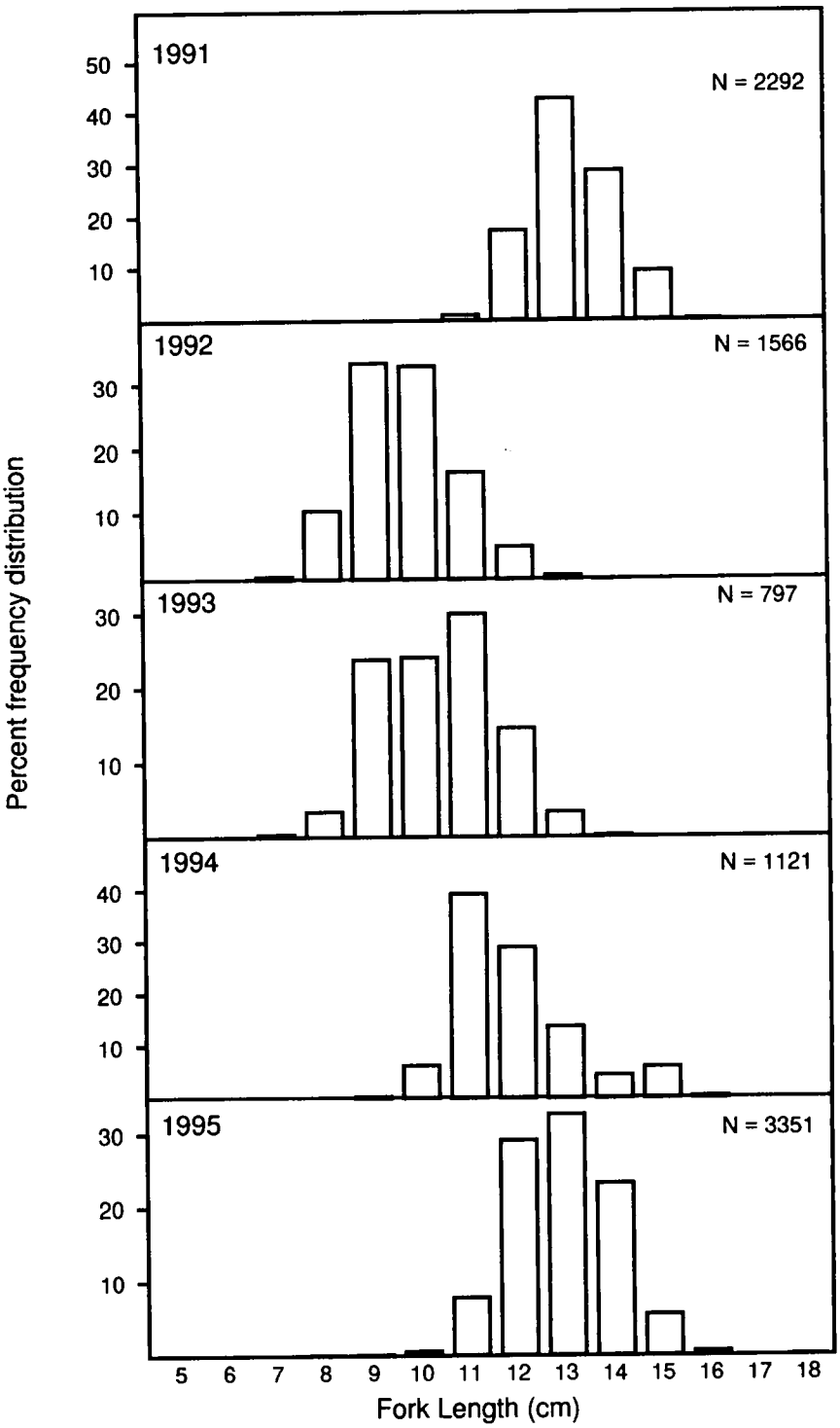

Figure 6. Percentage frequency distribution at fork length (cm) of young-of-the-year striped bass sampled from the open water smelt fishery of the Miramichi River in October and November, 1991 to 1995. N = number of bass measured for fork length annually.

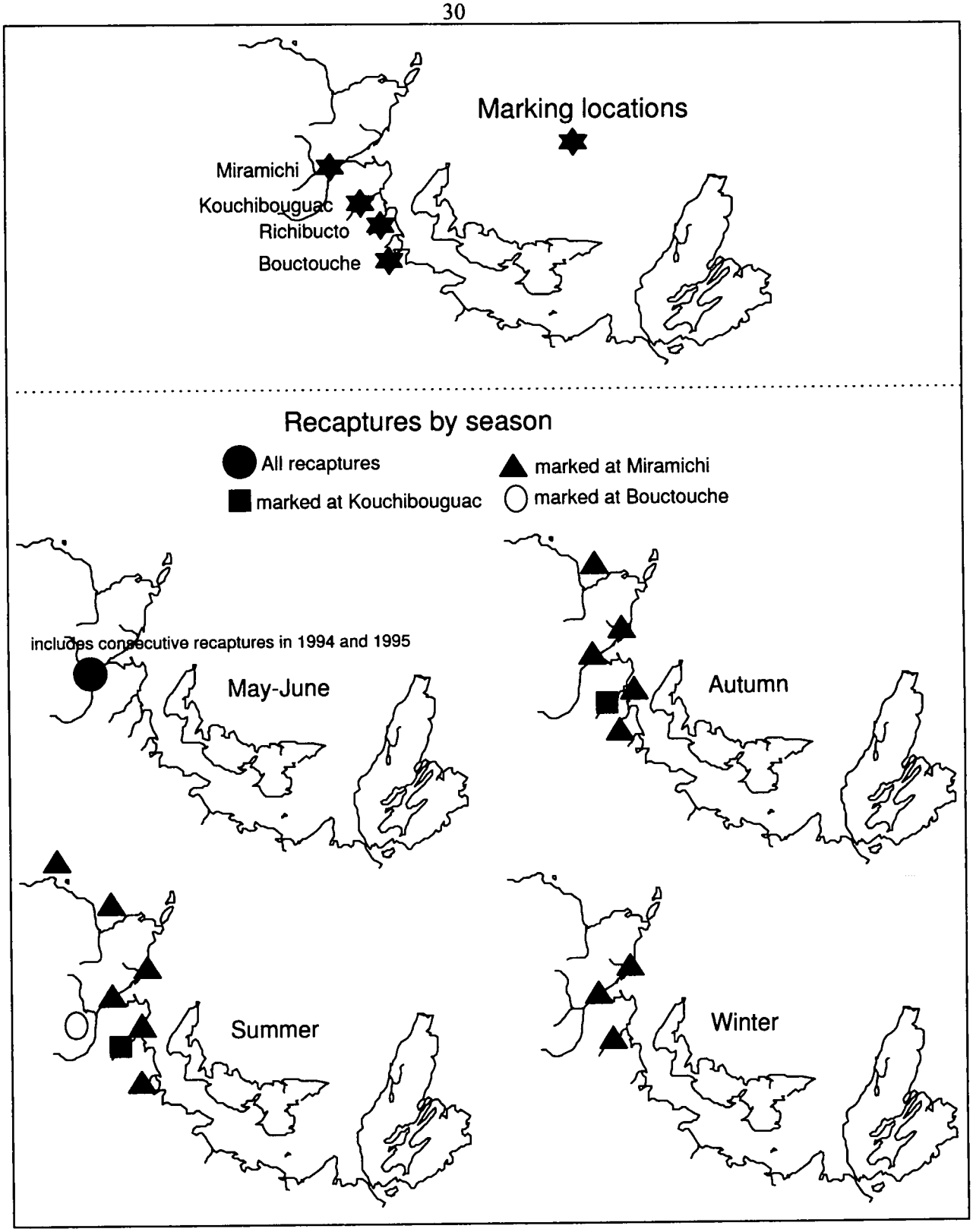

Figure 7. Recaptures by season of striped bass tagged during May and June in four rivers of the southern Gulf of St. Lawrence, 1991 to 1995.

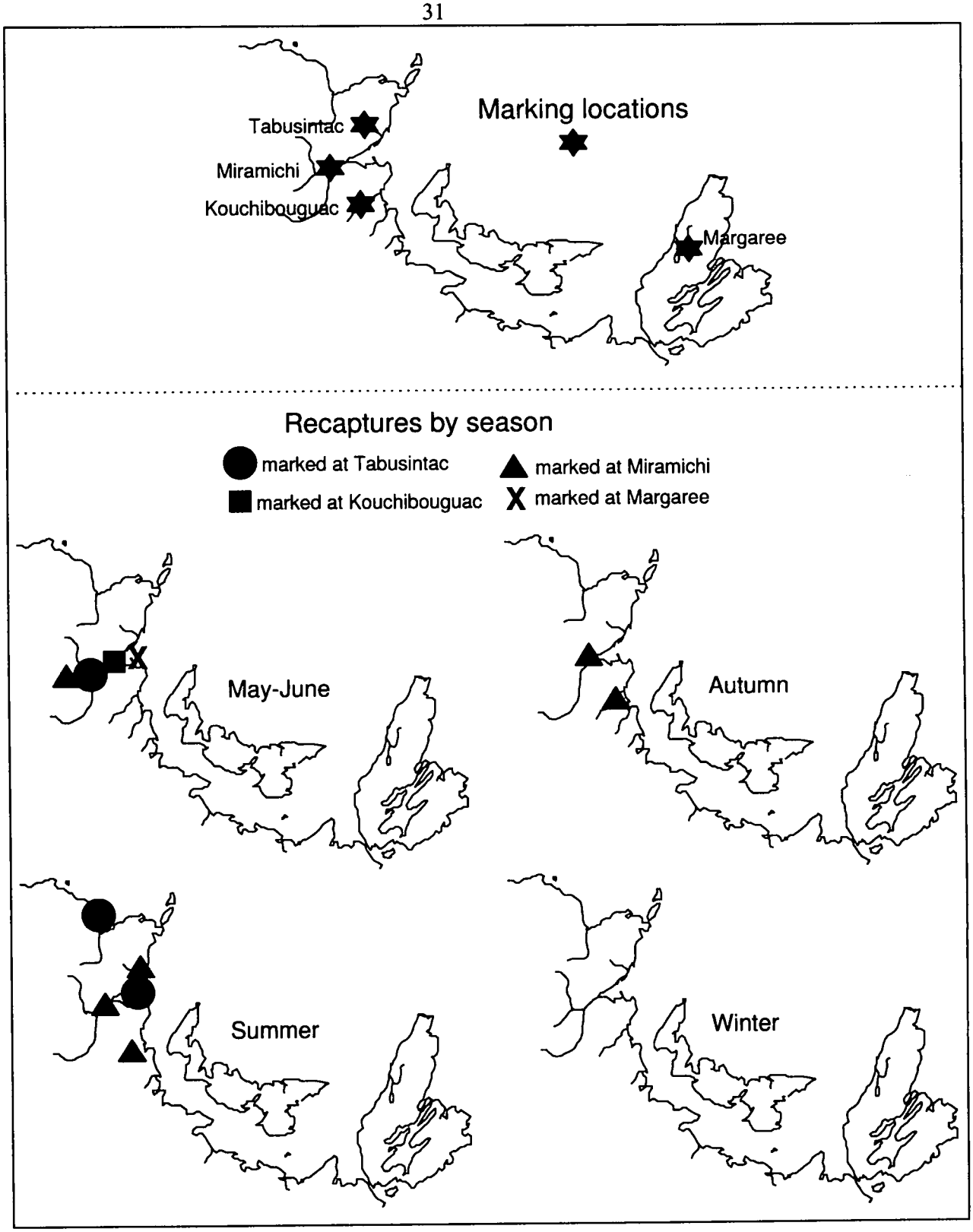

Figure 8. Recaptures by season of striped bass tagged during the summer in four rivers of the southern Gulf of St. Lawrence, 1991 to 1995.

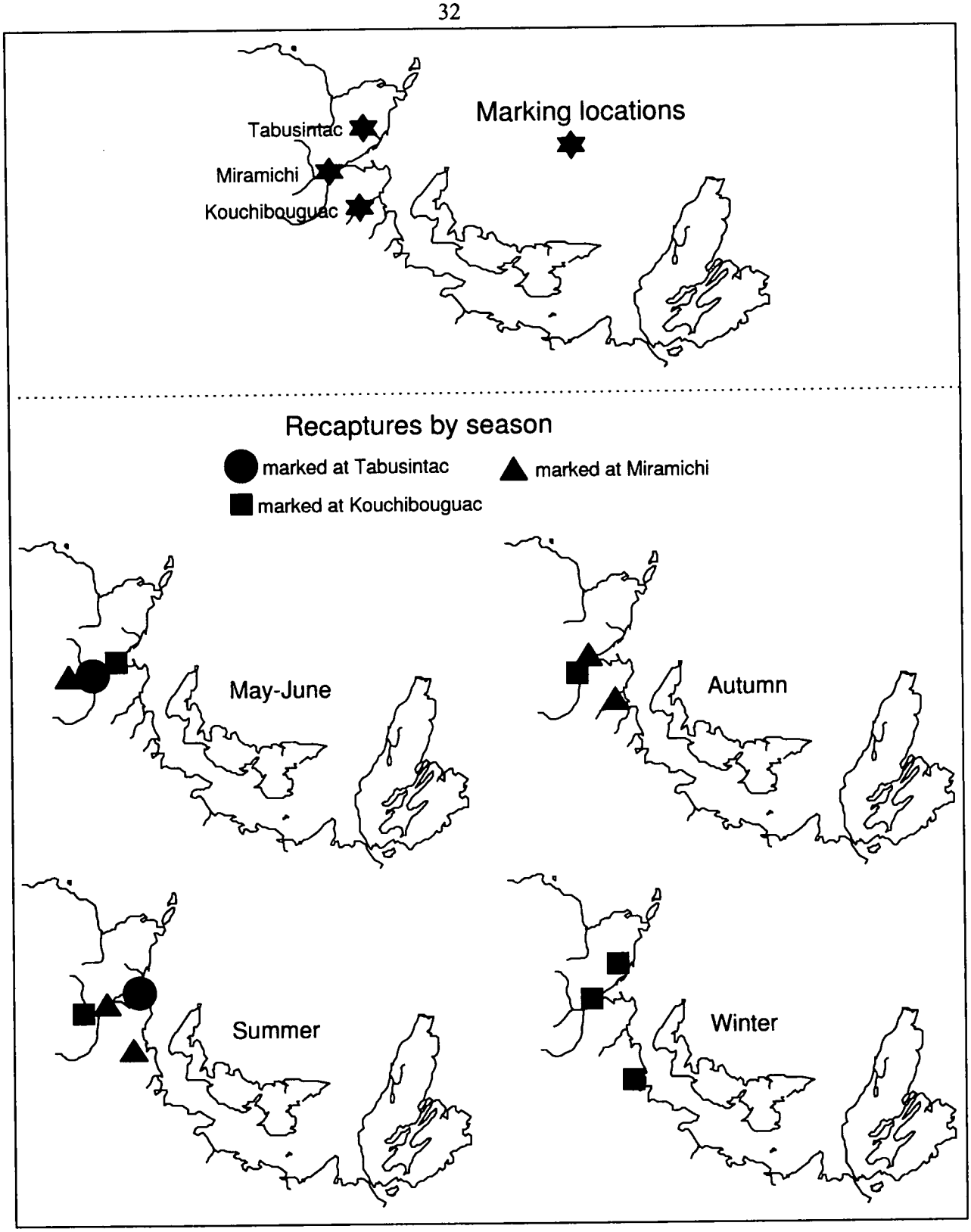

Figure 9. Recaptures by season of striped bass tagged during autumn in three rivers of the southern Gulf of St. Lawrence, 1991 to 1995.

Appendix 1. Striped bass science workshop minutes.

January 19, 1996
Wharf Inn, Miramichi

Participants

Normand Allain	Fisher, Richibucto Village
Rod Bradford	New Brunswick Wildlife Federation, Fredericton
Brian Donovan	Angler, Miramichi
Edmond Drysdale	M.F.U. Shédiac
Gerald Dutcher	Fisher, Loggieville
Bernard Duffy	Renous-Dungarvon Rivers Enhancement Group, Renous
Edouard Landry	Fisher, Pokemouche
Jean-Guy Maillet	Richibucto Fisheries Co-op, Richibucto Village
John Murdock	Fisher, Bay du Vin
Rhoda Murdock	Fisher's Wife, Bay du Vin
Ron Nowlan	Fisher, Pokemouche
Gilles T. Power	Fisher, Pokemouche
Eugène Richard	Fisher, Richibucto Village
Earl Rivers	Fisher, Pokemouche
Alvin Scott	Fisher, Miramichi
Bernie Dube	DNRE (NB), Miramichi
Raymond Michaud	NBAPC, Fredericton
Claude Williams	MPA (NB), Bouctouche
Florence Albert	DFO, Tracadie-Sheila
Robert Allain	DFO, Tracadie-Sheila
Rhéal Boucher	DFO, Tracadie-Sheila
Gérald Chaput	DFO Science, Moncton
David Dunn	DFO, Moncton
Mark Hambrook	DFO Science, Miramichi Salmonid Enhancement Centre, Miramichi
Bill Scott	DFO, Miramichi

The workshop commenced at 1330 and was chaired by Gérald Chaput. After introduction of all the participants, the agenda and objectives of the workshop were described.

1 - review of highlights of 1994 stock assessment

2 - fisheries in 1995: management and landings

3 - target: management objective

4 - spawner abundance in the Miramichi in 1995: estimates of population size, compared to previous years,

5 - spawning success: up to juvenile stage

6 - stock structure: how many spawning stocks in the Gulf of St. Lawrence

7 - management considerations: are management objectives being met and what are the prospects for 1996 and beyond,

8 - future work on striped bass: collaborations.

Appendix 1 (cont'd).

Numerous concerns were expressed regarding the type of management which DFO was proposing for striped bass (managed as a recreational species) and the effect this was having on the gaspereau fisheries of the Miramichi. In particular, fishers were concerned that the bycatch privilege was being removed without compensation. Following some brief clarifications by R. Allain, the chair reminded the group that the objectives of the workshop were to review the biology and arrive at a consensus on the status of the resource. This information would then be used to guide management but that these discussions would take place at the annual advisory meetings for the various fisheries.

The 1995 study was sponsored by the New Brunswick Wildlife Federation and funded under the Canada-New Brunswick Co-operative Agreement on Recreational Fisheries. This is the third year of sponsorship and funding under the Rec. Fish. program. Dr. Rod Bradford, working under contract to the New Brunswick Wildlife Federation, was responsible for presenting the results of the 1995 study. Translation (to French) was provided by the chair.

Review of 1994 science study

Spawning population of the Miramichi in 1993 was estimated at 5000 fish and rose to 50000 fish in 1994. In both years, male striped bass which mature at a younger age than females, made up 90% of the spawning stock. Predictions for 1995 were: an increase in the number of females in the spawning population, fewer age 2 and 3 years old bass based on relative abundance in gaspereau and smelt fisheries, and the presence of repeat spawners (bass which had spawned in previous years).

Fisheries

Management - the management plan remained unchanged. Bycatch retention size limits which had been imposed in 1993 and 1994 were not enforceable in 1995. Fishers could retain and sell any size of striped bass. Recreational fisheries limits (minimum size for retention of 68 cm total length, one fish per day retained and a season for retention which opened July 1) remained in effect.

Landings - landings from bycatch for 1995 were not available at the time of the meeting. There are no recreational fisheries data being collected. D. Dunn of DFO indicated that the national survey on recreational fisheries would provide information on striped bass catches in the New Brunswick sport fishery. The survey was to commence shortly with results available in the coming year.

Target

There is no target established for striped bass as is the case for some other species, such as salmon. The target is defined in general terms: to arrest the decline in abundance, to increase abundance, and to sustain abundance at levels corresponding to supporting habitat. These are the principles which guide the management plan.

Spawner abundance

The estimate of spawners in the Miramichi River was obtained by two methods. In 1994, it was observed that the relationship between the number of tags returned from a daily tagging group was directly proportional to the number of days available to the gaspereau fishery. Using those data, it was estimated that the gaspereau traps in the Miramichi captured on average 1.3% of the bass in the area on any given day. Using this value, and knowing the average number of bass per day in the 13 traps in the Northwest Miramichi, estimates of the spawning stock in 1993 and 1994 were almost identical to the estimates using the mark and recapture data. The estimates were different in 1995, the

Appendix 1 (cont'd)

tag and recapture estimate was about 85000 fish while the gaspereau trap catch method indicated less than 37000 fish. From observations in the field, mainly from detailed sampling of bycatch kept bass, more females were observed in 1995 than in either of the previous years. The number of bass in the spawning area declines over time such that by the close of the gaspereau fishery, very few bass remain in the area. Abundance upon arrival in the estuary in both 1994 and 1995 appears to have approached 75000 to 100000 fish.

Spawning success

Abundance of young-of-the-year striped bass was estimated from the fall open water smelt fishery of the Miramichi. The average number of bass per smelt trap per day of fishing in 1995 was 475 fish, the highest ever recorded since the first sampling of 1991. This indicates that spawning success was high in 1995 and depending upon the survival of these young fish over the first winter, should be an important part of the spawning stock in 4 to 5 years. The usefulness of such bycatch data was highlighted and the collaboration of the fishers in the Miramichi was gratefully acknowledged.

Stock structure

Based on 5 years of tagging and recapture data, the evidence indicates that there is one population of striped bass in the southern Gulf of St. Lawrence and that the Miramichi River estuary is the source of striped bass production for the region. There was no evidence of production outside the Miramichi estuary. It was pointed out that the spawning area in the Northwest Miramichi in the vicinity of McKays Cove is the only verified spawning location for striped bass although the Southwest Miramichi has not yet been sampled.

Management considerations

Unregulated bycatch and retention of striped bass in May to November 1995 has introduced a large uncertainty in the reliability of the population estimates of the spring 1995 to predict abundance of spawners in 1996. The 1991 year class will continue to be the basis for production for at least the next spawning season. Adult abundance will be expected to decline until recruitment to the spawning population from the 1994 and 1995 year classes occurs. There is one management unit for striped bass because production appears restricted to the Miramichi River and harvests are occurring from Nova Scotia to Quebec (Chaleur Bay).

Dave Dunn (DFO) indicated that a workshop is planned for Feb. 15 1996 to consider the implications of the scientific findings presented today. The objectives of the workshop will be to consider how the resource should be managed to ensure that the population is sustained at the most beneficial level possible. The workshop will be open to all interested parties.

Several individuals suggested that the theoretical economic value of the recreational striped bass fishery in New Brunswick is exaggerated and used as an example the estimates of the economic value of the salmon recreational fishery at the time of the closure of the commercial fishery which have not been substantiated. The chair launched a challenge to prepare a similar economic analysis of the bycatch fishery value for the workshop using a similar approach to the recreational fishery estimate.

Given that DFO was proposing that striped bass be managed as a recreational fisheries species, Edmond Drysdale requested that at a future science meeting on striped bass, that the catch of striped bass in the recreational fisheries be tabled. There is concern that the catch in the sport fishery is higher than thought and that it may be as important if not more important than the bycatch fisheries in

Appendix 1 (cont'd).

terms of impact on the stock. Dave Dunn (DFO) indicated that catch data would be obtained from the national recreational fisheries survey which will be conducted over the next few months.

Rod Bradford thanked and acknowledged the cooperation of the gaspereau fishers of the Northwest Miramichi in the last three years. I 1995, in spite of being legally allowed to retain and sell all striped bass, an agreement among the fishers resulted in the tagging and release to the water of over 700 bass which otherwise could have been harvested. Such cooperation is the key to ensuring that the proper management of the resource is based on the best biological information possible.

The workshop ended at 1630.