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Status of Striped Bass (Morone saxatilis) in the Gulf of St. Lawrence in 1997

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ABSTRACT

Spawner abundance for 1997 was estimated at about 8,000 fish (2,500 females; 5,500 males). The spawning population has not recovered from the precipitous decline from 1995 when spawners were estimated to be 50,000 fish. Removals of adults through unregulated, direct commercial fishing activities between May 1995 and March, 1996 are the primary cause of the decline. The 1991 year-class continued to be an important component of the spawning population, a consequence of a poorer than expected contribution to spawning by the 1992 and 1993 year-classes. The decline in female abundance is expected to continue into 1998. The juvenile abundance index obtained by sampling of the bycatch in the autumn smelt fishery corresponded to the reduced number of females in the spawning population in 1997. The average body size of the 1997 year-class after the first season of growth was small and the prospects for winter survival are poor. Production of Miramichi striped bass is likely to remain heavily dependent on the spawners of the 1991 year-class through to 1998 or 1999.

RÉSUMÉ

Pour 1997, l'abondance des géniteurs est estimée à environ 8 000 poissons (2 500 femelles; 5 500 mâles). Cette population ne s'est pas rétablie de la baisse précipitée de 1995, alors que les géniteurs étaient évalués à 50 000. Le prélèvement d'adultes par des activités de pêche commerciale directe, non réglementée, entre mai 1995 et mars 1996, est la principale cause de cette baisse. La classe d'âge de 1991 continue d'être une importante composante du groupe de géniteurs, à cause d'une contribution plus faible que prévue à la reproduction par les classes d'âge de 1992 et 1993. La diminution de l'abondance des femelles devrait se maintenir en 1998. L'indice d'abondance des juvéniles, qui a pu être obtenu par échantillonnage des prises accidentelles de la pêche de l'éperlan à l'automne, correspondait au nombre réduit de femelles au sein de la population de géniteurs de 1997. La taille moyenne des poissons de la classe d'âge de 1997, après une première saison de croissance, était petite et les perspectives de survie en mer sont faibles. La production de bar rayé de la Miramichi demeurera donc fortement dépendante des géniteurs de la classe d'âge de 1991 jusqu'en 1998 ou 1999.

INTRODUCTION

The southern Gulf of St. Lawrence (Fig.1) is currently the principal area of wild striped bass production in New Brunswick (Bradford et al. 1995a,b; Anon. 1996). Gulf striped bass are genetically distinct from Bay of Fundy fish (Wirgin et al. 1993) and are considered to comprise a single biological unit (Bradford and Chaput 1996). Southern Gulf of St. Lawrence striped bass, which spawn predominantly in the Northwest Miramichi River estuary, are also highly migratory (Hogans and Melvin 1984; Bradford and Chaput 1996). The known summer range of Miramichi spawning fish extends from Percé, Québec to Margaree River, Nova Scotia (Bradford and Chaput 1996).

The 1997 assessment represents the second census of spawner abundance since the permanent closure of the commercial fishery in March, 1996. As such, current levels of spawner abundance will provide the basis for monitoring the response of this population to conservation management and subsequently the development of a recreational fishery. Since 1990, southern Gulf of St. Lawrence striped bass have been categorized as either reduced or declining (Chaput and Randall 1990). In 1993 a mark-recapture experiment estimated spawner abundance to be about 5,500 fish. Signs of recovery were evident in 1994 with recruitment of the 1991 year-class. Resumption of harvesting as bycatch in commercial fisheries in July 1994 reduced spawner abundance below the level of returns that were anticipated for 1995 (Bradford and Chaput 1996). However, high abundance of young-of-the-year bass in the fall open-water smelt fishery of the inner Miramichi Bay supported the view of a greater overall egg production in the Miramichi in 1995 relative to the two previous years.

Further reductions in spawner abundance were anticipated and confirmed for 1996 given that commercial fishing targeted spawners during 1995 and into the first quarter of 1996 (Bradford and Chaput 1996).

Forecasts for 1997 included:
1) spawning potential for the Northwest Miramichi was to remain above the 1993 level,
2) poor recruitment from the 1993 year-class, and
3) possible extension of the known geographic range of migrant Miramichi striped bass.

The study area during 1993 to 1997 is the Miramichi River estuary (Fig.1) which remains the principal site of spawning for striped bass within the southern Gulf (Bradford and Chaput 1996). It also corresponds to the location of well-developed fixed-gear commercial fisheries (Chaput 1995). Direct, systematic sampling of bycatch in these fisheries was initiated in 1991 (Hanson and Courtenay 1995) and has continued into 1997. A summary of the Science workshop held on March 2, 1998 to gather additional information from user groups and other government agencies regarding striped bass from the southern Gulf is presented in Appendix 1.

DESCRIPTION OF FISHERIES

Commercial

Commercial fisheries for striped bass were permanently closed in March 1996 through an amendment of the Canada Fisheries Act. The sale of wild-caught striped bass is no longer permitted. Commercial fishers are required to release all striped bass that are intercepted in commercial fishing gear that targets other species (i.e., a bycatch). An exception (through condition of license) has been made for gaspereau and smelt fisheries where a bycatch tolerance for fish <35 cm total length (TL) is in effect. The bycatch tolerance in these fisheries recognizes the difficulty of sorting bass less than 35 cm TL from large quantities of similar-sized fish.

Season:	None
Harvest:	None
Size Restriction:	Striped bass <35cm TL captured in gaspereau and smelt fishing gear may be retained but not sold.

A summary of the commercial harvest , by statistical district and by month for the years 1917 to 1995 was presented by Bradford and Chaput (1996).

Striped bass harvests were reported for 1996 from three statistical districts from the southern Gulf of New Bunswick. A total of 14.5 t were reported landed during January and February 1996 from district 76 (Richibucto district). After March 1996, no harvests of striped bass should have occurred but an additional quarter ton was reported for June from district 66 (Acadian peninsula, Miscou area) and another quarter ton from district 77 (Bouctouche area) during October to December of 1996. No landings of striped bass were registered in the 1997 database.

Striped bass are intercepted in coastal commercial fisheries; two striped bass tags were returned from coastal nets off Escuminac in the spring of 1997.

Recreational

Recreational fishing data are not collected on a regular basis. There is no new information to report beyond that summarized in Bradford et al. (1995a) and Bradford and Chaput (1996). Recreational fisheries regulations in effect during 1997 were similar to those of 1996:

Season:	1 May to 31 October
Bag Limit:	hook and release only
Size Restriction:	no fish may be kept

First Nation Fisheries

First Nations harvest striped bass for food, social and ceremonial purposes. Harvest levels are based on communal needs. Prior to 1996, harvests were restricted to striped bass larger than 68cm TL. However, size restrictions have proven to be impractical because gillnets, a common food fishing gear, also intercept smaller sized bass which could not always be released alive. Therefore, the size restrictions were lifted for 1996 and the harvest managed on the basis of total catch.

Season:	July 1 - October 31
Harvest:	based on communal needs of individual first nations (Table 1)

Size Restriction: none

Harvests by First Nations in 1997 are summarized in Table 1.

Other losses

There were reports of striped bass mortalities in April and May, 1997 particularly from the Richibucto River area. The mortalities were reported shortly after ice-out. One bass was sent to the Fish Health Laboratory (DFO) but no bacterial pathogens were isolated. The absolute number of losses in the spring of 1997 could not be quantified.

CONSERVATION REQUIREMENTS

Data compiled on southern Gulf striped bass since 1993 indicate that production of viable year-classes depends upon spawner abundance above a minimum. The several fold increase in young-of-the-year abundance in the fall of 1995 and 1996 over previous years indicates that the striped bass population of the Miramichi benefits when spawning females number more than 5000 fish. There are insufficient data to determine the precise relationship between spawner abundance and recruitment. Protection of both spawners and potential spawners is the interim target specified in the 1993 New Brunswick Striped Bass Management Plan (Dept. of Fisheries and Oceans 1993), of which the major elements are:

- arrest the decline in abundance,
- increase abundance, and
- sustain abundance at levels correspondent to supporting habitat.

The goal of the management plan is to increase spawning escapement through reductions in fishing-induced mortality of adult and juvenile fish in commercial, recreational and aboriginal food fisheries.

ESTIMATION OF STOCK PARAMETERS

1997 Spawner Abundance

Mark-Recapture

The 1997 estimate of spawner abundance was obtained by separating the marking and recapture sites both in time and in location. Logbook data returned by gaspereau fishers in previous years (Bradford et al. 1995a) indicated that adult striped bass were available for capture in the Napan River one to two weeks before their arrival on the spawning grounds in the Northwest Miramichi. Tagging was initiated in the Napan River (Fig. 1) prior to the opening of the gaspereau fishery. Early marking was expected to provide precise, stable-with-time estimates of spawner abundance. Recaptures in the Northwest Miramichi of fish tagged in Napan River would be possible from the day of arrival of the fish in the spawning area. There would also be less need to tag continuously through the season in order to secure a sufficient pool of marked fish.

Tagging in the Napan River took place between May 22 and June 3, 1997. The trapnets, which operated continuously over this time period, were fished every 48h. The total catch of striped bass was counted, measured to length (fork length, FL; total length, TL to the nearest 0.1cm) and scale sampled for aging. Fish ≥35 cm TL were tagged with individually numbered, yellow T-bar tags (length 3.2 cm) inserted between the first two spines of the anterior dorsal fin, and then released. Recaptured fish carrying current year tags were noted and the fish released. Fish carrying tags applied in previous years were noted and added to the marked pool for 1997.

The recapture phase of the experiment began with the first day of commercial gaspereau fishing on the Northwest Miramichi River (20 May) with traps located on this river used as recapture sites for tags applied to striped bass in the Napan River. A total of 13 traps are fished within this section of the river, but not all are necessarily fished every day. The gaspereau fishery was extremely poor in the Northwest Miramichi in 1997 and fishers did not start fishing their traps intensively until June 4. Therefore, the total number of traps operated on any given day of sampling was also recorded. As many traps as possible (one to eleven in 1997) were visited daily during the fishing season (May 20 to June 20). The total catch of striped bass was counted, measured to length and scale sampled for later aging. Marked fish recaptured when the sampler was present were released after first recording the tag number and date of capture. Fishers whose traps were not sampled kept recaptured tags separated for each day fished. For the purposes of the mark-recapture experiment these tags were subtracted from the total pool of tags available for recapture in subsequent days.

A Bayes estimator (Gazey and Staley 1986) was used to calculate total returns of striped bass ≥35cm TL, both sequentially for each day of fishing and as a single census estimate for the season. Tag loss was assumed to be negligible over the duration of the experiment. The reporting rate for recaptures from the gaspereau fishery was assumed to be 100% (daily contact with fishers in the NW Miramichi). Estimates of marked fish available per day were corrected for removals reported from the previous day of fishing.

The day for termination of the recapture phase of the experiment was defined on the basis of change with time in 1) the catch rate, 2) the reproductive state of intercepted fish, and 3) the cumulative recapture profiles on the NW Miramichiof striped bass tagged in Napan River. Inspection of the cumulative recapture profiles suggested that spawning fish were in the NW Miramichi up to June 10 but left the area after that time. Direct observations of spent females indicated that a major spawning event occurred between June 1 and 3. The total cumulative exploitation rate of three tag groups (Napan River, June 4,and June 6) were in the range of 13.5% to 15.1% over the duration of the gaspereau fishery, values similar to those estimated for 1995 and 1996.

Indices of Abundance - CPUE

Stratified mean catch of striped bass ($fish \cdot trap^{-1} \cdot day^{-1}$) was calculated following Cochran (1977) and as detailed in Bradford and Chaput (1996). These data provide an index of year-to-year change in average catch during the gaspereau fishery in the Northwest Miramichi; i.e., the catch of mature, spawning and spent fish and therefore is not necessarily a precise measure of spawner abundance. Geometric mean CPUE and median CPUE for 1993 to 1997 were also calculated as additional indicators of change in abundance among years.

Bycatch of striped bass, by either size or age group, in the gaspereau and open-water smelt fisheries was standardized to catch per effort units of number of $fish \cdot net^{-1} \cdot 24h^{-1}$. 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 1 January. With this convention, all fish showing 2 annuli or less on the scales

and sampled before 15 May were considered to be juveniles. All fish with more than two annuli and sampled before 15 May are considered adults. The minimum observed age at first maturity has been two years, but greater than 99% of all mature fish have been three years of age or older (Bradford et al. 1995a).

Spawner Success

In 1996 and 1997, smelt fishers operating in the vicinity of Loggieville (Fig. 1) were visited twice weekly between 22 October and 5 December. During each visit striped bass were sorted from two smelt nets, usually a shallow set (depth <5m) and a deep set (depth >5m). Generally, one crate of catch (about 58 kg all species) was sampled from each net. The total number of bass in the net was obtained by scaling the number of bass from the sampled crate to the total number of crates of catch from the net. Striped bass less than 18cm FL were considered to be young-of-the-year (age-0) and their count was used to estimate spawner success in 1997. In addition, bass from the sampled nets were sampled for fork length. A length frequency distribution of the young-of-the-year was obtained from the sampled length frequency of each crate weighted by the total crates of catch in the net.

ASSESSMENT RESULTS

Spawner Abundance Estimates

Based on the sequential Bayesian estimates of population size, it appears that the 1997 spawner abundance in the Northwest Miramichi was initially about 8000 fish on June 4 and decreased to 5000 fish by June 6 and 2500 fish by June 10 (Fig. 2). The abundance index (catch per unit of effort, CPUE) varied from a high of 13.6 (average) on June 4 to 1.0 by June 17 (Fig. 3). Mature and spent females were observed on mostly June 4 and June 6 and none were observed beyond June 10. The sequential estimate of 9,400 fish obtained on 10 June was close to the June 20 (end of season estimate) of 8000 spawners (Table 2;Fig. 2).

Trends in Spawner Abundance

The approximately 8000 spawners in the Northwest Miramichi in 1997 was similar to that of 1996 and indicates a continued decline in the 1991 to 1993 year-classes and a weak contribution of the 1994 year class. Spawner abundance in the last two years represents a precipitous decline from 1995 levels of 50,000 fish.

There were estimated to have been about 5500 males and 2500 females on the spawning grounds in 1997. Female abundance declined by 50% from 1996 (Table 3). Identifiable males (ripe and running) comprised 69% of the sampled catch in 1997. Most of these were of the 1994 year-class.

Unregulated and directed commercial fishing up to March 1996 appears to have been the principal contributing factor to the reduction of spawner abundance during 1995 to 1996. Landings within the Miramichi system alone during 1995 were estimated at about 12,300 fish (Table 3). A further 18,800 (17.3 t at 0.92kg per fish; Bradford and Chaput 1996) were reported as landed and sold in districts other than those of the Miramichi River (Bradford and Chaput 1996). Total removals of spawners between May 1995 and May 1996 in the southern Gulf of St. Lawrence were therefore, in excess of 40,000 fish, 80% of the 1995 spawning stock.

Year-Class Composition and Sex Ratio

The 1997 female spawning population was again dominated by the 1991 year-class (Fig. 4; length range 50-65cm) as has been the case since 1994. The contribution of the 1992 year-class was lower than anticipated given that in 1995, age 3 male fish of this year-class were well represented in the spawner population (Fig. 4). The 1993 year class, as forecast in the 1995 and 1996 assessments, was virtually absent from the gaspereau catches (Fig. 4). The 1994 year-class recruited as males (35 to 40 cm group) but the abundance of these fish was low compared to previous years. The 1995 year class is virtually absent from the spawning area: this was supposed to be a strong year-class given the high abundance of the young-of-the-year.

Spawner Success

The median CPUE of young-of-the-year (age-0) striped bass in the 1997 open-water smelt fishery of the Miramichi was 10 fish, a level similar to 1991, 1993 and 1994 but only 2% of the 1996 level (Table 4; Fig. 5). The low abundance of age-0 bass in 1997 corresponds to an estimated female abundance of 2500 spawners, a level similar to the estimated abundance in 1994. The high abundance of age-0 bass in 1995 and 1996 was consistent with the high abundance of female bass in the spawning population of the Northwest Miramichi (Table 3).

Juvenile Mortality

Striped bass which enter their first winter at a fork length ≤10cm are less likely to survive the winter than those which are > 10cm (Bernier 1996, Bradford and Chaput 1997). The variability among years in the average pre-winter lengths of young bass combined with differences in spawner success will profoundly affect the recruitment to the spawning population. For example, the 1991 year-class which currently supports most of the egg production on the Miramichi was large bodied entering their first winter (13 cm on average) (Fig. 6). In 1993 the young-of-the-year were smaller on average (10cm fork length) and survivorship was only about 50% (Bernier 1996). This year-class will fail to contribute in any substantive way to spawner production for this population; i.e., a year-class failure has occurred.

Similarly, the lower than anticipated recruitment of the 1992 year-class in 1996 can be attributed in part to relatively poor spawner success (Table 4, Fig. 5), poor age 0 growth (Fig. 6) and subsequent poor first-winter survival.

The age-0 striped bass sampled from the openwater smelt fishery in 1997 were also small bodied relative to the 1991 and 1995 year classes (Fig. 6). The small size of these fish in addition to their relatively low abundance suggests that this will not be an important year-class in the coming years.

FORECAST/PROSPECTS

The 1990 categorization (Chaput and Randall 1990) of the stock as reduced or declining remains appropriate. There are no indications that females of the 1992 and 1993 year-classes will contribute substantively to the spawning in 1998 and therefore, egg production will continue to depend on spawners of the 1991 year-class. There are estimated to be no more than a few thousand fish of the 1991 year-class although most are probably females.

Female abundance is unlikely to increase in 1998 as a consequence of pressures exerted on the population. Mortality can be expected to have occurred as a consequence of natural factors, poaching, removals in native food fisheries as well as the hook and release angling fishery. The 1995 year- class was essentially absent in 1997; these pre-spawner recruits from other year classes were observed in previous years. The optimistic outlook for strong recruitment in 1998 and 1999 must now be tempered by the possibility that the 1995 year class has suffered an exceptionally high level of natural mortality at an age not previously observed for this population.

The 1995 recommendation (Bradford and Chaput 1996) that a future change in the status of southern Gulf striped bass be based on increases in both spawner abundance and spawner success remains valid. However, and as shown in this document, spawner success may not directly translate into recruitment to the spawning stock. Winter survival, during the first and, now apparently, the second years, appears to be an important determining factor of year-class strength and must be integrated into the assessment of stock status.

The prospects for a recovery of this resource in the short term are poor. A spawning population of at least 50,000 fish (i.e., the maximum observed to date) in which both males and females are well represented is unlikely either in 1998 or 1999. The abundance of the previously expected strong 1995 year-class in the spring 1998 Northwest Miramichi gaspereau fishery will provide the more reliable indication of whether or not recovery of this population in 1999 to 2000 remains a realistic expectation.

ECOLOGICAL CONSIDERATIONS

The conservation status of striped bass in the southern Gulf of St. Lawrence is based on the assumption that there is one spawning location (population), the Northwest Miramichi. Under this assumption, harvesting of striped bass throughout the southern Gulf of St. Lawrence, from Percé (Quebec) to western Cape Breton Island impacts on the spawning stock. If there are other, presumably smaller, spawning populations in the southern Gulf, fisheries in those estuaries may be exploiting these at excessive levels. There exists within some communities a conviction that the striped bass within their river do not originate from the Miramichi. These convictions are based on the presence of juveniles in the fall, the presence of adult bass under the ice in the winter and in the spring and anecdotal reports of striped bass spawning activity (ex. Tabusintac River, Richibucto River, Kouchibouguac River). In 1996 and 1997, there was no evidence of striped bass eggs and larvae in the Kouchibouguac River and the Richibucto River (Mike Robinson, UNB, personal communication). Striped bass juveniles observed in late summer in these estuaries are believed to have emigrated from the Miramichi as evidenced by the presence of these juveniles along the coast from the Miramichi to the Richibucto (Mike Robinson, UNB, personal communication). The studies and data to date are insufficient to establish the Miramichi as the only spawning estuary of striped bass. Tagging of adult bass which can provide evidence of homing to a river and of temporal spawning site fidelity are the only reliable method of determining the existence of an established and sustained spawning population in the absence of manifest genetic discreteness. This

evidence exists for the Miramichi based on the sequential year recoveries of bass tagged in the Miramichi at spawning time and of bass tagged in numerous rivers in the southern Gulf and recovered on the spawning grounds in spawning condition in the Miramichi (Bradford and Chaput 1997; Bradford and Chaput 1998).

Striped bass overwinter in the brackish waters of estuaries and are vulnerable to human activities. Their vulnerability is evident in the very lucrative hoop-net fisheries which operated historically throughout the southern Gulf and the large landings reported during the winter months, even in recent years. Under the current management program, fisheries exploitation during the winter should have been eliminated. The impact of other human activities has received little attention. In particular, point source discharges into the estuary of the Miramichi occur in proximity to the expected striped bass overwintering area in the Northwest Miramichi. There are three major discharge sources in the immediate area of striped bass spawning and overwintering habitat: REPAP Kraft Mill (Newcastle), Groundwood Mill in Nelson-Miramichi, and the Miramichi City sewage treatment facility (1998 operation). Other than the study conducted by Bradford et al. (1998), there is no information on striped bass distribution and habitat characteristics during the winter.

MANAGEMENT CONSIDERATIONS

The abundance of female spawners is at risk of a continued decline in 1998. Measures to deter poaching and to further reduce and eliminate fisheries-induced mortality are to be encouraged. Conscientious angling practices (hook and release techniques) should be promoted throughout the southern Gulf of St. Lawrence. Current status of stocks information should be communicated to all parties (First Nations, commercial fishers, recreational fisheries) for improved collaboration towards effective conservation measures.

There is no doubt that excessive fisheries exploitation of striped bass has contributed to the boom-bust oscillations of striped bass abundance in the southern Gulf of St. Lawrence. During 1995 and 1996, fisheries succeeded in removing as much as 80% of the spawning stock. This level of exploitation greatly exceeds any established reference points for striped bass management. The target fishing mortality of striped bass in the eastern United States has been set at $F = 0.31$ (annual removal of 27% of the stock) and the threshold $F = 0.40$ (annual removal of 33%) (SARC 1998).

RESEARCH RECOMMENDATIONS FOR 1998

Repeat Miramichi Sampling, Mark-Recapture Experiments: May-June

Objectives:
1) establish baseline spawner abundance for regulation and development of recreational fishery and for development of conservation requirements,
2) confirm the hypothesis of a year-class failure in 1992 and 1993 and evaluate the strength of the 1995 year-class,
3) extend migration/stock structure studies to 1998 by undertaking tagging programs in other estuaries, particularly the Richibucto and Kouchibouguac which have well developed gaspereau fisheries to serve as a platform for conducting the research. The model of the Miramichi would serve as a template. A

properly designed tagging program would address whether there is homing and site fidelity of bass to rivers other than the Miramichi and at the same time provide a population estimate in those estuaries.

Sample Miramichi Smelt Bycatch: October-December, 1998
Objectives:
1) continue the assessment of striped bass spawning success in the Miramichi in 1998 given the expectation that female abundance has declined since June 1996
2) assess the relationship between pre-winter abundance, pre-winter body size and post-winter survival.

Size-dependent Winter Survival
Objectives:
1) Extend the back-calculation analysis to the 1994 to 1997 year-classes to determine if size-selective mortality contributed to the apparently low survival of the 1995 year class.

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Table 1. First Nations harvest agreement levels and reported harvests of striped bass for 1997.

First Nation	Agreement Allocation	Reported Harvest in 1997
Burnt Church[1] (Tabusintac River and Miramichi Bay)	40[2]	NA
Eel Ground (Northwest Miramichi)	150	
Red Bank (Northwest Miramichi)	100	
Indian Island (Richibucto River)	500	
Big Cove[1] (Richibucto River)		NA
Buctouche (Buctouche River)	172	
Millbrook (River Philip, NS)		

[1] No agreement in 1997
[2] 1996 agreement level

Table 2. Summary of sequential and single census spawner population size estimates for 1994 to 1997. The mode and 95% confidence intervals are also shown.

				Number of Spawners		
Year	**Duration**	**Model**	**Marks**	**Mode**	**95% Confidence Interval**	
1994	1 June - 12 June	Single	430	27775	21475	40550
		Sequential	485	29000	23000	47000
1995	1 June - 9 June	Single	275	47800	31000	138100
		Sequential	289	50000	35000	175000
1996	29 May - 10 June	Single	417	8050	6150	12000
		Sequential	452	8090	6275	13370
1997	4 June - 10 June	Sequential	177[1]	9400	6400	25000
			156[2]	4300	2950	11050
			139[3]	2900	1900	9600
	4 June - 20 June	Sequential	177[1]	7900	5800	17500
			156[2]	4900	3400	11200
			139[3]	2500	1800	5900

[1] Napan River tag group
[2] June 4 Northwest tag group
[3] June 6 Northwest tag group

Table 3. Summary of catch statistics and spawner abundance for 1993 to 1997.

Year	1993	1994	1995	1996	1997
CATCH DATA					
Stratum (Days)	16	19	20	18	12
Traps per Stratum	13	13	13	13	13
Traps Sampled	46	50	64	72	60
Total Trap Days	208	247	260	212	247
Stratified Mean Catch/Trap/Day	3.58	68.69	36.83	8.85	4.86
POPULATION ESTIMATES (BAYESIAN)	**1993**	**1994**	**1995**	**1996**	**1997**
All Spawners					
Estimated Number of Spawners (mode)	5500	29000	50000	8090	8000
0.025 quantile	4550	23000	35000	6275	5800
0.975 quantile	7300	47000	175000	13370	17500
By Sex					
Proportion (Mature Males)	0.94	0.92	0.63	0.37	0.69
Mature Males	5170	26680	31500	2993	5500
Mature Females (maximum)	330	2320	18500	5097	2500
INTERCEPTION / EXPLOITATION	**1993**	**1994**	**1995**	**1996**	**1997**
Northwest Miramichi					
Number of Intercepted Spawners	745	16966	9576	1876	1200
Number of Spawners Removed (n)	51	4513	9576	19	
Biomass of Spawners Removed (t)	<0.1	1.8	8.8	<0.1	
Other than Northwest Miramichi					
Number of Spawners Removed (n)	65	5808	12324	16400	
Biomass of Spawners Removed (t)	<0.1	2.3	11.3	15.0[1]	

[1] In 1996, 14.5 t of the reported 15.0 t were removed during January and February 1996 in district 76, prior to the spawner estimate of May/June 1996.

Table 4. Summary of abundance indices expressed as the catch of fish per net per day of fishing effort (median, 5th to 95th percentiles) 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.

	Median	5th ; 95th percentiles	Median	5th ; 95th percentiles	Sample size
Abundance indices from the open-water smelt fishery (downstream traps only)					
	Age-0		Age-1		
1991	18	[15 ; 227]	0	[0 ; 3]	3
1992	50	[0 ; 191]	0	[0 ; 0]	16
1993	17	[2 ; 62]	0.1	[0 ; 18]	8
1994	7	[2 ; 21]	0	[0 ; 0]	10
1995	255	[132 ; 671]	0	[0 ; 0]	11
1996	452	[159 ; 2964]	NS		11
1997	10	[1 ; 59]	NS		22
Abundance indices from the gaspereau fishery in the Northwest Miramichi (stratified mean and standard deviation)					
	Age-2		Spawners		
1991	0.02		1.5		23
1992					NS
1993	5.6	0.3	3.6	0.25	46
1994	8.0	3.2	68.7	17.4	50
1995	0.3	0.01	36.8	5.0	64
1996	5.8	0.5	8.8	0.6	72
1997	0.3	0.7	4.9	5.8	60

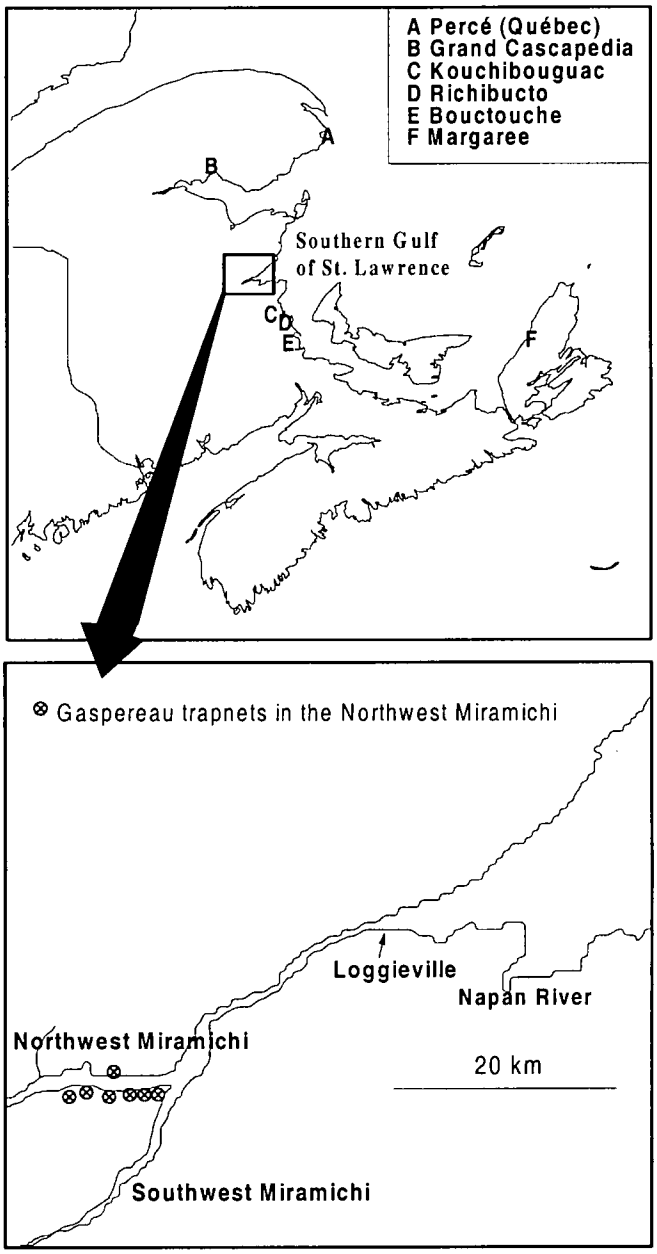


Figure 1. Place names and locations sampled for assessing the status of the striped bass stock of the southern Gulf of St. Lawrence.

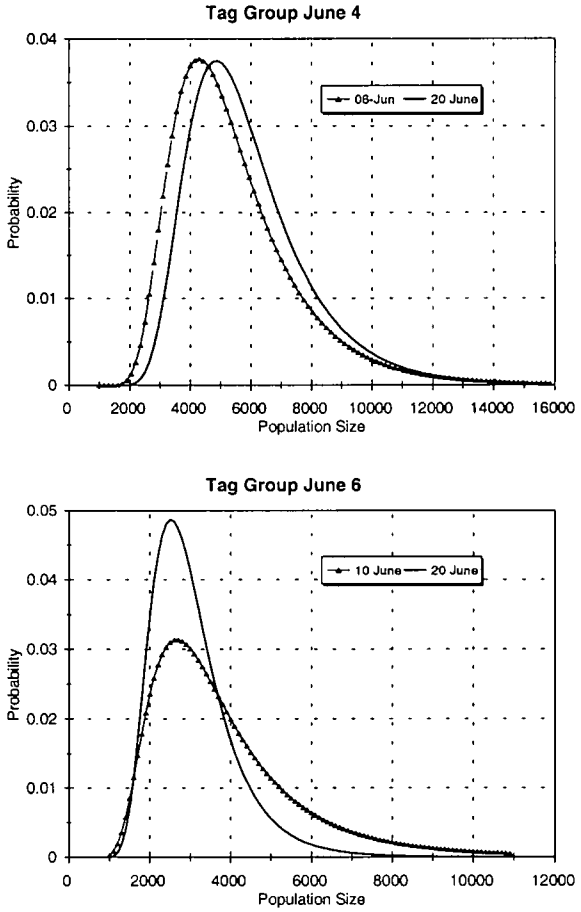
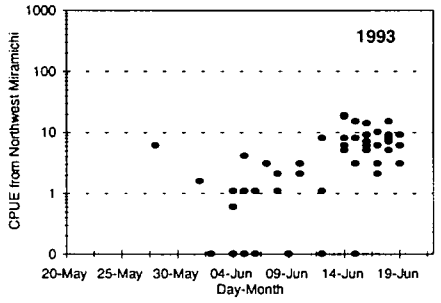
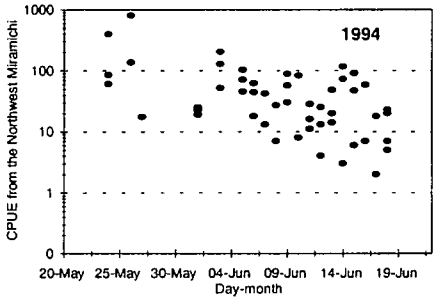
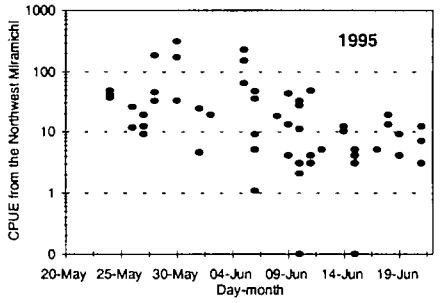


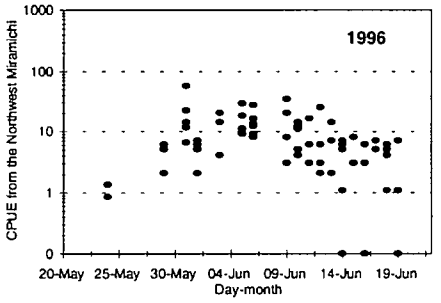
Figure 2. Multiple census Bayesian population estimates of striped bass spawners in the Northwest Miramichi in 1997. The upper panel refers to the group of bass tagged in Napan River during May 22 to June 3 (M = 177). The middle panel refers to the group of bass tagged in the Northwest Miramichi on June 4 (M = 156), and the bottom panel refers to the group of bass tagged in the Northwest Miramichi on June 6. The two lines define the population estimates for the two recovery period durations: June 10, and the end of the season (June 20).



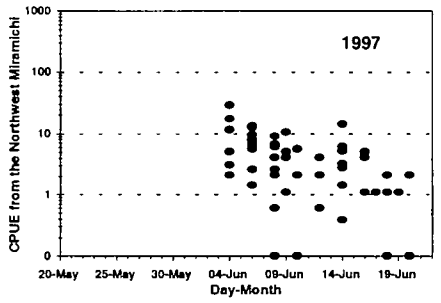


Stratified mean	3.5	68.7
Geometric mean	0.5	30.3
Median	3.0	27.5
Obs. without bass	11 of 56	0 of 50





Stratified mean	36.8	8.8
Geometric mean	11.7	4.0
Median	12.0	6.0
Obs. without bass	2 of 56	3 of 71



Stratified mean	4.9
Geometric mean	0.3
Median	2.8
Obs. without bass	7 of 60

Figure 3. Catch per unit of effort (bass per trapnet per 24 hr period) of striped bass greater than 35 cm fork length from the Northwest Miramichi gaspereau fishery, 1993 to 1997. Individual points may represent several observations.

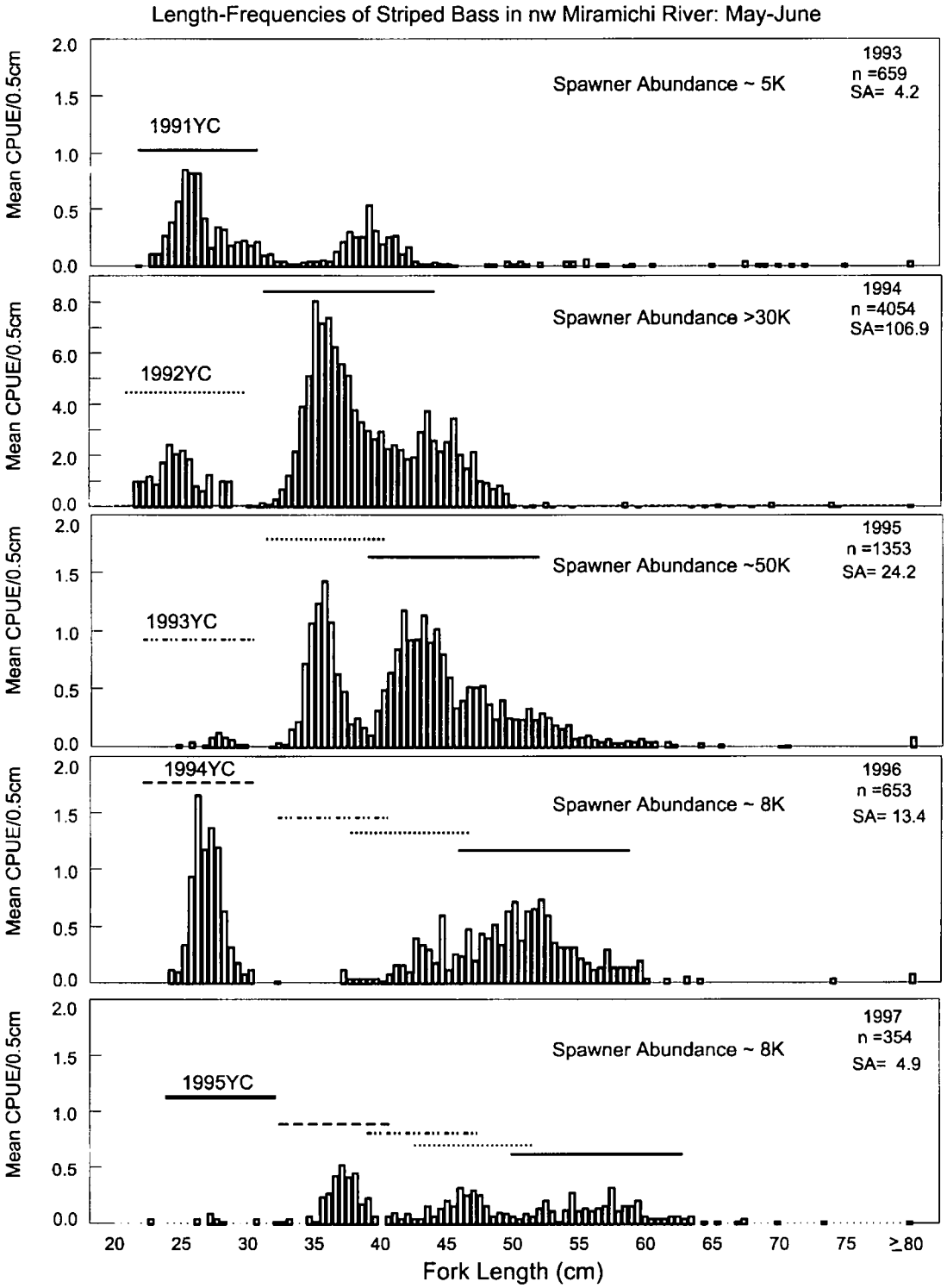


Figure 4. Length frequencies expressed as the mean catch per unit of effort (CPUE per half cm length group) of striped bass from the gaspereau fishery of the Northwest Miramichi during May and June 1993 to 1997. Numbers expressed in bold italics represent the size range of the year-classes in the population.

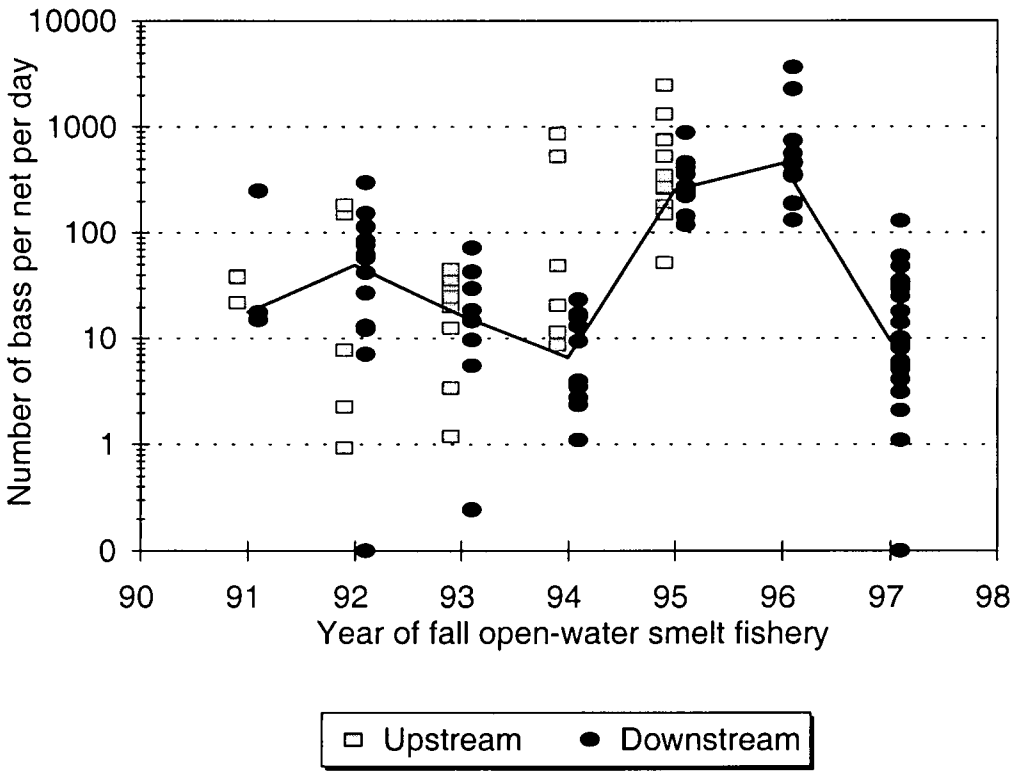


Figure 5. Catch per unit effort (fish per net per 24 hr period) of striped bass in the open water smelt fishery of the Miramichi River at upstream (Chatham) and downstream (Loggieville) locations, 1991 to 1997. Solid line is the median value at the downstream sampling location. Individual points may represent several observations.

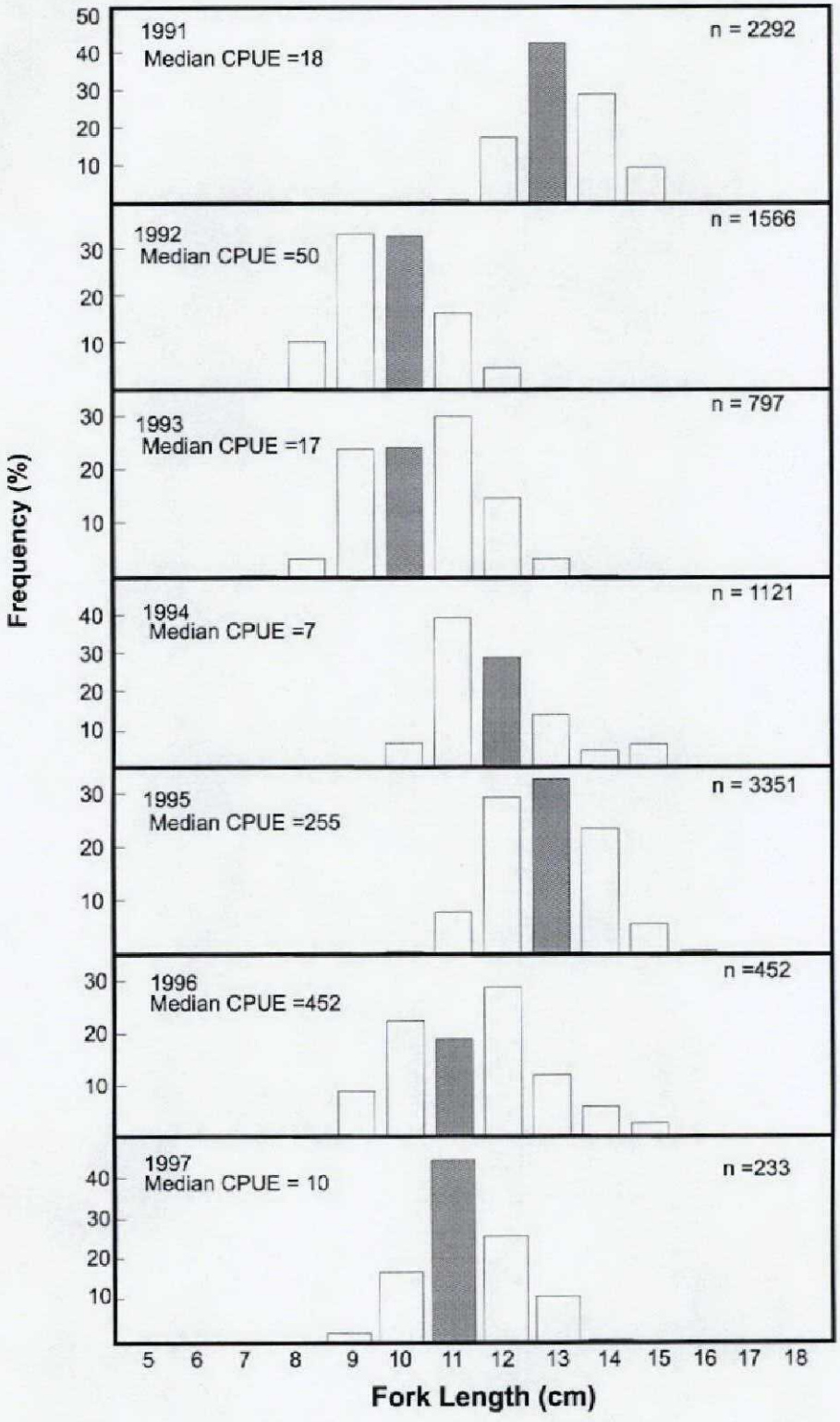


Figure 6. Length frequency distributions of age-0 striped bass sampled from the fall smelt fishery (October and November) in the Miramichi estuary. The median length interval is shown as the shaded bar.

Appendix 1. Record of Science consultation for striped bass for 1997.

1. SPECIES / STOCK:
• Striped bass Miramichi River/Southern Gulf of St. Lawrence
2. ARRANGEMENTS: DATE: March 2, 1998 TIME: 10:00 to 14:00 LOCATION: Kouchibouguac National Park, Kouchibouguac, New Brunswick
3. FORM OF CONSULTATION (Science Workshop, ZMAC, ETC..)
• Science Workshop
4. PARTICIPANTS (Name and Affiliation)
• Normand Allain, Gaspereau fisher (Northwest Miramichi), Richibouctou Village, NB • Robert Allain, DFO, Area Manager, Tracadie-Sheila, NB • Gerald Beck, Richibucto Sustainable Development, Richibucto, NB • Gerald Chaput, DFO Science, Moncton, N.B. • Harry Collins, MREAC, Chatham, N.B. • Rona Cormier, Gaspereau fisher, Pointe-Sapin, NB • Simon Courtenay, DFO Science, Moncton, NB • Brian Donovan, Angler, Miramichi, N.B. • Bernard L. Dubee, DNRE, Miramichi, N.B. • David Dunn, DFO Fisheries Management, Moncton, N.B. • Glen Ferguson, DFO, Tracadie-Sheila, NB • John Hayward, DFO Science, Miramichi, N.B. • Léophane LeBlanc, Kouchibouguac National Park, Kouchibouguac, N.B. • Eugène Richard, Gaspereau fisher (Northwest Miramichi), Richibouctou Village, NB • Mike Robinson (MSc Student), University of New Brunswick, Fredericton, NB • Eric Tremblay, Park Ecologist, Kouchibouguac National Park, Kouchibouguac, NB • Kevin Walker, Beaver Enterprises, Miramichi, NB • France Vautour, Fisher, St. Louis, NB • Chris Ward, Eel Ground Fisheries, Eel Ground, NB • James P. Ward, North Shore Micmac Development Corporation, Eel Ground, NB • Fred Wheaton, New Brunswick Wildlife Federation, Moncton, N.B.
5. NEW INFORMATION BROUGHT FORWARD (what? by who?)-*(Only a brief description is required)*
• egg and larval survey in Kouchibouguac did not find bass in 1996 but juveniles were seined in late summer (L. LeBlanc, Kouchibouguac Park) • eggs and larvae not found in Kouchibouguac Park but juveniles observed in late summer as in 1996 (Mike Robinson, UNB) • eggs and larvae not found in the Richibucto River in 1997 but juveniles observed in August. Sampling along the coast from Miramichi to Richibucto found young-of-the-year bass distributed along the coast suggesting that juveniles observed in Kouchibouguac River and Richibucto River probably originated from the Miramichi river (Mike Robinson, UNB). • overwinter study conducted by telemetry in Kouchibouguac Park indicated that winter habitat for bass was restricted to a small portion of the estuary under specific brackish water conditions (E. Tremblay, Kouchibouguac National Park) • summary of mercury content study in musculature of striped bass which indicated that bass greater than 45 cm fork length may or may not have mercury levels which exceed Health Canada guidelines (Harry Collins, MREAC)

6. CONCERNS RAISED BY CLIENTS (include concerns, plus follow-up action/response made or committed). -
• **frustration expressed by MREAC and the New Brunswick Wildlife Federation at the lack of support from the Environmental Trust Fund, NB Wildlife Trust, Environment Canada Science Linkages in supporting proposed studies regarding overwinter habitat requirements of bass and potential impact of human activities on this habitat.** • **proposal to establish a striped bass working group to focus the issues of striped bass conservation and promote the dissemination of issues, research being conducted and establish priorities. (E. Tremblay and G. Chaput to follow-up on terms of reference and organization)**
7. RECOMMENDATIONS: (*Only a brief description is required)*
a.) **Pertaining to Assessment**
• **The use of gaspereau traps in the Northwest Miramichi to estimate spawner abundance may be compromised by variations in season openings and effort. The use of alternate sources of data such as the Eel Ground food fishery trapnets should be considered to provide a more consistent measure of abundance (based on catch per unit of effort)**
b.) **Pertaining to next year's workplans**
• **continue estimation of spawner abundance and YOY index in openwater fishery to determine the extended contribution of the 1991 year-class** • **with the collaboration of user-groups in other estuaries (Richibucto, Kouchibouguac) assess through tagging and monitoring of spawners in the spring whether spawning does occur and in a consistent manner in estuaries other than the Miramichi**

Gérald Chaput
NAME OF PRESENTOR

Gérald Chaput
NAME OF RAPPORTEUR