The Community Aquatic Monitoring Program (CAMP) for Measuring Marine Environmental Health in Coastal Waters of the southern Gulf of St. Lawrence: 2007 Overview

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2009

Canadian Technical Report of
Fisheries and Aquatic Sciences 2825

Fisheries and Oceans Canada Pêches et Océans Canada

Canada

Canadian Technical Report of Fisheries and Aquatic Sciences

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by

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Cat. No. Fs. 97-6/2825 ISSN 0706-6457

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Correct citation for this publication:

Weldon, J., Courtenay, S. and Garbary, D. 2008. The Community Aquatic Monitoring Program (CAMP) for measuring Marine Environmental Health in Coastal Waters of the southern Gulf of St. Lawrence: 2007 Overview. Can. Tech. Rep. Fish. Aquat. Sci. 2825: viii + 75 p.

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ABSTRACT

In 2003, the Department of Fisheries and Oceans (DFO) Gulf Region initiated the development of a monitoring program called the Community Aquatic Monitoring Program (CAMP). One of the program goals was to help determine the ecological health of estuaries and coastal shorelines in the southern Gulf of St. Lawrence (sGSL). The primary goal of CAMP continues to provide an outreach program for DFO to interact with community environmental groups. The monitoring portion of CAMP is being used to test the hypothesis that a relationship exists between the health of an estuary or coastal shoreline and the diversity and abundance of finfish and crustacean species which inhabit the intertidal and near shore zone. CAMP expanded the number of locations from 4 in its 2003 pilot year (Thériault et al. 2006) to 24 throughout the Maritime Provinces of Nova Scotia (NS), New Brunswick (NB) and Prince Edward Island (PEI) in 2004. Baseline sites, meaning sites at which 6 stations were sampled by day-time beach seining once a month from May to September inclusive numbered 13 in 2004. In 2005, the number of locations totalled 22 of which 20 were considered as baseline (Weldon et al. 2007). In 2006, there were 22 locations participating and 18 were able to collect data for the five full months. In 2007, the number of baseline sites increased to 25, 24 of which maintained baseline status. NGOs in each watershed adhered to the same sampling methodology and related protocols as outlined in Weldon et al. (2005). All species of finfish, crab and shrimp collected were identified, separated into adults and young of the year, enumerated and released. Habitat was also characterized by collecting information such as water temperature, salinity, dissolved oxygen, % plant cover and algae cover and, once a year in September, collection of a substrate sample for measurement of grain size distribution, % moisture content and % organic content. Two water samples were collected at each station at all locations all 5 months then sent away for analysis of nutrient content. This report summarizes baseline physical and biological data for the estuaries sampled in 2007. This year more almost six hundred thousand (597295) animals were processed and 37 different species were identified. In order to test the hypothesis that these data reflect environmental quality, we are getting close to the several years of data required to detect temporal and spatial patterns that may exist.

RÉSUMÉ

En 2003, le Ministère des Pêches et Océans (MPO) de la Région du Golfe a mis au point un programme de surveillance intitulé Programme de surveillance de la communauté aquatique (PSCA) afin d'évaluer la santé écologique des estuaires et des zones du littoral du sud du golfe du Saint-Laurent (sGSL). L'objectif primaire du PSCA continu toujours d'offrir un programme d'extension permettant au MPO d'interagir avec les groupes environnementaux des collectivités. L'aspect de surveillance issu de ce partenariat vise à mettre à l'essai l'hypothèse qu'une relation existe entre la santé d'un estuaire ou d'une zone côtière et la diversité et l'abondance de poissons et de crustacés qui se trouvent dans la zone côtière. Le PSCA est passé de 4 emplacements lors de l'année du projet pilote (Thériault et al. 2006) à 18 répartis partout dans les provinces Maritimes, soit la Nouvelle-Écosse (N.-É.), le Nouveau-Brunswick (N.-B.) et l'Île-du-Prince-Édouard (Î.-P.-É.) en 2004. Les emplacements principaux, soit les emplacements où on a effectué des prélèvements mensuels diurnes dans six stations, à l'aide de seines de plage, de mai à septembre, s'élevaient à 13 en 2004. En 2005, le nombre d'emplacements atteignait 22, dont 20 emplacements principaux. En 2006, 22 sites ont été échantillonnés dont 18 d'entres eux ont été échantillonnés de mai à septembre. Chaque groupe environnemental communautaire a utilisé la même méthode d'échantillonnage et les protocoles connexes décrits par Weldon et al. (2005). Les individus de chaque espèce de poissons, de crabes et de crevettes capturés à l'aide d'une seine de plage ont été énumérés, identifiés, triés selon l'âge (jeunes de l'année et adultes) puis remis à l'eau. De plus, des données sur l'habitat de ces espèces ont été recueillies telles que la température de l'eau, la salinité, la teneur en oxygène dissous et le pourcentage de recouvrement par les plantes et les algues une fois par mois. De plus, la distribution de taille des grains, le % de la teneur en eau et de la teneur en matières organiques du substrat ont été recueillies une fois par an, soit en septembre. Deux échantillons d'eaux ont également été collectés à chaque station et analysés pour déterminer le contenu en nutriment (nitrate, nitrite, ammoniac, phosphate et silicate). Le présent rapport résume les données physiques et biologiques des emplacements principaux des estuaires étudiés en 2006. Cette année, un peu moins de quatre cents milles animaux ont été comptés et 37 différentes espèces ont été identifiées. Pour pouvoir vérifier l'hypothèse selon laquelle ces données reflètent la qualité de l'environnement estuarien, plusieurs années de données devront être étudiées afin de détecter les tendances temporelles et spatiales qui pourraient exister. On espère que le programme s'avèrera une méthode simple de caractérisation de la santé estuarienne qui sera à la fois utile et facile à appliquer pour les groupes communautaires.

1.0 INTRODUCTION

1.1 Background

In the Canada Oceans Strategy document (COS, 2002), Fisheries and Oceans Canada (DFO) established its commitment to work collaboratively with local stakeholders to "*establish marine environmental quality guidelines, objectives and criteria respecting estuaries, coastal waters and marine waters.*" During 2003 and 2004, the Stewardship and Aquatic Ecosystem Sections of DFO Gulf Region integrated their planning priorities to develop a practical monitoring program that would assist in determining the ecological health of estuaries in the southern Gulf of St. Lawrence (sGSL) as outlined in Canada's Stewardship Agenda (2003). The outcome was the development of the Community Aquatic Monitoring Program (CAMP) outlined in detail in the first report (Weldon et al. 2005). One of the aims of the program is to determine if a relationship exists between the health of an estuary and/or a coastal shoreline and the diversity and abundance of conspicuous crustaceans and fish species which utilize this ecosystem. This concern over animal abundance is highlighted by a regional concern over the decline in eelgrass populations (Hansen 2004) and the dependency of many of the estuarine animals on eelgrass as a primary habitat. One hypothesis being tested by CAMP is that an estuary which has been degraded by human activity may have fewer species and different abundance of individuals than a healthy, undisturbed estuary.

Methods and protocols to implement the CAMP approach were chosen after reviewing a wide variety of methods for evaluating estuarine health and population dynamics (Karr 1981, Methven et al. 2001, Whitfield and Elliot 2002). Standardized methodology continues to be followed in 2007 (see Weldon et al. 2005). This report will provide an overview of the CAMP results in 2007 and very briefly discuss some of the similarities and differences with outcomes of the 2004 - 2006 field seasons. A subsequent report will provide a more in-depth comparison of five years (2004-2008) of CAMP data.

1.2 Where has CAMP taken place?

CAMP is a long term monitoring program used to determine the ecological health of estuaries and coastal shorelines in the sGSL region. To become a baseline location, an estuary or coastal shoreline would be sampled monthly during the spring and summer months (May - September) (5 times) at 6 chosen stations. Total baseline locations for the 2004 was 13, followed by an increase to 20 in 2005, then a decrease to 18 in 2006 (due to decreased capacity of some groups to complete full baseline) and additional expansion to 24 in 2007. Changes in 2007 included Cocagne becoming full baseline again and Shediac River being added in New Brunswick. Pugwash and River Philip each became full baseline locations in Nova Scotia. Summerside was added as a new baseline in Prince Edward Island and the 3 locations in southeast PEI (Montague - Brudenell R.; Murray R.; Pinette R.) returned to full baseline status.

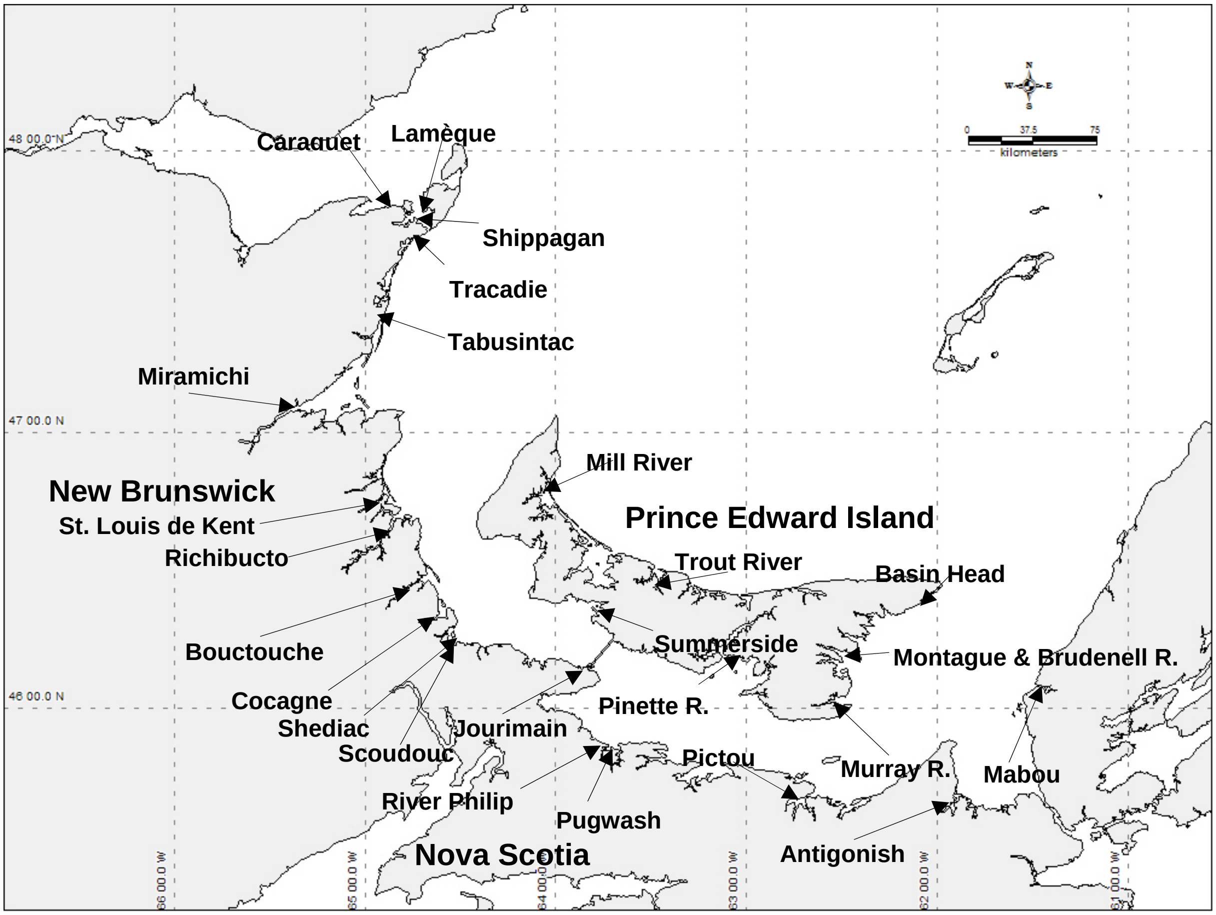


Figure 1. 2007 CAMP baseline monitoring locations for NB, NS and PEI. Each arrow shows the location of a baseline sampling estuary that includes six sample stations.

The CAMP program continues to involve several partnerships including DFO Oceans and Habitat and Environmental Science Divisions, DFO Area offices, Universities, various environmental organizations and local estuary community watershed groups, all based throughout the Gulf Region.

The groups who participated in 2007 include:

New Brunswick

- Partenariat pour la gestion intégrée du bassin versant de la baie de **Caraquet**
- Coalition pour la viabilité de l'environnement des havres de Shippagan et les Îles Miscou et Lamèque (**Lamèque and Shippagan**)
- L'association des bassins versants de la Grande et Petite rivière **Tracadie**
- **Tabusintac** Watershed Association
- **Miramichi** River Environmental Assessment Committee
- Friends of the Kouchibouguacis River (**St. Louis de Kent**)
- Elsipogtog First Nation Fisheries Management (**Richibucto**)

- Southeastern Anglers Association (**Bouctouche**)
- Pays de **Cocagne** Sustainable Development Group
- Shediac Bay Watershed Association (**Shediac and Scoudouc**)
- **Cape Jourimain** Nature Centre

Prince Edward Island

- **Mill River** Watershed Improvement Committee
- **Trout River** Environmental Committee
- **Basin Head** Lagoon Ecosystem Conservation Committee
- Southeast Environmental Association (**Pinette, Montague-Brudenell, Murray**)
- Montague Watershed Improvement Committee
- Bedeque Bay Environmental Management Committee (**Summerside**)
- Students from the University of Prince Edward Island Biology Department

Nova Scotia

- Friends of the **Pugwash** Estuary
- Cumberland County Rivers Association (**River Philip**)
- Fresh Air Outdoor Adventure Society (**Antigonish**)
- **Mabou** Harbour Coastal Management Planning Committee
- Students from the St. Francis Xavier University Biology Department and program in Integrated Studies in Aquatic Resources (ISAR) (**Pictou**)

Participation of community groups is a fundamental strength of the CAMP program, as NGO's share the responsibility of volunteering their time to monitor estuaries and coastal shorelines in their area. As NGO's often have several projects related to the estuary, their work is fundamental in demonstrating and initiating efficient stewardship principles.

2.0. MATERIALS AND METHODS

Monthly daytime sampling was done from May to September for the baseline sites. In this report a location (or site) refers to the specific estuary or coastal sample area and a station refers to one of the 6 areas at each site where beach seines were used to sample the shoreline community. Data on crustaceans and fish species, macrophytes, water quality and benthic substrate were collected at 150 baseline sampling stations throughout the provinces of NB, NS and PEI. Physical data included the use of a quadrat for vegetation cover, YSI meter readings to record temperature, salinity and dissolved oxygen, a sediment collection and a water sample collected for nutrient analysis. Methodology and protocols are described in more detail in Weldon et al. (2005).

2.1 Training

The new training and refresher review program for CAMP participants takes place in May and is a combination of theory and practical sessions. The theory session consist of an hour long presentation on CAMP which includes background, an outline of the methodology, an introduction to the equipment, training on use of the field data collection sheets and a review of the identification of species sampled during the field season. Each year, the training regime is modified depending on the experience of past NGO coordinators and the need to train new employees and/or volunteers.

The practical session involves training to familiarize participants with the proper use of equipment, standardized techniques and proper identification of fish, crustaceans and plant species with an actual on-station beach seine collection. After a beach seining, the volunteers identify the contents of the beach seine while DFO trainers and NGO coordinators assist with verification and identification. A folder for plant and animal identification with the most commonly encountered species, mostly referenced from Scott and Scott (1988), was prepared and provided to each community group

2.2 Site Selection

In 2007, NGO's returned to the same estuary or coastal location to repeat the sampling regime at the same stations of the past year. There was some site movement for safety reasons but they usually only a few meters to the left or right of the original site. New baseline estuary sites were added in 2007 (Shediac River and Summerside) and 4 other locations regained full baseline status using protocols identical to those of the 2004 - 2006 collections (Weldon et al. 2004).

2.3 Fish Identification

When difficulties with identification arose, groups could refer to the CAMP identification guide for clarification, or collect a specimen for identification. One option was to get the unknown plant or animal back to the local Area Office or DFO HQ for identification. A species that could not be identified in the field would be put on ice and frozen or otherwise preserved upon return to their NGO office. Guides such as Peterson Atlantic Coast Fishes and Atlantic Seashore field guides were made available and distributed to community groups to be used to assist with identification. Groups were also encouraged to take a quality digital photograph to assist with later identification for any unknown species.

2.4 Substrate Characteristics

Each visit to a site at each location involved recording a percentage of what the volunteer considered the bottom to be composed of. The four main choices are sand, mud, gravel and rock; rock descriptions could vary in that they could be solid, have gravel or small stones or some combination of any of the above. After five visits to the site each season and because of varying tides, a volunteer could see entirely different bottom characteristics each visit. This is the reason that volunteers are encouraged to visit a site at similar tidal times each month. To get the best idea of the site bottom structure, the results will present an overall average of what was recorded for the five months. An even better picture of the site could emerge if all five years of observations were summarized

2.5 Substrate Composition

In September, a sample of benthic substrate was collected from each sample station to analyze moisture content, organic content and grain size distribution of the sediment. Using a garden trowel, a sample of the surficial ten cm layer was obtained from within the seine area, bagged and returned for freezing at -20˚C and stored for later analysis at the Gulf Fisheries Center. From each frozen sediment sample, a thawed portion (100 ± 20 grams) was removed and placed in an aluminum pan.

In the laboratory, moisture content was determined as the difference in weight before and after drying at 70°C for 24 h (standardized time). Organic content was calculated as the difference in weight before and after burning the sediments in a muffle furnace at 500°C for one hour (standardized time). Grain size distribution per sample was determined from 10 min shaking (standardized time) with a mechanical sieve shaker with six different sieve sizes: >2 mm (very coarse sand), >1 mm (coarse sand), >500 µm (medium sand), >250 µm (fine sand), >125 µm (very fine sand), >63 µm (coarse silt) and <63 µm (silt) (Higgins and Thiel 1988). The mean grain size (MGS) was then calculated from the cumulative frequency curves established with the grain size distribution.

2.6 Macrophyte Cover

A 50 cm x 50 cm quadrat, divided into four equal sub-quadrants, was used to estimate macrophyte percentage cover at each sample station. The quadrat was thrown three times, across the sample area from left to right at middle depth. The data sheet was used to record the approximate percentages of the dominant plant and algal types. The use of this quadrat method was possible only when the water column was not turbid. Wind and wave action stirred up the sediment and made the percentage cover evaluation difficult in some cases.

Volunteers also included a general description of the sample area by taking notes of the overall dominant macrophytes present, their approximate cover percentage and location in reference to the shore.

2.7 Physical Measures

YSI meter model 85 was used to measure three physical components of water: temperature (± 0.1 C°), dissolved oxygen (± 0.1 mg/L) and salinity (± 0.1 ppt). Meter readings were taken either before (adjacent to the sweep site) or after the beach sweep (within the net area). The YSI probe was submerged approximately at mid-depth in the vicinity of the center of the sample area.

Also in 2007, Vemco continuous temperature monitoring probes were deployed for most of the sampling season. This was done in 2005 by DFO personnel with a NGO representative or with Area Office coordinator assistance. In 2006, NGOs were given the probes to place within their estuary or coastal location. In 2007, NGO’s or DFO personnel deployed the probes attached to a wooden stick that was attached to a fixed structure such as a wharf or dock so the probe was one meter below the low water mark. Recovery was successful for about 60% of the probes.

2.8 Nutrient Analysis

In 2007, each group was supplied with 60 water bottles (30 ml) to collect two replicate water samples at each station for each month in their location. All 60 bottles were numbered and on the date of collection, matched with the station. The samples were collected on the sampling day and stored in a cooler bag with ice. Upon return to home base, they were frozen to await transport back to DFO where they were then sent to Halifax for analysis. The Bedford Institute of Oceanography physical parameter section (nutrient lab) completed the chemical analysis for nutrient content (ammonia, nitrate, nitrite, phosphate and silicate) during the winter. Results were made available in the spring of 2008. Detailed protocols for the treatment of the water samples is presented in Theriault and Courtenay, 2008 (unpublished report).

2.9 Permits

Each group was able to apply on-line to acquire a species sampling permit for scientific purposes. These are available from DFO Gulf region at the following location:

https://www.glf.dfo-mpo.gc.ca/fam-gpa/bssp-saps/s52/form-e.php?form_lgE=e

Persons listed as part of the community group on the Section 52 permit are authorized to collect, count and release fish species commonly found in estuarine locations. The permit also allowed them to collect and transfer unidentified specimens that required further identification.

3.0. RESULTS AND DISCUSSION

Descriptive statistics were used to examine the CAMP data and determine the relative abundance and species richness for sampling stations at all locations in each of the Maritime Provinces.

The total abundance values were determined by adding the totals for each species for the five months sampled of the season at each CAMP estuary or coastal site. Abundance of a particular species or grouped species of invertebrate or fish can be compared across sites and stations. Species richness was calculated by determining the total number of different species captured at each of all six stations located within a CAMP location, for each month sampled. In addition, the species richness was averaged across all stations for all five months sampled at each baseline site. Presenting the data in this way allows for comparisons among all the estuarine and coastal shoreline sample sites. Species richness graphs were therefore presented as a mean for the month. This information is also available in graphic form on posters developed for each geographical region of the Northumberland Strait.

3.1 Fish and Crustaceans

This section will discuss sampling results for locations with four to five complete months of sampling data. This includes the provinces of NB, NS, and PEI for the following 25 sites; Jourimain, Scoudouc, Shediac, Cocagne, Bouctouche, Saint Louis de Kent, Richibucto, Miramichi, Tabusintac, Tracadie, Lamèque, Shippagan, and Caraquet (NB); River Philip, Pugwash, Pictou, Antigonish, and Mabou (NS); and Mill River, Trout River, Basin Head, Summerside, Pinette River, Montague-Brudenell Rivers and Murray River (PEI).

For the 2007 sample season, a total of 597,295 adult and Young of Year (YOY) fish and crustaceans were counted from 13 baseline estuaries/coastal shorelines within NB, 5 in NS and 7 in PEI. Total adults numbered 478,722 and these numbers were used to produce graphed comparisons.

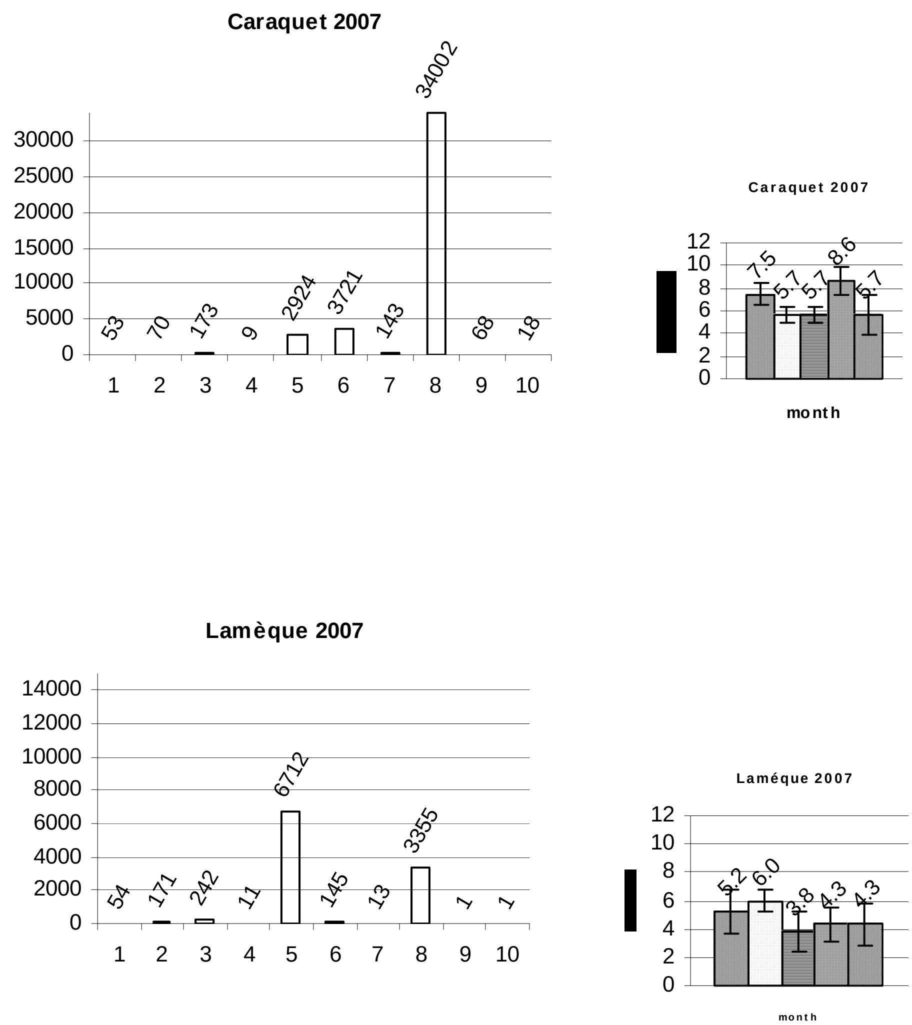
There were 34 different species of fish and crustaceans identified during the 2007 sample season, 28 of those species were fish and six were crustaceans. Species in **Appendix 1** are a list of those found in 2007 and include three invertebrate tunicates.

The five common species of crustaceans were; sand shrimp (*Crangon septemspinosa)*, grass shrimp (*Palaemonetes vulgaris*), rock crab (*Cancer irroratus*), green crab (*Carcinus maenas*), and mud crabs (*Xanthidae sp*.).

The most abundant fish and crustacean species were very similar for New Brunswick, Nova Scotia and Prince Edward Island. They were, in order of most abundant; sand shrimp (*Crangon septemspinosa*), both mummichog (*Fundulus heteroclitus*) and killifish (*Fundulus diaphanus*) grouped as *Fundulus* sp. (the majority of which were always mummichogs), 4-spine stickleback (*Apeltes quadracus*) and Atlantic silverside (*Menidia menidia*).

The ten most abundant species or species groups for each province/zone are graphed below (Figures 2 - 6B) to show the abundance relationship among the three sections in New Brunswick, namely northeastern (Figs. 2 & 2A), central (Figs. 3 & 3A) and southeastern sites (Figs. 4 & 4A), Nova Scotia (Figs. 5 & 5A) and Prince Edward Island sites (Figs. 6, 6A & 6B). Within the ten categories of species, the ‘other’ category pools the remaining less abundant species which sometimes represents a large number of certain species at specific stations at specific times of the season (eg. pipefish, smelts, striped bass). Because groups have collected up to 34 different species, the decision was made to group less numerous individuals rather than try to illustrate 34 graphs (Weldon et al. 2005). For each month, average species richness per beach seine haul was calculated across the six stations. The mean and 95 % confidence interval for these monthly estimates of species richness (SR) were plotted for each estuary or coastal location.

The legend for each graph (Figures 2 - 6) is similar in this report as it has for the previous two publications (Weldon et al. 2005, 2007). In the legend, “Stickle” refers to stickleback and “Killi” refers to killifish.



1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

May June July Aug. Sept.

SR = Species Richness

Figure 2. Season totals of adult animals for the 10 most abundant species or species groups in Caraquet and Lamèque (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

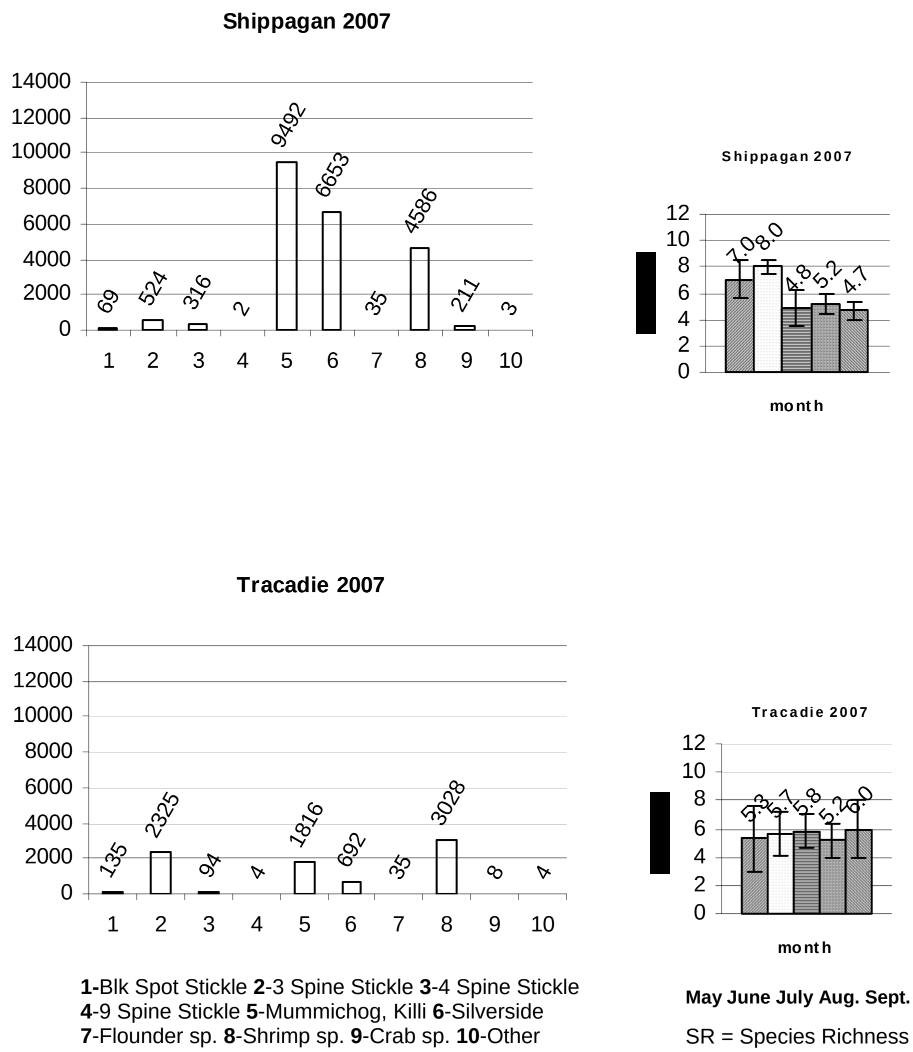


Figure 2A. Season totals of adult animals for the 10 most abundant species or species groups in Shippagan and Tracadie (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

In northeastern NB (Figures 2 & 2A), the five most abundant species in Caraquet, Lamèque, Shippagan and Tracadie were mummichog, shrimp, silversides, three and fourspine sticklebacks. *Fundulus* species were the most abundant at Shippagan and Lamèque where shrimp was the most abundant at Caraquet and Tracadie. The threespine stickleback counts were higher than last year in two locations (Shippagan and Tracadie) while fourspine stickleback counts were higher in Lamèque and Caraquet. Ninespine sticklebacks remained at lowest total number of all the sticklebacks as it has for all years since 2005. Except for Shippagan in 2006, the black spotted stickleback numbers have generally decreased every year since 2005 in all locations in the northeast. The other two stickleback species, three and fourspine have shown season total numbers going up and down with no distinct trends obvious over the last four years.

In 2007, Tracadie had the lowest overall total number (8141) of adult fish and crustaceans for the season compared to the other three locations whereas Shippagan had the lowest totals (6601) in 2006. Caraquet and Shippagan had big total number increases compared to the previous year (41181 from 12628 and 21891 from 6601 respectively). These increases were mostly influenced by increased numbers of sand shrimp in Caraquet and by mummichog and silversides in Shippagan. With total numbers going up and down over the three - four years, many locations have no discernable pattern. Having multiple year data available may allow for specific patterns to be determined.

Generally, mean species richness was higher in June than it was in May, except in Caraquet where the trend was similar to 2006 with higher values in May than June. Tracadie and Caraquet had values for species richness slightly higher that last year while Shippagan and Lamèque maintained similar numbers to last year. It would appear that normal aggregative behaviour of these smaller pelagics as it relates to feeding and breeding may have been slightly delayed, possibly due to lower spring water temperature. As in previous years, the species richness declined slightly as the sampling season progressed with one notable exception in Caraquet in August where a high value of nine species was recorded. Analysis of five years of CAMP data is scheduled for completion in 2009 at which time trends in species richness may provide insights to certain population changes.

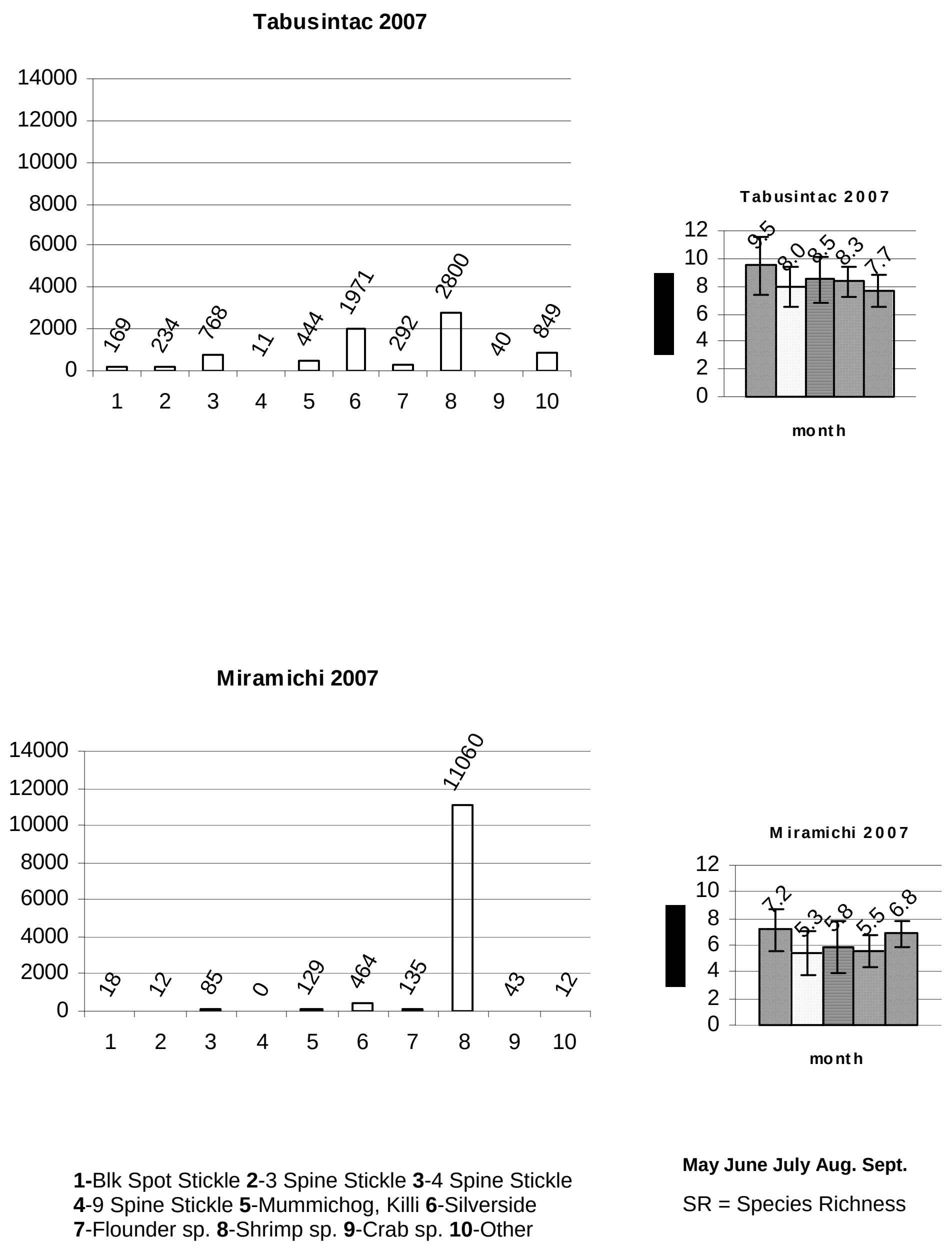
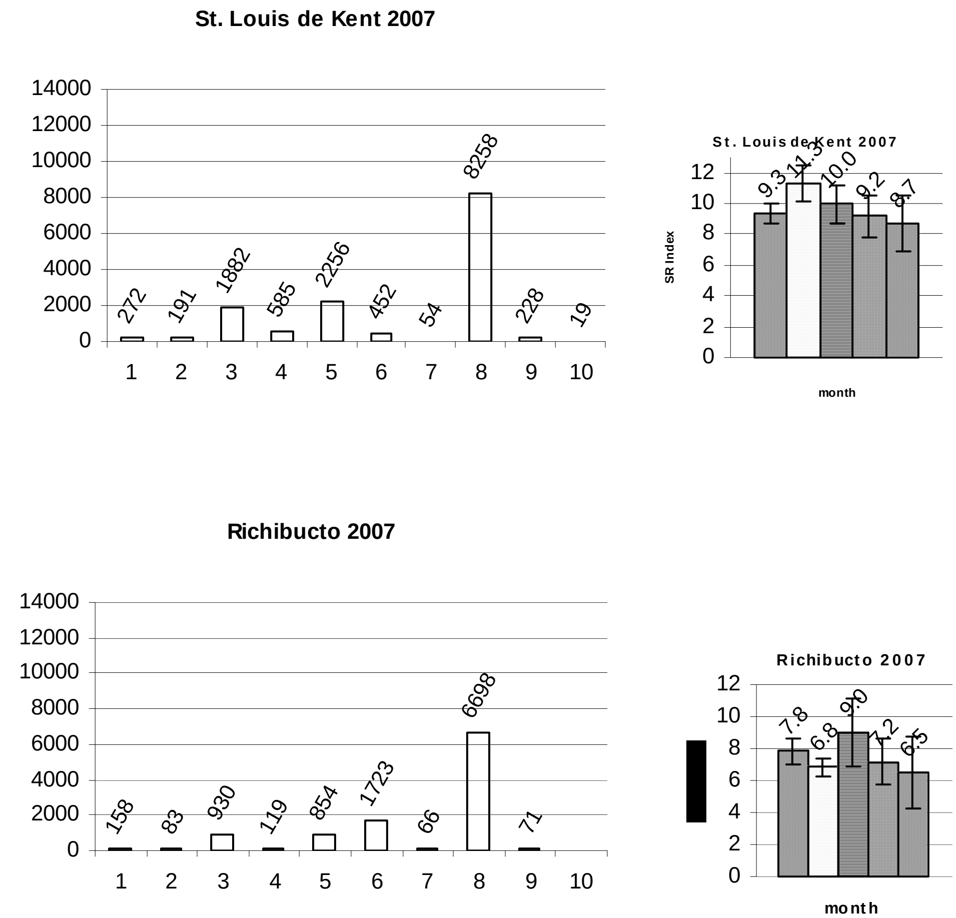


Figure 3. Season totals of adult animals for the 10 most abundant species or species groups in Tabusintac and Miramichi (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).



1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

May June July Aug. Sept.

SR = Species Richness

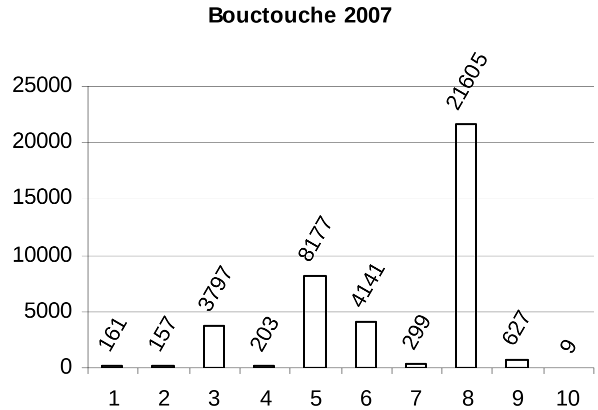
Figure 3A. Season totals of adult animals for the 10 most abundant species or species groups in St. Louis de Kent and Richibucto (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown among the months (95 % confidence interval CI) (n = 6 stations per bar).

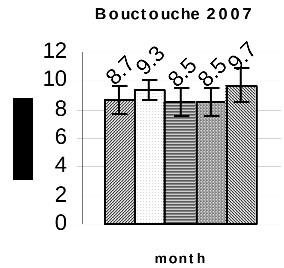
In central NB (Figure 3 & 3A), Tabusintac and Richibucto who joined Miramichi and St. Louis de Kent (Kouchibouguacis) as the baseline locations in 2006 maintained full status in 2007. Shrimp species were numerically the most abundant species in all four locations in 2007. Silversides were second in abundance totals for all fish species in all locations except St. Louis where mummichogs were more numerous than silversides. In the stickleback category, fourspine sticklebacks lead abundance numbers in all locations, a similar trend as shown in 2006.

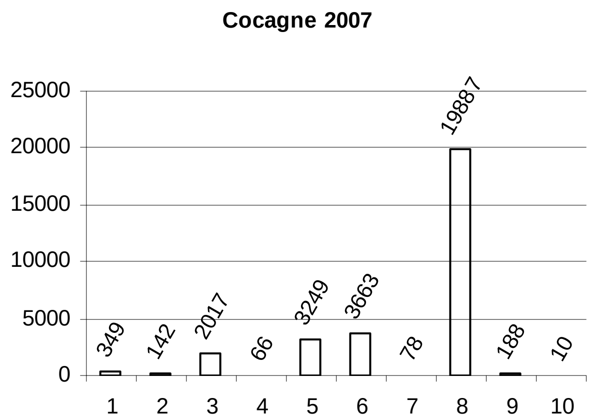
In 2007, Tabusintac had the lowest overall total number (7578) for the season compared to the other three locations whereas Richibucto had the lowest totals (7076) in 2006. After a drop in 2006, St. Louis (14197) recorded an increase in 2007 for total species recorded as did Richibucto (10704). As in 2006, the higher abundance totals for species collected in St. Louis probably reflects the differences in estuary site characteristics. More vegetation, thus more habitats for protection, characterizes most of the St. Louis sites. Compared to other locations where sand is the more dominant substrate, more vegetation can help explain the higher abundance totals in St. Louis. Tabusintac and Miramichi had total number (11227 to 7578 and 138441 to 11958 respectively) decreases compared to the previous year. Patterns such as these may relate to certain factors in the environment and this will be explored in the five year summary report due in 2009. This variation could also be due to sampling at different times during the tidal regime.

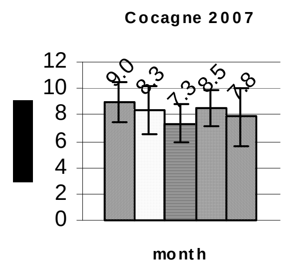
In the "other" category, striped bass YOY do not show up as the abundance results are based on totals for adults only. In Miramichi alone, 2277 YOY striped bass were caught mostly in August. These were likely the result of a strong YOY spring survival as determined in the field (Scott Douglas pers. comm.). In previous years the YOY were probably incorrectly identified as juveniles who would have been put in the young adult category, though in most cases it has been determined they were young of the year. For other species, volunteers were instructed to put yearlings and juveniles who are not considered young of the year into the adult category.

Mean species richness showed no pattern with monthly numbers highest in May (Tabusintac), May and September (Miramichi), June (St. Louis) and July (Richibucto). A similar trend to 2005, 2006 data was evident in that species richness was higher overall in central NB when compared to northeast NB. Compared to last year, the overall species richness values was down in Miramichi and Richibucto, stayed about the same in St. Louis and was up slightly in Tabusintac in 2007.









1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

May June July Aug. Sept.

SR = Species Richness

Figure 4. Season totals of adult animals for the 10 most abundant species or species groups in Bouctouche and Cocagne (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

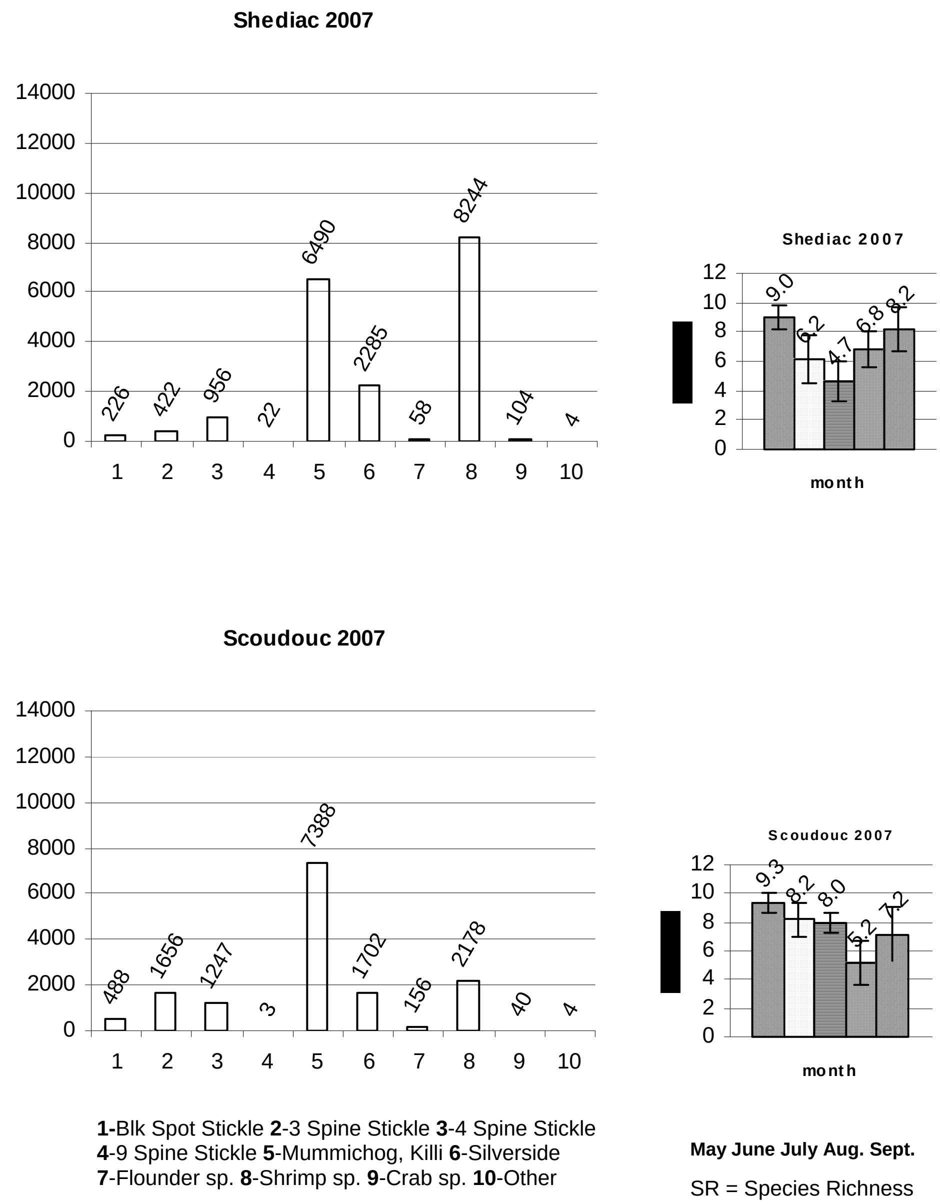


Figure 4A. Season totals of adult animals for the 10 most abundant species or species groups in Shediac and Scoudouc (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

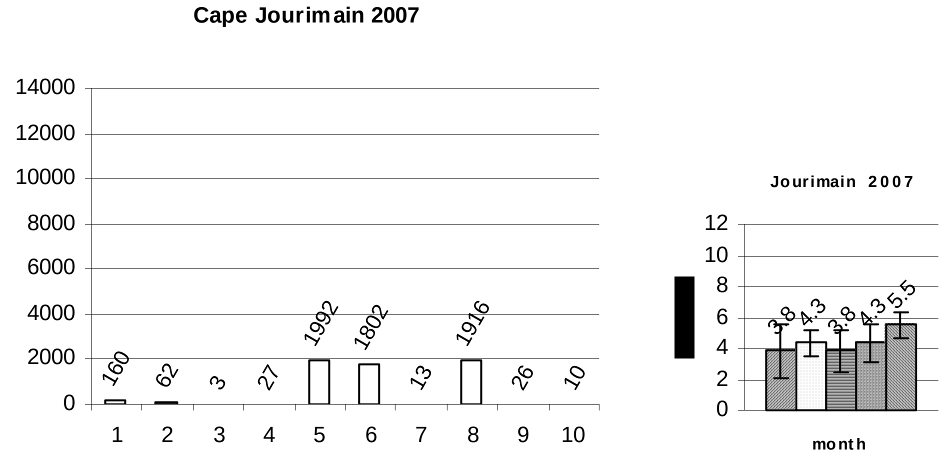
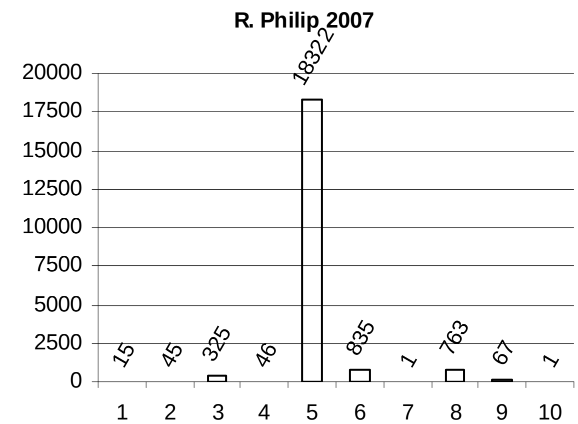
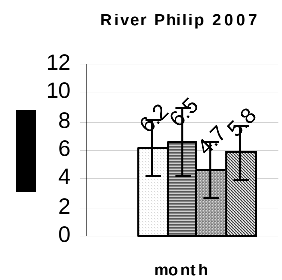


Figure 4B. Season totals of adult animals for the 10 most abundant species or species groups in Cape Jourimain (NB) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

In southeastern NB (Figure 4, 4A & part of 4B), Bouctouche, Scoudouc and Cape Jourimain maintained while Cocagne regained baseline status. The Shediac River became a new baseline site. Local NGOs know the difference but others should note for comparison purposes, and in the future, the Scoudouc River is in Shediac and the Shediac River is in Shediac Cape. Earlier reports refer to Shediac sites that are on the Scoudouc river system. Silverside numbers were highest in number for the fish in Cocagne and mummichogs were the abundant fish at the other four locations. Shrimp species were the most abundant crustacean and highest in species abundance everywhere except Scoudouc River. Interestingly, shrimp numbers have declined in the Scoudouc location over the last three years. Excluding Shediac River, the other four locations illustrate a shrimp number drop in 2006 and subsequent increase in 2007. Among the stickleback species, the fourspine was highest in abundance at three locations (Bouctouche, Cocagne and Shediac rivers). The ninespine sticklebacks showed increases everywhere except in the Scoudouc location. Cape Jourimain has maintained black spotted sticklebacks with the highest abundance totals as has been the case for the last three years. Cape Jourimain is more of a coastal sample area compared to the other locations (being estuaries) which might explain the lower overall abundance totals per species and higher blackspotted numbers. Though Scoudouc had the higher overall total (43156) for 2006, Bouctouche had the high total number (39176)of species in 2007. Of interest is total abundance numbers for Scoudouc dropped and in Bouctouche they increased by approximately 50% respectively from the previous year (2006). Cocagne total number of species was up from 21183 to 29649 and Jourimain dropped a bit from 6011 from 10139.

Mean species richness (SR) in the southeast was slightly less than central NB but greater than northern NB as it was the trend in previous years. The Bouctouche sites had the higher SR values compared to the lowest values for the coastal Cape Jourimain location. Species richness values fluctuate throughout the monthly sampling in all locations. Except for the Scoudouc River, all locations had lowest mean SR values in July. Compared to last year, Scoudouc stations were up, Bouctouche showed a slight drop, Jourimain a bigger drop and Cocagne remained about the same for monthly mean species richness values.

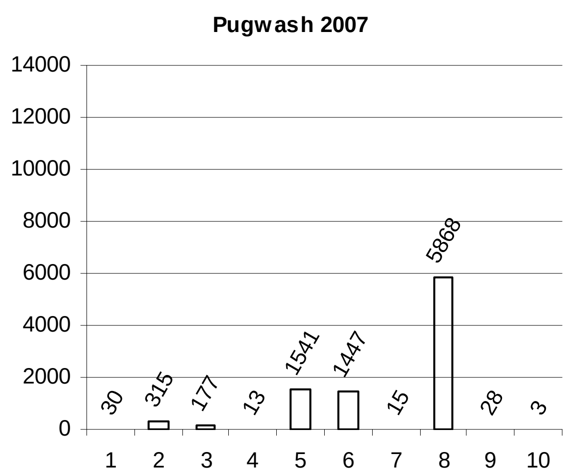




1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

May June July Aug. Sept.

SR = Species Richness



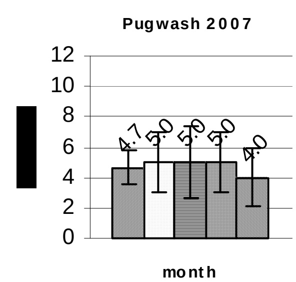
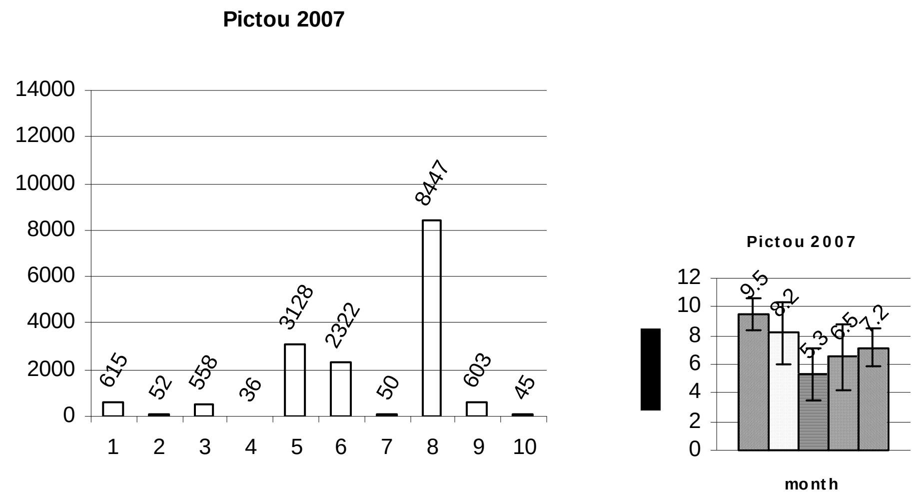


Figure 5. Season totals of adult animals for the 10 most abundant species or species groups in R. Philip and Pugwash (NS) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).



1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

May June July Aug. Sept.

SR = Species Richness

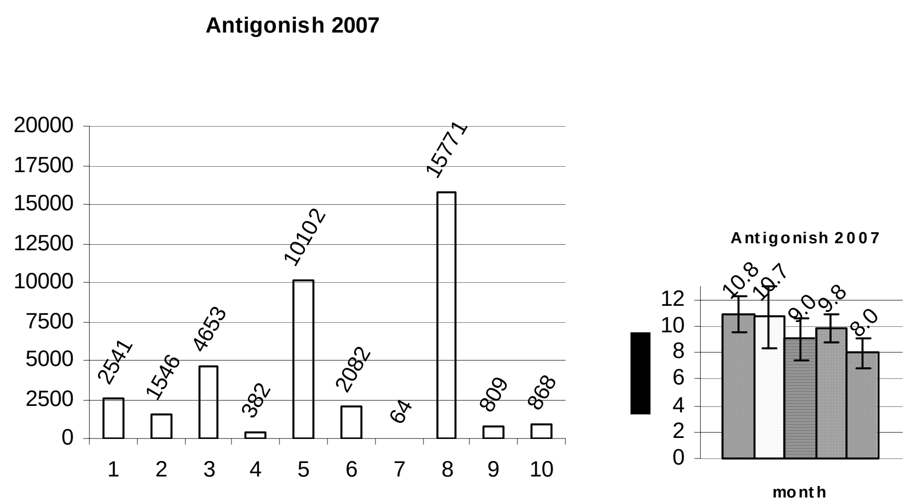


Figure 5A Season totals of adult animals for the 10 most abundant species or species groups in Pictou and Antigonish (NS) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

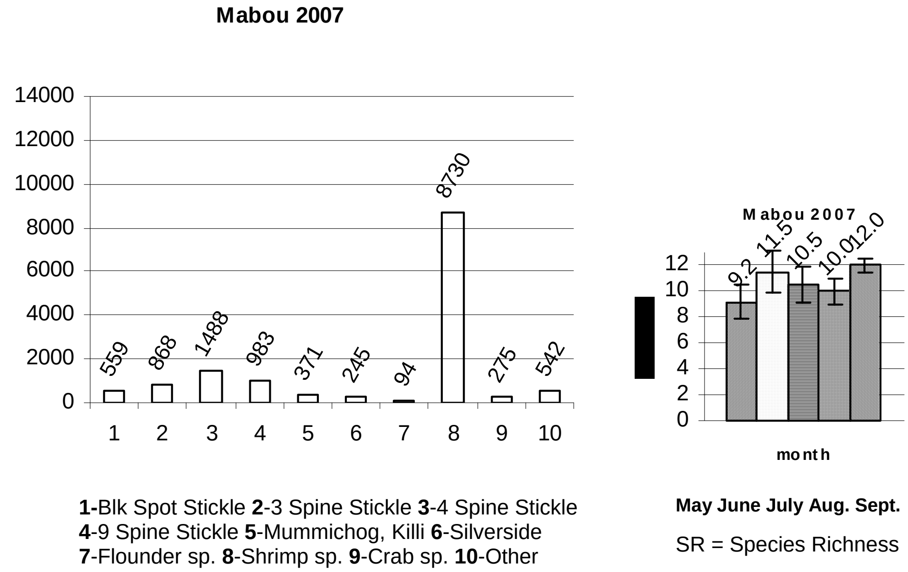
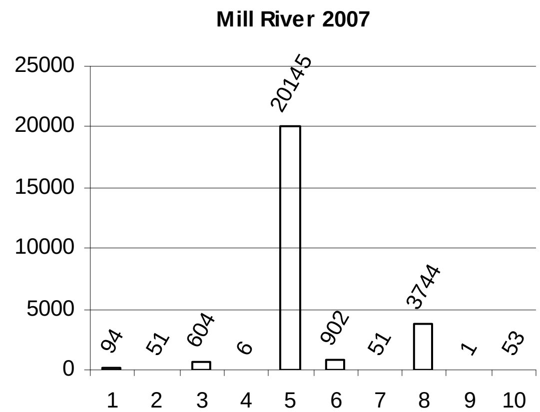


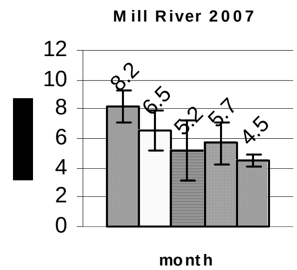
Figure 5B. Season totals of adult animals for the 10 most abundant species or species groups in Mabou (NS) sampled over 5 months in 2007. Mean taxon richness (total number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

In Nova Scotia, Pictou, Antigonish and Mabou maintained baseline status in 2006 (Figure 5 & 5A). These locations maintained a full sampling schedule because of regular assistance of biology students from St. Francis Xavier University. The River Philip-Pugwash combined location (in 2006) expanded in 2007 so each became a full baseline location, each with six stations or sampling sites.

Sand shrimp were highest in numbers in four locations, (Pugwash, Pictou, Antigonish and Mabou) but much lower in the newly established R. Philip site where *Fundulus* were most abundant. *Fundulus* species were second in abundance in Pugwash, Antigonish and Pictou. Silversides were second in abundance at R. Philip and Pugwash and fourspine sticklebacks second in Mabou. The most abundant stickleback species was the fourspine in three locations, Mabou, Antigonish and R. Philip. Black spotted sticklebacks had the highest total number in Pictou while threespines dominated in Pugwash. Among the four stickleback species, the abundance patterns when compared to the previous year changed at every location.

There were some large fluctuations in species richness in Nova Scotia throughout the sampling months. Overall comparisons of mean species richness illustrate lower values (5 - 7.5) for R. Philip-Pugwash to a higher range of 10 to 13 for Mabou. The others were in-between and the average for Nova Scotia was approximately seven. Compared to 2006, overall species richness for all five locations shows very small increases or very small decreases in 2007.

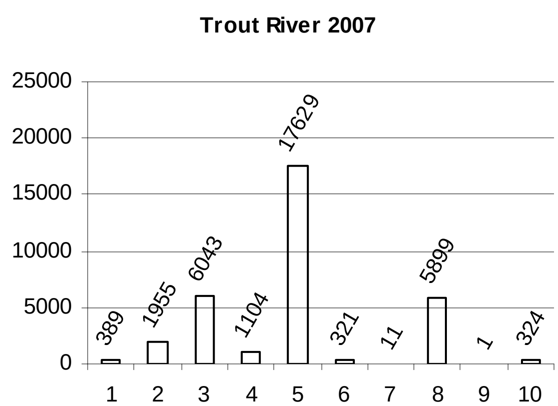


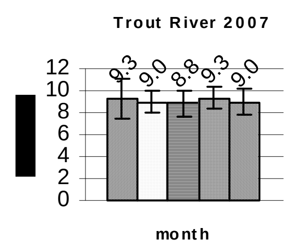


1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

May June July Aug. Sept.

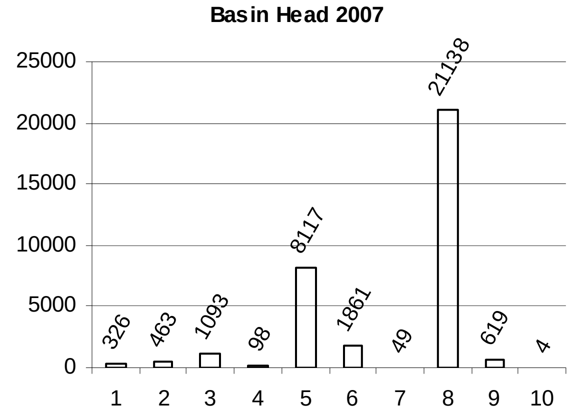
SR = Species Richness

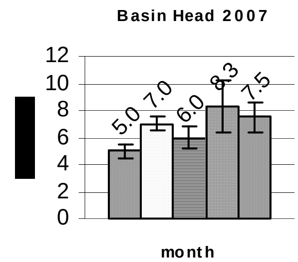




1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

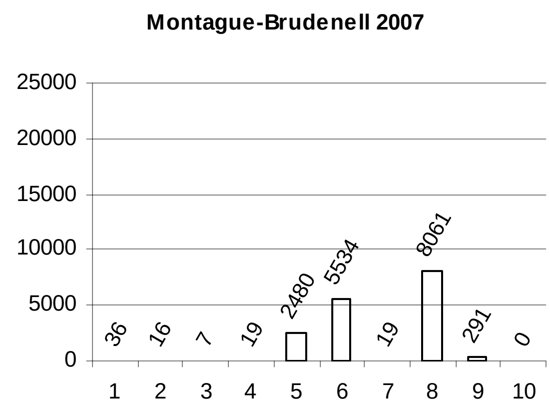
Figure 6. Season totals of adult animals for the 10 most abundant species or species groups in Mill River and Trout River (PEI) sampled over 5 months in 2007. Mean taxon richness (total 6 number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

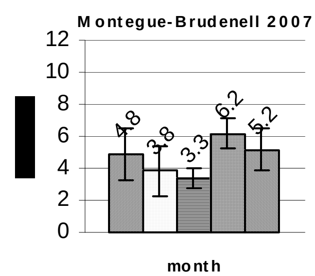




May June July Aug. Sept.

SR = Species Richness





1-Blk Spot Stickle **2**-3 Spine Stickle **3**-4 Spine Stickle
4-9 Spine Stickle **5**-Mummichog, Killi **6**-Silverside
7-Flounder sp. **8**-Shrimp sp. **9**-Crab sp. **10**-Other

Figure 6A. Season totals of adult animals for the 10 most abundant species or species groups in Basin Head and Montague - Brudenell (PEI) sampled over 5 months in 2007. Mean taxon richness (total 6 number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

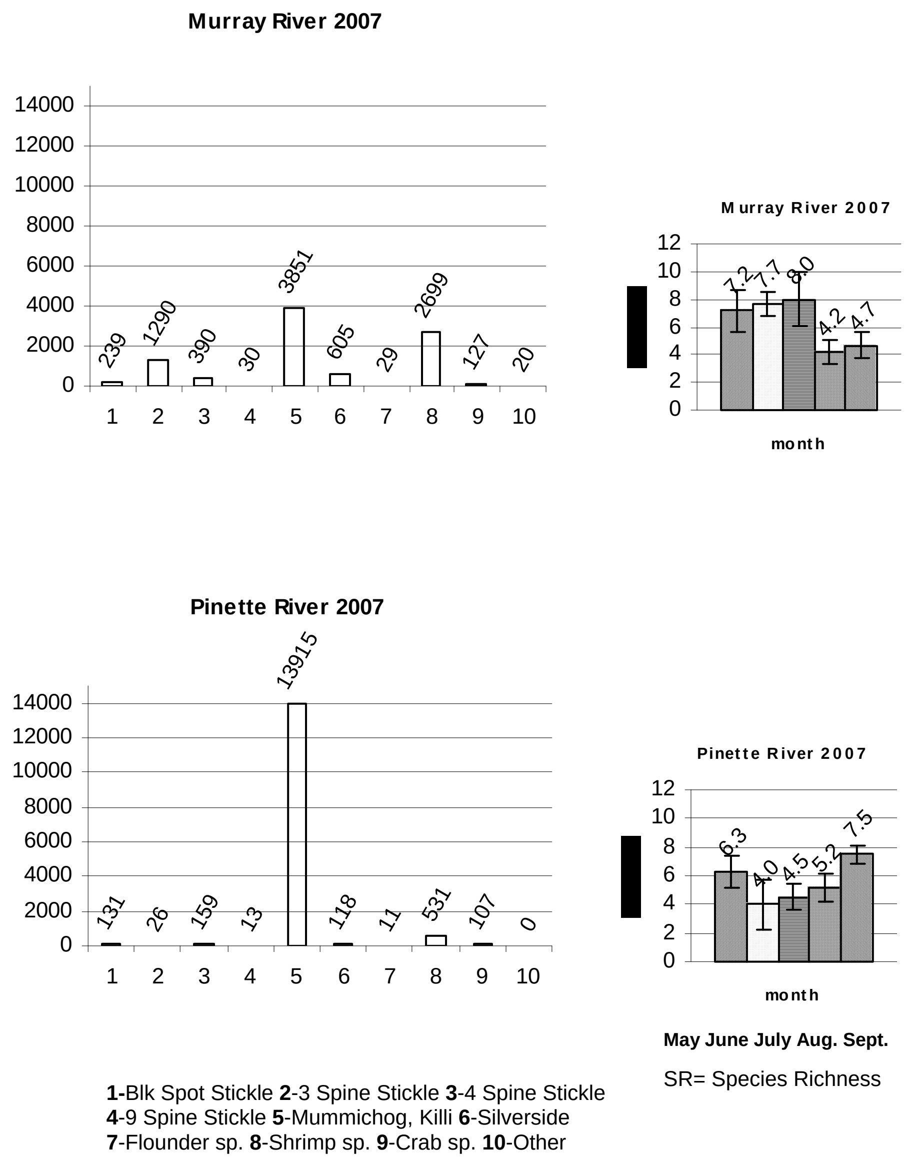


Figure 6B. Season totals of adult animals for the 10 most abundant species or species groups in Murray and Pinette Rivers (PEI) sampled over 5 months in 2007. Mean taxon richness (total 6 number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

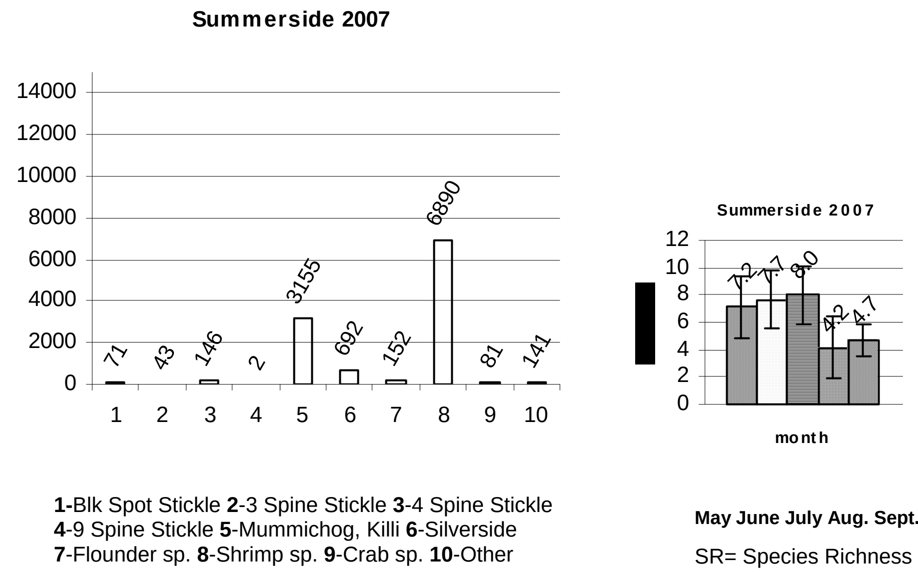


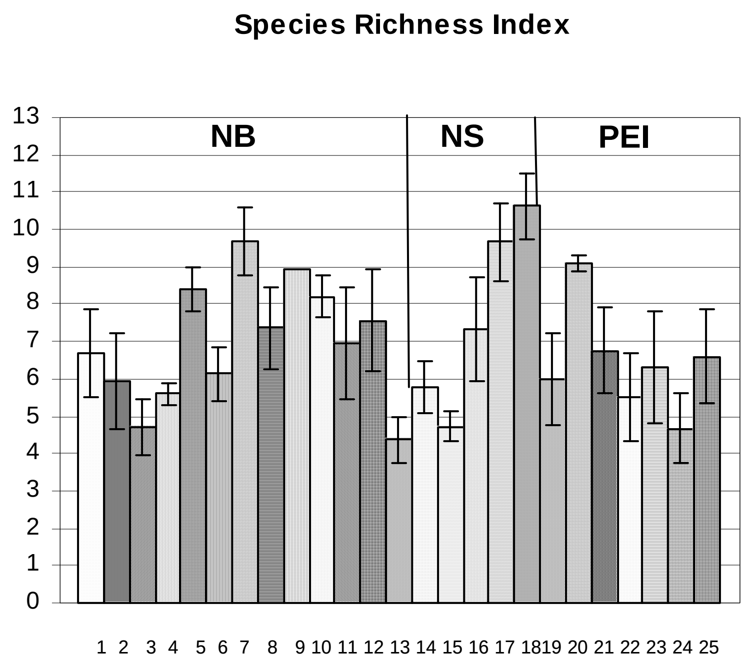
Figure 6C. Season totals of adult animals for the 10 most abundant species or species groups in Bedeque Bay (Summerside) (PEI) sampled over 5 months in 2007. Mean taxon richness (total 6 number of species taxa) is also shown for each month (95 % confidence interval CI) (n = 6 stations per bar).

In Prince Edward Island (Figure 6, 6A & 6B), Basin Head, Trout River and Mill River again maintained their baseline status in 2007. The Southeast Environmental Association (SEA) completed CAMP at the Pinette, Murray and Montague-Brudenell river estuaries to return to full five month baseline status in 2007. The Bedeque Bay Summerside group became the new addition in 2007 and completed the full five months of sampling.

Comparing the seven baseline locations in PEI, *Fundulus* sp. had the highest totals in Mill, Summerside, Trout, Murray and Pinette rivers. *Fundulus* sp. was second and third, respectively, in Basin Head and Montague-Brudenell. Shrimp species were highest in total numbers in Basin Head, Montague-Brudenell and Summerside and second most abundant in Mill, Trout, Murray and Pinette. Overall, the three longest standing baseline sites, Mill River, Trout River and Basin Head show higher total numbers in 2007 than in 2006. The others cannot be compared because of less frequent sampling compared to the previous year.

For the stickleback species, fourspine abundance was highest at all locations except Montague-Brudenell and Murray river locations, similar to what was found in 2006. The threespine stickleback abundance was second highest in Trout River and Basin Head, locations and the blackspotted second at Mill and Pinette while being number one in abundance in Montague-Brudenell. Trout River had a very high number of ninespine sticklebacks compared to all the other locations.

Mean species richness showed no consistent pattern over the months, though higher numbers generally occurred in May except for Basin Head and Montague-Brudenell where higher numbers came later in the sampling season. Species richness comparisons showed a slight drop as the season progressed in Mill River, Murray River and Summerside but remained steady in the other four locations. Once again, Trout River had the higher mean species richness numbers compared to the other locations.



(NB) 1- Caraquet **2**- Shippagan **3**- Lamèque **4**- Tracadie **5**- Tabusintac
6- Miramichi **7**- St. Louis de Kent **8-** Richibucto **9**- Bouctouche **10**- Cocagne
11-Shediac **12**- Scoudouc **13**- Cape Jourimain **(NS) 14**- R. Philip **15-** Pugwash
16- Pictou **17**- Antigonish **18**- Mabou **(PEI) 19-** Mill River **20**-Trout River
21- Basin Head **22-** Pinette R. **23**- Murray R. **24-** Montague-Brudenell R.
25- Summerside

Figure 7. The mean species richness with a confidence interval at ± 95% (n = 5 months for each bar; total species observed at all six stations averaged for each month) for 25 baseline estuary locations in the Gulf of St. Lawrence over a 5 month period

Figure 7 provides an average species richness of all 6 sample stations, for all months for each of the 25 baseline estuaries or coastal shoreline locations. The species richness for all five months was averaged to arrive at the reference value shown in the graph. At this time the combined data provide a baseline reference point. When more information is available, environmental science personnel will examine the successive year data for patterns and trends.

In New Brunswick, St. Louis de Kent had the highest average species richness for the five month sampling period at 9.70 species ± 0.90 (SD), followed by Bouctouche (8.93) and Tabusintac (8.40). The lowest average species richness was in Cape Jourimain at 4.37 species ± 0.60. Trends from 2007 show four locations increased in average species richness;

Caraquet (5.1-6.9), Tabusintac (7.2-8.4), Miramichi (4.7-6.1) and Cocagne (7.4-8.2) while three locations decreased namely Lamèque (5.4-4.7), Richibucto (8.1-7.4) and Cape Jourimain (5.4-4.4). Trends in 2007 shows that the average SR increased from 2006 values in four locations.

In Nova Scotia, Mabou Harbour had the highest species richness value at 10.63 ± 0.87 (SD) followed closely by Antigonish with 9.67 ± 1.04 (SD) both having similar results to 2007 levels. Pugwash was lowest at 4.73 species ± 0.38 (SD). Pictou remained the same as 2007 levels at 7.33 average species richness.

In PEI, Trout River had the highest mean species richness value at 9.10 species ± 0.20 (SD), up from the 2006 value of 8.32. Basin Head and Mill River had almost identical species richness values at 6.80 ± 1.14 (SD) and 6.00 ± 1.24 (SD) respectively in 2007. For the three locations in the southeast sampled as full baseline in 2007 the Montague - Brudenell system has the lowest value at 4.67 species ± 0.94 (SD) similar to the 2006 levels. The other two locations, Pinette and Murray Rivers were slightly higher at 5.5 and 6.3 respectively in 2007, again similar to their levels in 2006.

3.2 Substrate Characteristics

For each site at all locations the percentage of substrate characteristics were recorded each month. The three dominant substrates were mud, sand or rock. This could change depending on the distance sampled from the high water mark. Though some sites would show no change whether the seine was hauled at low or high tide, others easily could. The most often encountered situation would be sand close to shore, mud-sand part way out and mud further out. This is one of the reasons that groups were encouraged to try and sample at similar water depths each month. A multitude of logistic factors contribute to this not always being possible, but for the majority of visits it was. **Table 1** below provides an average of percentage of the four dominant substrate types for each station at every location. The authors refer to a site as primarily of one substrate type if the average (for five months) value determined for the station is greater than 50 percent for the dominant substrate. Keep in mind that groups might describe the station as mostly mud at lower tides as compared to calling it mostly sand at higher tides. As can be seen from the table, in New Brunswick, there are approximately six rocky stations with some sand, 12 primarily muddy stations with some sand, three stations that are half and half, mud and sand and the rest (57) are sandy stations with various combinations of some mud, gravel and/or rock. One of the reasons that sand is the dominant substrate has to do with location, the other with tides. Groups tend to sample the shoreline when the tide is more in than out and locations that have driving access often relates to the public being able to get to locations suitable for recreation. Historically, access roads more often end up at a sandy beach location than at a muddy beach location. Comparing the sites from successive years will provide a general substrate description after all the volunteer categorizations are averaged. This can be best accomplished in the five year summary report,

Table 1. Summary of the dominant bottom sediment type observed for six stations of each estuary location in New Brunswick based on the average of the recorded percentage for the five months of sampling in 2007

Cara	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	43	16	0	41
2	97	3	0	0
3	95	5	0	0
4	67	19	0	14
5	31	6	44	20
6	55	31	2	12

Lam	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	80	1	6	13
2	61	7	26	6
3	74	5	13	8
4	60	8	24	8
5	72	8	15	5
6	55	8	13	24

Ship	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	80	3	15	2
2	61	5	30	4
3	40	21	7	32
4	70	6	16	8
5	58	12	26	4
6	57	11	18	14

Trac	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	76	6	17	1
2	80	2	18	0
3	69	8	22	1
4	76	4	19	1
5	73	9	18	0
6	58	9	32	1

Tabus	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	62	13	13	12
2	78	3	19	0
3	56	2	42	0
4	48	12	4	36
5	50	0	50	0
6	60	0	40	0

Miram	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	89	6	3	2
2	50	0	30	20
3	80	6	0	14
4	43	10	41	6
5	89	3	0	8
6	21	7	0	72

St.Lou	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	80	0	20	0
2	73	2	24	1
3	27	18	48	7
4	35	7	57	1
5	34	20	44	2
6	32	11	54	3

Rich	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	51	26	13	10
2	62	23	7	8
3	54	4	1	51
4	60	9	9	22
5	27	17	0	56
6	68	21	4	7

Bouct	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	56	4	36	4
2	38	2	48	12
3	90	1	9	0
4	64	6	20	10
5	34	14	46	6
6	42	8	44	6

Cocag	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	87	5	2	6
2	29	5	63	3
3	77	13	5	5
4	69	8	14	9
5	63	7	16	14
6	75	18	1	6

Shed	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	25	2	68	5
2	69	1	30	0
3	65	0	34	1
4	60	6	34	0
5	48	8	24	20
6	68	4	28	0

Scou	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	54	6	40	0
2	60	3	37	0
3	96	1	3	0
4	49	1	50	0
5	73	3	22	2
6	68	0	32	0

Jouri	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	95	4	0	1
2	43	4	47	6
3	88	5	0	7
4	76	10	0	14
5	71	2	0	27
6	59	21	0	20

In Prince Edward Island, as can be seen from **Table 2**, there are no stations where rock is dominant, though three in both Murray and Summerside and one in Trout have a rock base covered with sand. There are seven primarily muddy stations with some sand (two in each of Trout and Basin Head, one in Summerside), six stations that are approximately half and half, mud and sand (two in Mill and Pinette, one in each of Trout and Basin Head) and the rest (31) are sandy stations with various combinations of some mud, gravel and/or rock. As before, above 50 percent for the average of the five monthly observations by volunteers is the value used to say what kind of substrate is dominant, or what combination dominates.

In Nova Scotia (also **Table 2**), there are no rocky stations (one is close at 41% in Philip), three that are mostly gravel with some rock and sand (two in Mabou, one in Antigonish), six primarily muddy stations (three in Philip, two in Pugwash, one in Antigonish), three sand/gravel, eight stations that are approximately half and half, mud/sand or mud/gravel and the rest (nine) are sandy stations with various combinations of some mud, gravel and/or rock.

Table 2. Summary of the dominant bottom sediment type observed for six stations of each estuary location in Nova Scotia and Prince Edward Island based on the average of the recorded percentage for the five months of sampling in 2007

PEI

Mill	avg %				Sum	avg %				Trou	avg %				Pine	avg %			
stn	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**
1	59	5	12	4	**1**	88	4	3	5	**1**	30	2	68	0	**1**	89	3	3	5
2	95	1	4	0	**2**	50	1	14	35	**2**	34	0	66	0	**2**	68	0	32	0
3	86	4	7	3	**3**	56	0	8	36	**3**	44	4	52	0	**3**	58	0	32	10
4	77	3	20	0	**4**	32	2	64	4	**4**	65	0	35	0	**4**	78	4	10	8
5	59	0	40	1	**5**	67	9	8	16	**5**	73	0	3	24	**5**	89	9	2	0
6	50	0	50	0	**6**	47	7	16	30	**6**	76	6	18	0	**6**	72	3	24	1

Murr	avg %				Mont	avg %				BasH	avg %			
stn	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**
1	70	2	0	28	**1**	80	9	0	11	**1**	63	2	35	0
2	69	7	0	24	**2**	98	0	0	2	**2**	86	0	14	0
3	60	7	0	24	**3**	73	5	18	4	**3**	31	0	69	0
4	71	16	0	13	**4**	81	0	19	0	**4**	60	0	40	0
5	75	6	9	10	**5**	81	6	1	12	**5**	38	2	56	4
6	75	0	19	6	**6**	88	0	10	2	**6**	19	0	81	0

NS

Phil	avg %				Pugw	avg %				Pict	avg %				Anti	avg %			
stn	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**	**stn**	**sand**	**grav**	**mud**	**rock**
1	34	23	2	41	**1**	2	2	96	0	**1**	21	26	36	17	**1**	7	34	42	17
2	45	38	1	16	**2**	16	0	94	0	**2**	36	26	36	2	**2**	12	40	36	12
3	29	14	54	3	**3**	83	11	0	6	**3**	5	45	33	17	**3**	48	50	0	2
4	62	9	26	3	**4**	62	18	0	20	**4**	66	22	8	4	**4**	0	0	100	0
5	23	23	54	0	**5**	96	0	0	4	**5**	95	5	0	0	**5**	39	22	16	23
6	30	6	60	4	**6**	74	10	0	16	**6**	60	18	12	10	**6**	71	16	8	5

Mab	avg %			
stn	**sand**	**grav**	**mud**	**rock**
1	26	50	33	11
2	14	44	24	18
3	12	38	43	7
4	7	46	27	20
5	48	34	12	6
6	22	50	16	12

3.3 Substrate Composition

In September, one sediment sample was taken at every sample station at all locations. Each group used a 165 cm blade trowel to dig into the sediment. Depth was restricted to elbow depth in the water. The samples were analyzed by a Coop student in our Gulf Region laboratory in the spring of 2008. The three dominant sediment types were sand and mud or a combination of both. The sediment analysis was completed in the fall by lab technicians at DFO Gulf region. A more detailed description of the procedure is included in Weldon et al. 2005.

Table 3. Summary of average % organic content (± S.D.), % moisture content (± S.D.), and mean grain size (MGS) for all the baseline locations (n = 6).

	% Moisture	% Organic	mean Grain Size MGS (mm)
N.B.	**September**		
Caraquet	**21.18 ± 3.78**	**0.99 ± 0.22**	**0.32 ± 0.16**
Lamèque	**22.47 ± 2.59**	**1.53 ± 0.17**	**0.61 ± 0.68**
Shippagan	**20.53 ± 2.49**	**0.96 ± 0.25**	**0.47 ± 0.12**
Tracadie	**25.84 ± 1.33**	**1.70 ± 0.56**	**0.30 ± 0.09**
Tabusintac	**22.72 ± 4.06**	**1.56 ± 0.34**	**0.62 ± 0.55**
Miramichi	**30.67 ± 14.62**	**4.35 ± 6.56**	**0.28 ± 0.12**
St. Louis de Kent	**23.41 ± 2.70**	**1.43 ± 0.54**	**0.34 ± 0.26**
Richibucto	**22.10 ± 1.41**	**1.27 ± 0.37**	**0.56 ± 0.51**
Bouctouche	**27.81 ± 9.05**	**3.18 ± 1.77**	**0.36 ± 0.23**
Cocagne	**21.13 ± 2.78**	**1.15 ± 0.65**	**0.47 ± 0.27**
Shediac	**29.51 ± 10.82**	**2.12 ± 1.54**	**0.37 ± 0.08**
Scoudouc	**22.48 ± 1.58**	**1.21 ± 0.29**	**0.25 ± 0.04**
Jourimain	**23.97 ± 2.75**	**0.55 ± 0.19**	**0.54 ± 1.71**
average for NB	**24.14 ± 4.6**	**1.69 ± 0.55**	**0.42 ± 0.37**
N.S.	**% Moist**	**% Organic**	**MGS**
Philip	**20.77 ± 3.85**	**0.28 ± 0.12**	**0.61 ± 0.72**
Pugwash	**30.98 ± 27.85**	**9.25 ± 20.15**	**0.79 ± 0.67**
Pictou	**22.40 ± 12.92**	**2.33 ± 2.70**	**1.00 ± 0.83**
Antigonish	**22.18 ± 16.61**	**2.67 ± 4.07**	**1.75 ± 0.75**
Mabou	**23.69 ± 5.75**	**0.87 ± 0.60**	**0.61 ± 0.72**
average for NS	**24.00 ± 13.40**	**3.08 ± 5.53**	**0.95 ± 0.74**
PEI	**% Moist**	**% Organic**	**MGS**
Mill River	**21.00 ± 4.07**	**0.68 ± 0.26**	**0.50 ± 0.60**
Trout River	**23.75 ± 3.54**	**1.16 ± 0.74**	**0.53 ± 0.73**
Summerside	**18.70 ± 2.73**	**0.53 ± 0.12**	**0.35 ± 0.14**
Basin Head	**30.09 ± 16.55**	**3.18 ± 5.60**	**0.31 ± 0.06**
Murray	**15.65 ± 5.40**	**0.74 ± 0.22**	**1.17 ± 0.73**
Mont.- Brudenell	**21.27 ± 4.06**	**0.60 ± 0.27**	**0.59 ± 0.52**
Pinette	**23.98 ± 5.59**	**1.51 ± 1.47**	**0.29 ± 0.07**
average for PEI	**22.06 ± 5.99**	**1.20 ± 1.24**	**0.53 ± 0.41**

In New Brunswick, the Miramichi samples had the highest average value for percent moisture content at 30.67 with Shediac close behind at 29.51, though all sites fell between 20.53 and

30.67. In New Brunswick, percent moisture content averaged 24.1% over all 13 locations. This is an increase of almost two percentage points from last year at 22.3 %.

Miramichi has the highest percent organic content (4.35) compared to the next nearest in Bouctouche (3.18). Every location had lower values for organic content than in 2006. The average for percent organic was 1.7% in 2007, down from the 5.4% in 2006 and similar to the 2.0% in 2005. The average mean grain size for the 13 locations was 0.42 which corresponds to fine sand category (Weldon et al. 2005) compared to 0.47 in 2006 for 12 locations.

In Nova Scotia, Pugwash had the highest percent moisture content at 30.98 compared to the lowest at 20.77. Percent moisture content averaged 24.0% over all five locations. This is an increase from the last year average at 20.8 %. Pugwash also had the highest percent organic content at 9.25. The average for the five locations for the percent organic content was 3.1% up from the 2.3% in 2006. The average mean grain size for the five locations was 0.95 which corresponds to coarse to medium sand compared to 1.3 in 2006 for two locations (other two not available).

In Prince Edward Island, the Basin Head samples had the highest average value for percent moisture content at 30.09 with the lowest being 15.65. Percent moisture content averaged 22.1% over all seven locations. This is a slight increase from last year at 21.3 %. Basin Head also had the highest percent organic content at 3.18. The average for seven locations for percent organic was 1.2% in 2007, down from the 1.6% in 2006. The average mean grain size for the seven locations was 0.53 which corresponds to medium sand compared to 0.28 in 2006 for six locations.

One general observation is that mud bottoms with characteristic small mean grain size had higher percentages of both organic matter and moisture. The opposite patterns exist for sandy bottom locations. Overall, all three provinces show increases for average percent moisture, two show decreases for average total organic and two show decreases for average total mean grain size.

Each time in September a sediment sample is taken in approximately the same place, but keep in mind the effect stage of tide has on the sampling. As referred to repeatedly, mud can be taken at lower tide and sand at a higher tide. Averaging the results over the five years will provide an accurate averaged description of the sites at each location.

3.4 Macrophyte Cover

Percent vegetation cover was estimated using the sampling grid as described in Weldon et al. (2005). A modification to the standardized method for evaluating macrophyte coverage will reduce variability among volunteer samplers. In 2007, each NGO was introduced to the use of a one to five number scale to provide percentage vegetative cover in each or the four sections of the standard quadrat. Number "0" means zero percent vegetation present. Number "5" means 100% vegetation cover. Numbers one, two, three and four represent 0 - <25%, 25 - <50% and 50 - <75%, 75 - < 100% respectively.

For **Tables 4** and **5**, the legend or code was developed to indicate what plant material was present in the quadrat. This enables the individual NGO's to look at the stations and see patterns or trends that may be taking place over the five months of sampling. All together there is data for 12 squares per station (three throws of the quadrat times four sub-quadrats) which was averaged across the 12 sub-squares. This table only describes more than or less than 50% of the squares having vegetation. It does not summarize what percentage of vegetation cover is seen in the square, only that there was vegetation present. Exact percentages can be found in data sheets for the sites, and this may be presented in the summary report to be available in 2009. The table uses the categories from the newly refined vegetation data sheet as reference to what dominant vegetation was present. The categories from the data sheet include the following:

Seed Plants includes Eelgrass - *Zostera marina* and Widgeon (Ditch) Grass - *Ruppia maritime* represented by the letter "S or s".

Green Seaweeds includes Sea Lettuce - *Ulva lactuca*, Hollow Green Weed - *Enteromorpha sp.* and Green Fleece - *Codium fragile* represented by the letter "G or g".

Brown Seaweeds includes the Rockweeds - *Fucus sp.*, Kelps - *Laminaria sp.*, Tangleweeds and Knotted Wrack - *Ascophyllum nodosum* represented by the letters "B or b".

The less plentiful others were represented by "O or o". These would include representatives from the following, listed in order of frequent to less frequently encountered: the various green, brown and red filamentous seaweed species and the red seaweed - Irish Moss - *Condrus crispus*. Some refinement of these categories will occur in 2008.

The following legend should be used to interpret what was seen at the site for each location for each of the five months the site was sampled.

S = Seed plants mostly eelgrass; capital "S" means six or more quadrates with vegetation, "s" is less than six of the 12 small sub-quadrate had vegetation

G = Green algae mostly Ulva; capital "G" means six or more, "g" is less than six of the 12 small sub-quadrates had vegetation

B = Brown algae mostly Fucus; capital "B" means six or more, "b" is less than six of the 12 small sub-quadrates had vegetation

O = Others which could include filamentous species or red algae; capital "O" means six or more, "o" is less than six of the 12 small sub-quadrates had vegetation

The first letter indicates the more abundant species recorded on the day of sampling. A zero "0" means no vegetation was recorded (note the subtle difference of the letter "O" and the number “0”). If wind and wave action made viewing impossible, the not available “n/a” was used. This was also used for the rare case where volunteers forgot to record anything during their visit.

Table 4. Composition of the vegetation profile showing presence in the quadrat from six sample sites at all locations in New Brunswick for the five months in 2007.

Cara	**stn**					
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	b-s	0	s	0	n/a	g
June	B-G	0	s	G	n/a	G-b
July	B	0	S-o	o	0	s
Aug.	B	0	s	n/a	0	G-b
Sept.	B	n/a	n/a	n/a	n/a	G-b

Lamè	**stn**					
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	s-g	n/a	G-o	n/a	b-g	b
June	S-G	G-o	G	S	n/a	n/a
July	0	g	G-b	0	G-b	S-G
Aug.	G-s	S-g	G-b	G	S-G	S-G
Sept.	S-g	S-g	G	G	Sgb	s-G

Shipp	**stn**					
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	0	0	b	0	n/a	0
June	O	S	G	G	0	S
July	S	s	S	S	sgb	S
Aug.	S-O	S-G	s-g	0	G	s-G
Sept.	G	G	G	0	g	g

Trac						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	0	0	s	0	s	0
June	s	s	S	S	S	S
July	S	S	S	S	S	S
Aug.	S	S-g	S	S	S	S
Sept.	S	0	S	s	S	s

Tabu						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	s-g	0	n/a	n/a	n/a	0
June	o	0	s-o	n/a	n/a	g
July	0	0	s	0	S	0
Aug.	0	0	0	0	0	0
Sept.	0	0	S	0	S	0

Mira						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	0	0	0	n/a	n/a	s-o
June	n/a	g	o	g	n/a	n/a
July	0	0	0	n/a	sgb	0
Aug.	o	o	0	n/a	0	0
Sept.	0	b	n/a	n/a	n/a	s-o

St.L						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	S	n/a	0	0	s	s
June	S	0	S	s	s-g	S
July	S	S	S	s	Sgo	S
Aug.	0	s	s	S	Sgo	S
Sept.	s	S	0	s	0	s

Rich						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	0	0	0	0	0	S
June	s	0	0	0	0	0
July	s	b	b	0	b	S-b
Aug.	0	0	0	0	0	S
Sept.	0	S	0	s	g	0

Bouct						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	n/a	n/a	0	n/a	n/a	g-o
June	0	n/a	g	G	G	G-o
July	0	n/a	g-s	g	0	n/a
Aug.	0	n/a	0	G	n/a	S-G
Sept.	g-b	g	n/a	gbo	G-o	G-s

Coca						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	o	n/a	0	n/a	n/a	n/a
June	sgo	s-o	S-g	n/a	G	gos
July	S-O	S	0	S-g	S-G	sgo
Aug.	0	G	S-O	n/a	n/a	n/a
Sept.	s	S-g	s-G	s-G	n/a	S-g

Shed						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	G-O	O	s	o	S	S
June	s-g	sgo	0	g-o	g-b	s
July	S-b	0	0	g	0	0
Aug.	n/a	Sgo	n/a	G	g-O	SGO
Sept.	s	S-g	S	G-s	O-s	SgO

Scou						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	0	n/a	b	o	0	n/a
June	0	0	s-o	0	O	S-O
July	0	sgo	s	G-s	SGO	S-O
Aug.	0	g-o	0	0	0	g
Sept.	g	g	0	g	g-s	0

Jouri						
mth	**1**	**2**	**3**	**4**	**5**	**6**
May	0	0	0	0	0	0
June	n/a	n/a	0	o	s	B
July	o	o	0	0	o	o
Aug.	0	o	0	0	o	b
Sept.	0	0	0	0	0	0

Table 5. Composition of the vegetation profile showing presence in the quadrat from six sample sites at all locations in Prince Edward Island and Nova Scotia for the five months in 2007.

PEI

Mill — stn

mth	1	2	3	4	5	6
May	g	s-g	S	S	G-s	G
June	G	S-G	O	o	G	g
July	n/a	G	G	g	G	G
Aug.	G	G	0	0	G	G
Sept.	G	0	g	G	g	G

Sum — stn

mth	1	2	3	4	5	6
May	b-o	b	b	0	0	0
June	n/a	n/a	0	g	g	G
July	n/a	G	s	0	g	g
Aug.	g	G	g	G	G	G
Sept.	S-g	n/a	s	g	g	g

Trou — stn

mth	1	2	3	4	5	6
May	G	g	S	S	sgo	g
June	n/a	n/a	S	S-g	sgo	s-G
July	S-o	n/a	S	S	S-O	S-g
Aug.	Sgo	0	S	S-G	Sbo	G
Sept.	s-g	G	S	s-G	sgb	G

Basin

mth	1	2	3	4	5	6
May	s-g	0	s-g	0	s	s
June	S	S	S	n/a	s	G
July	0	0	s	S	g	G
Aug.	S	S	0	g	s	G
Sept.	0	0	0	0	0	sgo

Mon - Bru

mth	1	2	3	4	5	6
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug.	0	0	0	0	0	0
Sept.	s	S	0	0	S	s

Murr

mth	1	2	3	4	5	6
May	0	0	0	0	g-b	0
June	0	0	n/a	g	0	n/a
July	n/a	0	S	s	S	S
Aug.	s	s	0	s	s	0
Sept.	0	s	0	0	s	0

Pine

mth	1	2	3	4	5	6
May	0	0	n/a	n/a	s	S
June	S	0	0	0	0	0
July	S	S	0	0	0	s
Aug.	S	S-g	s-o	o	s	S
Sept.	s	S	s-o	0	s	S

NS

Phil

mth	1	2	3	4	5	6
May		no		sample		
June	B	0	S	s-g	o	0
July	B	b	S	g	O	0
Aug.	B	0	S	S	O	0
Sept.	B	s-o	O	O	b-O	O

Pugw

mth	1	2	3	4	5	6
May	S	0	b-o	b	0	0
June	S	b	0	O	0	n/a
July	0	S	b	b	0	s-b
Aug.	O	S	n/a	n/a	b	n/a
Sept.	O	O	0	0	0	0

Pict

mth	1	2	3	4	5	6
May	G	G-O	G	0	0	b
June	n/a	G-O	gbo	0	n/a	b
July	o	n/a	g	0	0	b
Aug.	o	0	g-o	0	0	0
Sept.	s-g	s	g	0	n/a	0

Anti

mth	1	2	3	4	5	6
May	g	S-g	o	O	O	O
June	S	n/a	g-o	0	b-O	0
July	S	s-G	b-o	0	0	b
Aug.	O	B-o	s	0	0	0
Sept.	S	B-o	b-o	0	o	0

Mabo

mth	1	2	3	4	5	6
May	g	B	B	g-b	G-B	B
June	S	S	s	B	G-B	B
July	S	S-b	s	s-b	G-b	B
Aug.	S	S-b	S	sgb	S	B
Sept.	S	S	S	s-B	S	B

When considering all locations from all three provinces, the dominant vegetation present was the submerged eelgrass beds. When present, the eelgrass bed was located in the outer 1/5th or just beyond the sample sweep area. Generally, upper estuary sites in the river system contain more eelgrass beds than the outer portion that is closer to the mouth or associated with a beach area. When a vegetation bed was present, the number of fish and invertebrates collected was usually higher as more habitats for the pelagic species were available. An increase in vegetation was most noticeable where mud bottom substrates supported eelgrass vegetation. When sampling at higher tides, the vegetation bed was often not swept by the beach seine. A continuing concern to NGO volunteers was the accumulation of unattached material in the beach seine at a sample site. Large collections of floating algae such as sea lettuce and eelgrass could hinder the effectiveness of collections by smothering fish before they could be counted and released unharmed. Since it was impossible to sweep a net through certain sites in mid-summer, due to the large volumes of un-attached algae, some station relocations were necessary. These stations were moved, but for as short a distance as possible, so a level of comparability was maintained. This year, the moving of sites was minimal, but potential changes are evaluated at the end of each season after consultation with area office coordinators.

Sites with larger rocks are likely to include species of rockweed (usually *Fucus vesiculosus*). Other abundant macrophyte vegetation included sea lettuce (*Ulva lactuca*) and filamentous green algae (*Cladophora sp*.). In northern NB and at a few NS sites hollow green weed (*Enteromorpha intestinalis*) was noticeable but not abundant. On many occasions, NGO volunteers have found floating unattached pieces of kelp species (*Laminaria*) and the invasive green fleece (*Codium fragile*) in the net sweep. These species are usually attached by a holdfast in deeper water. Vegetation type is important as it defines the variety of available habitats. Preference of YOY pelagics and juvenile crustaceans for protective cover from predators usually translates into greater numbers when vegetation is present.

These vegetation cover indicators fluctuated throughout the season and do show variation from year to year. Percent vegetation cover using the one – five number scale is a qualitative measure because some is attached (eelgrass and rockweed) and some is floating as was observed with sea lettuce. The spring observations have lower values for vegetation but as a season progressed, the vegetation present generally increased.

The quadrat method described in Weldon et al. (2005) is effective when the water has not been stirred up. In 2006, it was suggested that the quadrat be thrown parallel to the shore at a mid depth from shore, usually at a distance where the bottom could still be seen. This protocol was followed in 2007 as well. The NGO's were instructed to make a detailed record of the characteristics of the bottom profile for each station each month so comparisons could be made as the season progressed. Characteristic broken off wash up of all plant material in the shoreline berm was also recorded. Over time an averaging of the results of the site for every station will produce the best possible picture of the vegetation profile. Also, the changes from year to year, though often subtle can be determined. But these observations can still be complicated by a variety of factors. The most obvious would be the results recorded can change depending on what stage of tide the site was visited, so it becomes important to try and visit the site at the same tide stage each month and hopefully carry this pattern over to successive years.

3.5 Physical Measures

At each sample location and at every station, three physical parameters were measured on each occasion. Readings for water temperature, salinity and dissolved oxygen provide a monthly snapshot of conditions at each site (**Tables 6 - 8**).

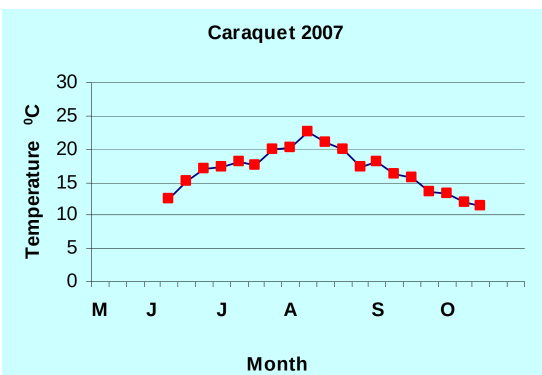
Table 6. Average monthly temperature (^{0}C ± S.D.) per site for the 2007 season (n = 6). (NA = not available)

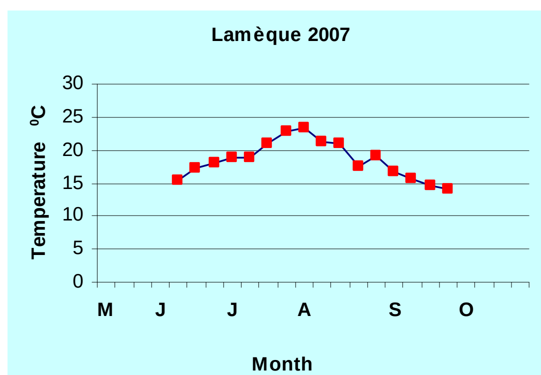
	Temp ^{0}C ± S.D.				
N.B.	**May**	**June**	**July**	**Aug.**	**Sept.**
Caraquet	**14.1 ± 2.6**	**20.3 ± 2.4**	**26.3 ± 3.4**	**21.4 ± 2.7**	**12.4 ± 1.4**
Lamèque	**10.9 ± 0.6**	**21.0 ± 0.6**	**22.8 ± 0.2**	**18.8 ± 0.9**	**11.6 ± 0.4**
Shippagan	**12.3 ± 1.2**	**22.1 ± 1.3**	**28.4 ± 1.5**	**24.8 ± 2.1**	**12.4 ± 0.5**
Tracadie	**12.7 ± 1.4**	**18.5 ± 1.1**	**25.0 ± 0.8**	**20.1 ± 2.3**	**12.9 ± 1.4**
Tabusintac	**14.1 ± 0.8**	**18.1 ± 0.7**	**24.8 ± 0.3**	**19.4 ± 0.6**	**14.0 ± 1.0**
Miramichi	**13.7 ± 1.2**	**19.3 ± 1.0**	**21.4 ± 0.8**	**20.0 ± 1.4**	**16.4 ± 0.9**
St Louis	**14.9 ± 1.2**	**20.7 ± 1.2**	**26.3 ± 1.9**	**21.5 ± 0.7**	**16.9 ± 0.6**
Richibucto	**11.1 ± 0.6**	**18.2 ± 0.9**	**23.1 ± 1.3**	**20.0 ± 0.7**	**15.7 ± 0.7**
Bouctouche	**13.9 ± 2.3**	**19.0 ± 0.1**	**22.4 ± 0.6**	**19.8 ± 2.4**	**19.5 ± 3.5**
Cocagne	**12.1 ± 1.4**	**22.5 ± 2.7**	**25.8 ± 1.4**	**17.4 ± 1.1**	**16.7 ± 1.2**
Shediac	**17.2 ± 2.0**	**21.1 ± 1.3**	**25.5 ± 0.9**	**20.6 ± 1.7**	**14.7 ± 1.3**
Scoudouc	**15.8 ± 0.9**	**18.7 ± 1.9**	**23.2 ± 1.4**	**21.9 ± 0.4**	**18.4 ± 0.3**
Jourimain	**13.3 ± 1.8**	**19.0 ± 1.5**	**22.2 ± 2.2**	**20.5 ± 1.3**	**16.9 ± 0.7**
Average NB	**12.1 ± 1.4**	**19.9 ± 1.3**	**24.4 ± 1.3**	**20.5 ± 1.4**	**15.3 ± 1.1**
N.S.					
Philip	**N/A**	**19.7 ± 0.6**	**24.1 ± 0.7**	**22.1 ± 1.1**	**16.3 ± 1.2**
Pugwash	**10.4 ± 0.8**	**17.7 ± 0.2**	**24.1 ± 2.1**	**20.7 ± 0.4**	**19.6 ± 2.6**
Pictou	**12.9 ± 2.2**	**18.4 ± 2.4**	**25.2 ± 3.3**	**22.4 ± 1.4**	**18.7 ± 2.5**
Antigonish	**13.1 ± 1.7**	**17.7 ± 1.2**	**24.3 ± 1.4**	**22.0 ± 1.2**	**15.7 ± 1.1**
Mabou	**9.6 ± 0.6**	**17.2 ± 1.3**	**24.2 ± 1.1**	**18.5 ± 1.5**	**17.6 ± 1.1**
Average NS	**11.5 ± 1.3**	**18.1 ± 1.1**	**24.4 ± 1.7**	**21.1 ± 1.1**	**17.6 ± 1.7**
P.E.I.					
Mill River	**14.8 ± 1.5**	**19.2 ± 1.0**	**25.1 ± 0.5**	**21.9 ± 1.0**	**17.0 ± 0.4**
Trout River	**15.1 ± 3.1**	**20.2 ± 2.3**	**25.1 ± 1.3**	**20.2 ± 1.3**	**16.8 ± 1.3**
Summerside	**10.7 ± 1.0**	**18.7 ± 1.0**	**19.2 ± 1.2**	**21.6 ± 1.2**	**18.7 ± 2.5**
Basin Head	**8.2 ± 0.4**	**18.7 ± 0.9**	**22.2 ± 0.9**	**20.4 ± 2.6**	**12.9 ± 0.2**
Mont.-Brudenell	**9.7 ± 2.3**	**14.9 ± 0.4**	**18.2 ± 0.9**	**20.5 ± 0.6**	**17.8 ± 0.2**
Murray	**10.6 ± 0.8**	**14.5 ± 0.9**	**19.8 ± 1.3**	**20.9 ± 0.8**	**18.9 ± 0.8**
Pinette	**11.9 ± 0.3**	**13.1 ± 0.6**	**19.8 ± 0.8**	**21.5 ± 0.3**	**19.0 ± 2.8**
Average PEI	**11.6 ± 1.3**	**17.0 ± 1.0**	**21.3 ± 1.0**	**21.0 ± 1.1**	**17.3 ± 1.2**

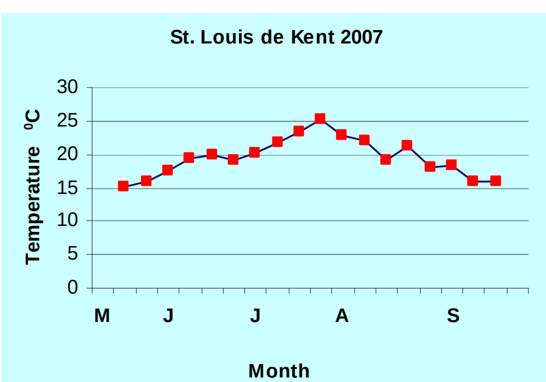
Each estuary has its own temperature characteristics. **Table 6** reflects the average temperature on the day of sampling after averaging all six stations in the estuary. There are individual differences depending on whether the sample site is inner, middle or outer estuary as is reflected in the standard deviation values. Temperature was obviously related to seasonal increases and decreases in air temperatures as spring moved to fall; hence the warmest temperatures occurred in July and August. Also, warmest air temperature in the early afternoon could affect water temperature later in the afternoon. Examining the data from 2006 and 2007, a couple of patterns are evident. In 2007, generally the May and June average temperature was slightly less than in 2006 but became slightly higher in July and August and remained about the same in September. In most cases the temperature difference was small, often less than one degree centigrade. Going back to the first year of CAMP data (Weldon et al 2005), the few locations that have continuous temperatures recorded do show an obvious increase in almost every location for the months compared.

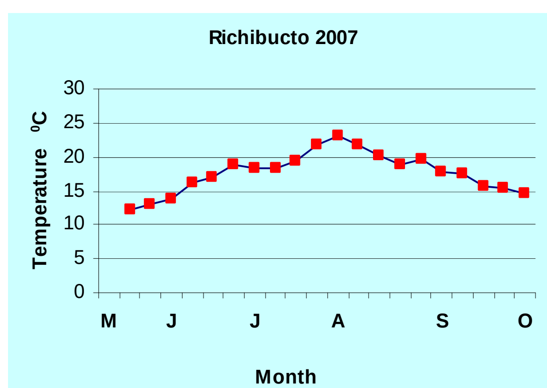
In 2007, one Vemco continuous temperature minilog probe was deployed in each CAMP estuary/coastal location. In most cases, the loggers were attached to a wooden stake and then screwed into a floating dock structure. Recovery rates were slightly less than 2006, and there was a new learning experience. The bivalve *Teredo navalis* (common name shipworm) was a very effective infiltrator of the wooden stakes. In the short CAMP season they were very efficient in penetrating the untreated wooden stake and their network of burrowed holes weakened the structure just below the water level. Subsequent strong wind and waves would cause the stakes to break off in many locations. Many stakes were recovered and would have been lost in another month due to the shipworm's activity. In 2008 this will be addressed by using metal stakes.

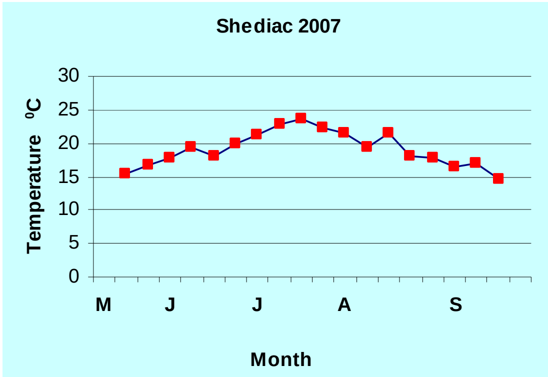
The loggers were set to record at hourly intervals and the graphed data represent weekly averages. The following graphs represent those weekly averages for those locations where probe information was available.

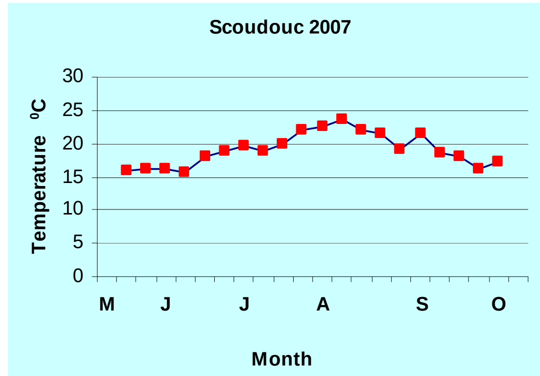


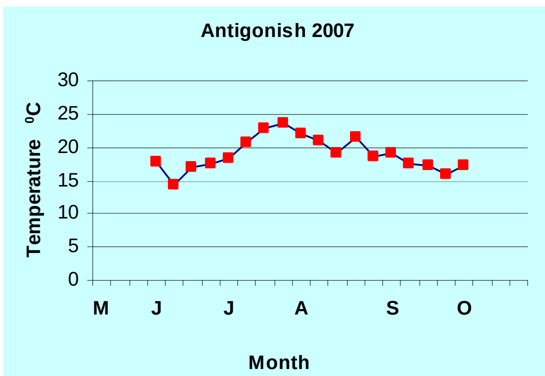


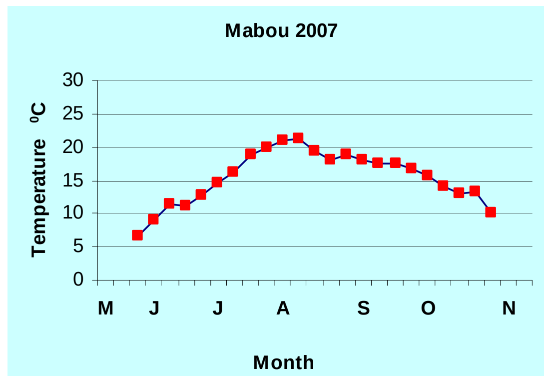


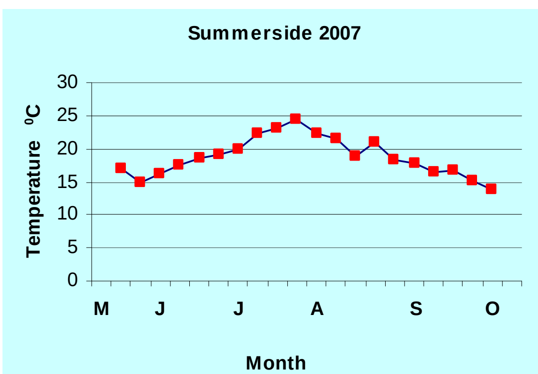


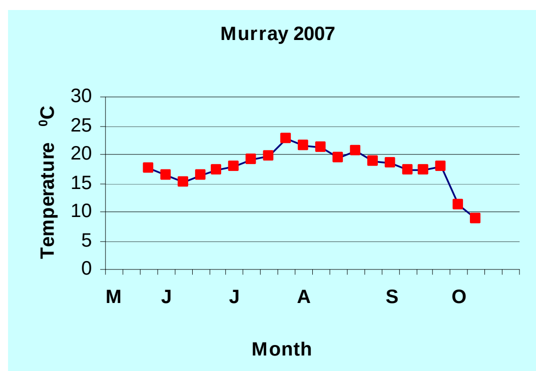












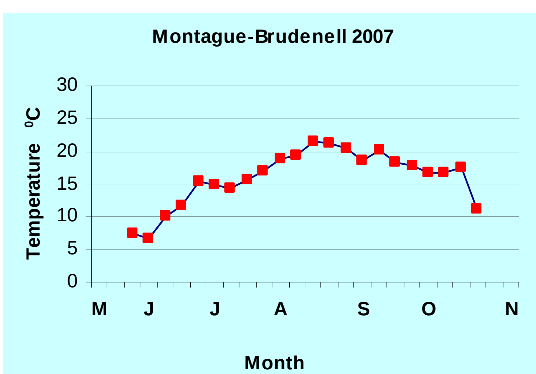


Figure 8. Graphs representing the weekly mean temperature (°C) determined from hourly readings from Vemco minilog temperature recorders for all sites involved in the 2007 sampling season for CAMP

In New Brunswick, three of the six locations show slight overall increases in surface temperature from the comparable locations in 2006. Shediac was slightly lower than 2006 and Richibucto remained about the same. All six locations show a drop of about two degrees centigrade in mid-August followed by an increase to previous levels in late August-early September. If this decline were correlated to weather at that time, it would seem there was a cold spell in that two week period. It is not practical to bring weather variables into this analysis at this time. Noticeable is the slight differences between the adjacent Scoudouc and Shediac rivers possibly attributable to one location being farther out at the mouth of the estuary (Shediac) compared to the inner location of the other (Scoudouc). All six graphs showed a gradual spring increase in surface water temperature to a high in early August followed by the expected decline as air temperatures cool in September.

In Nova Scotia, only Mabou could be compared to 2006 values and no average temperature differences are apparent. The two locations, Antigonish being the other, did also show the same approximate two degree drop in mid-August as the sites in New Brunswick. The probe was also in the water longer in Mabou.

In Prince Edward Island, minilog recovery was poor also with only two from the east and the one in Summerside being returned. The only comparable location, Montague-Brudenell was slightly warmer in 2007 than 2006. The same drop in temperature as the other two provinces occurred in mid August in Summerside and Murray locations but was two weeks later in Montague-Brudenell.

Values for salinity (**Table 7**) can vary extensively among sites at each location which can be noticed by examining the standard variation values. When monthly averages were examined monthly variations were not extreme. If the tide was just starting to recede in the upper estuary, the salinity would naturally be higher than if the tide had not come in yet due in part to greater influence from headwaters leaving the estuary. As much as possible, groups attempted to sample on a similar tide regime each month. Each year, their efforts in coordinating sampling times have improved. Stations are usually visited on a rising tide that continues to reach its fullest and starts to drop during the four to five hours it generally takes to complete all six CAMP stations. Since the groups try to start out sampling each morning, this regime sometimes has to be adjusted. There have been instances where sampling is carried out over two days. There are other circumstances, such as new and full moon tides that make the station unsatisfactory for a visit as the tide is too high. Drastic weather changes during the day can also make sampling uncomfortable or even possibly unsafe. One difference to note from the 2006 table is that Shediac River has been added in 2007. In past reports this location called Shediac was more precisely the Scoudouc River which it will be referred to for all future reference.

In the upper estuary samples, salinity was generally lower as expected due to the large fresh water influence. There is monthly variation. The dominant pattern is that early months have lower salinities for most locations, probably due to run-off related to spring snow melt. This was more noticeable in systems like Bouctouche, St. Louis, Tabusintac and the Miramichi rivers. Other locations were sampled more towards the mouth where this influence was less pronounced. Middle sites in most locations vary in salinity, and this probably can be attributed to the state of the tide. Incoming tides bring in higher salt water content as compared to the increase in fresh water outflow when the tide was receding. The outer stations had the higher salinities. The comparison of salinities from the two years was in close agreement for the last two years for all locations throughout the Gulf Region.

Table 7. Average monthly salinity (ppt ± S.D.) per location for the 2007 season (n = 6). (NA = not available)

	Salinity (ppt) ± S.D.				
N.B.	**May**	**June**	**July**	**Aug**	**Sept**
Caraquet	**24.3 ± 2.0**	**25.3 ± 1.5**	**25.7 ± 0.7**	**25.6 ± 1.6**	**26.5 ± 1.6**
Lamèque	**26.0 ± 1.1**	**26.3 ± 1.0**	**26.3 ± 2.0**	**26.0 ± 3.0**	**27.7 ± 0.4**
Shippagan	**27.6 ± 1.3**	**27.2 ± 0.6**	**26.5 ± 1.6**	**27.0 ± 2.0**	**28.5 ± 0.3**
Tracadie	**20.9 ± 3.6**	**24.3 ± 2.2**	**26.1 ± 1.8**	**25.3 ± 2.8**	**27.4 ± 0.3**
Tabusintac	**13.5 ± 2.8**	**18.2 ± 4.5**	**19.7 ± 4.4**	**22.7 ± 2.9**	**23.5 ± 1.9**
Miramichi	**13.9 ± 6.0**	**16.3 ± 5.8**	**18.8 ± 6.0**	**17.6 ± 6.4**	**18.5 ± 5.4**
St Louis	**7.7 ± 5.8**	**15.1 ± 4.3**	**15.1 ± 2.8**	**21.5 ± 2.2**	**22.1 ± 1.9**
Richibucto	**15.0 ± 3.2**	**25.4 ± 1.3**	**21.9 ± 2.1**	**25.9 ± 1.1**	**26.8 ± 1.2**
Bouctouche	**9.5 ± 2.4**	**24.0 ± 0.7**	**24.3 ± 0.6**	**23.9 ± 1.0**	**24.3 ± 0.6**
Cocagne	**16.0 ± 3.3**	**24.4 ± 3.0**	**23.0 ± 3.0**	**27.7 ± 0.6**	**27.5 ± 0.8**
Shediac	**18.8 ± 2.5**	**21.4 ± 2.3**	**25.2 ± 1.3**	**24.2 ± 2.3**	**21.8 ± 2.7**
Scoudouc	**22.0 ± 2.2**	**22.5 ± 1.3**	**25.2 ± 0.6**	**27.0 ± 0.5**	**27.7 ± 0.2**
Jourimain	**27.7 ± 0.5**	**26.8 ± 1.1**	**27.8 ± 0.2**	**28.2 ± 0.1**	**28.2 ± 0.2**
Average NB	**18.7 ± 2.8**	**22.9 ± 2.3**	**23.5 ± 2.1**	**24.8 ± 2.0**	**25.4 ± 1.3**
N.S.					
Philip	**N/A**	**25.0 ± 2.3**	**28.0 ± 0.6**	**25.0 ± 2.4**	**28.2 ± 0.8**
Pugwash	**21.9 ± 5.4**	**22.6 ± 5.6**	**27.8 ± 0.8**	**29.0 ± 0.3**	**26.6 ± 0.7**
Pictou	**19.5 ± 3.7**	**13.0 ± 8.5**	**24.2 ± 6.3**	**23.3 ± 2.8**	**28.1 ± 0.8**
Antigonish	**20.3 ± 5.0**	**14.4 ± 7.7**	**19.9 ± 5.1**	**18.4 ± 5.0**	**26.5 ± 2.5**
Mabou	**20.8 ± 1.1**	**16.6 ± 9.1**	**19.4 ± 7.9**	**2.7 ± 0.8**	**16.0 ± 2.9**
Average NS	**20.6 ± 3.8**	**18.3 ± 6.6**	**23.9 ± 4.1**	**19.7 ±2.3**	**25.1 ± 1.5**
P.E.I.					
Mill River	**18.9 ± 2.0**	**23.2 ± 1.8**	**24.8 ± 0.9**	**25.1 ± 1.2**	**25.1 ± 0.9**
Trout River	**15.9 ± 9.5**	**18.9 ± 7.5**	**24.1 ± 2.4**	**22.0 ± 5.6**	**24.7 ± 4.3**
Summerside	**24.1 ± 5.2**	**21.5 ± 7.9**	**19.5 ± 8.7**	**23.7 ± 3.8**	**24.7 ± 2.9**
Basin Head	**28.9 ± 0.5**	**26.1 ± 2.3**	**28.4 ± 0.3**	**23.2 ± 2.0**	**28.4 ± 0.8**
Mont.-Bruden	**28.1 ± 0.2**	**26.9 ± 1.4**	**27.6 ± 0.8**	**27.1 ± 1.0**	**28.3 ± 0.3**
Murray	**27.5 ± 0.9**	**27.2 ± 1.3**	**28.3 ± 1.1**	**25.4 ± 8.5**	**27.5 ± 0.9**
Pinette	**26.9 ± 0.8**	**27.9 ± 0.4**	**28.0 ± 0.4**	**26.9 ± 0.6**	**26.1 ± 1.3**
Average PEI	**24.3 ± 2.7**	**24.5 ± 3.2**	**25.8 ± 2.1**	**24.8 ± 3.2**	**26.4 ± 1.6**

In New Brunswick, lower salinities were noted for St. Louis de Kent and Miramichi estuaries because they were sampled further up the estuary than other sites in NB. These two longer estuaries had lower salinities in the upper sites and higher salinities at the mouth. The stations located farther up river were changed in 2007 and moved downriver where the salinity range is comparable to the other locations.

Dissolved oxygen values (**Table 8**) were taken at each station after completion of the beach sampling. The average of the six stations was used to provide a value for that sampling location for that month and summarized in the table below.

Table 8. Average monthly dissolved oxygen (mg/l ± S.D.) per location for the 2007 season (n = 6). (NA = not available)

	Dissolved Oxygen (mg/l) ±S.D.				
N.B.	**May**	**June**	**July**	**Aug**	**Sept**
Caraquet	**10.5 ± 1.8**	**9.1 ± 1.4**	**8.9 ± 1.4**	**9.2 ± 1.8**	**8.9 ± 0.2**
Lamèque	**9.1 ± 0.4**	**10.6 ± 4.2**	**5.0 ± 0.6**	**7.3 ± 1.6**	**6.5 ± 1.4**
Shippagan	**9.3 ± 0.3**	**8.9 ± 1.0**	**10.2 ± 1.0**	**12.8 ± 3.4**	**9.0 ± 1.7**
Tracadie	**9.1 ± 0.6**	**8.0 ± 1.2**	**9.0 ± 2.0**	**9.8 ± 1.2**	**6.9 ± 1.9**
Tabusintac	**9.1 ± 1.1**	**6.9 ± 0.7**	**7.8 ± 0.7**	**7.3 ± 1.1**	**6.4 ± 0.8**
Miramichi	**13.0 ± 0.6**	**10.6 ± 0.5**	**10.8 ± 1.2**	**11.6 ± 1.2**	**12.1 ± 1.0**
St Louis	**8.2 ± 3.3**	**8.5 ± 0.5**	**8.1 ± 1.7**	**7.6 ± 0.4**	**8.9 ± 0.8**
Richibucto	**10.7 ± 0.3**	**8.3 ± 0.6**	**9.3 ± 1.5**	**8.4 ± 1.4**	**9.4 ± 0.9**
Bouctouche	**10.1 ± 0.6**	**6.8 ± 0.4**	**6.6 ± 0.7**	**9.2 ± 6.7**	**6.6 ± 0.7**
Cocagne	**10.3 ± 0.2**	**8.9 ± 1.0**	**9.8 ± 1.6**	**6.8 ± 0.5**	**6.8 ± 0.9**
Shediac	**9.5 ± 2.1**	**8.8 ± 1.9**	**5.9 ± 1.4**	**8.7 ± 1.4**	**10.6 ± 1.8**
Scoudouc	**8.7 ± 0.3**	**10.3 ± 2.0**	**8.0 ± 1.8**	**6.4 ± 0.8**	**5.9 ± 0.5**
Jourimain	**8.3 ± 1.5**	**6.6 ± 0.9**	**7.1 ± 0.4**	**8.2 ± 1.5**	**7.9 ± 0.4**
Average NB	**9.7 ± 1.0**	**8.6 ± 1.3**	**8.2 ± 1.2**	**8.7 ± 1.8**	**8.1 ± 1.0**
N.S.					
Philip	**N/A**	**8.9 ± 0.4**	**9.0 ± 1.0**	**9.7 ± 1.9**	**7.3 ± 0.5**
Pugwash	**10.0 ± 0.4**	**9.5 ± 0.6**	**8.9 ± 0.7**	**9.2 ± 0.4**	**10.2 ± 2.0**
Pictou	**10.0 ± 1.6**	**9.6 ± 2.6**	**9.7 ± 1.9**	**9.0 ± 0.7**	**11.1 ± 0.6**
Antigonish	**10.7 ± 0.7**	**11.0 ± 2.0**	**9.0 ± 1.4**	**9.1 ± 1.5**	**13.4 ± 3.1**
Mabou	**10.4 ± 0.2**	**9.0 ± 0.8**	**7.4 ± 0.4**	**7.9 ± 0.6**	**7.5 ± 1.4**
Average NS	**10.3 ± 0.7**	**9.6 ± 1.3**	**8.8 ± 1.1**	**9.0 ± 1.0**	**9.9 ± 1.5**
P.E.I.					
Mill River	**10.6 ± 1.4**	**9.3 ± 1.3**	**6.2 ± 1.6**	**8.2 ± 2.4**	**6.5 ± 0.6**
Trout River	**13.0 ± 1.4**	**12.8 ± 2.6**	**8.5 ± 3.2**	**9.9 ± 4.2**	**7.8 ± 2.0**
Summerside	**8.6 ± 0.7**	**7.4 ± 0.8**	**8.1 ± 1.9**	**6.0 ± 0.6**	**9.2 ± 0.6**
Basin Head	**10.3 ± 1.6**	**9.6 ± 0.8**	**7.1 ± 1.0**	**5.8 ± 1.4**	**8.8 ± 1.7**
Mont.-Brudenell	**10.1 ± 0.7**	**8.0 ± 0.6**	**7.9 ± 0.4**	**9.1 ± 1.5**	**7.0 ± 0.3**
Murray	**9.4 ± 0.7**	**8.0 ± 0.6**	**7.3 ± 0.5**	**8.7 ± 0.7**	**6.1 ± 0.5**
Pinette	**8.7 ± 0.4**	**8.1 ± 0.3**	**6.8 ± 0.6**	**8.6 ± 0.3**	**9.5 ± 1.8**
Average PEI	**10.1 ± 1.0**	**9.0 ± 1.0**	**7.4 ± 1.3**	**8.0 ± 1.6**	**7.8 ± 1.1**

Dissolved oxygen values (**Table 8**) were generally highest in the spring sampling and had decreased by the June sampling then show a slight, though noticeable increase in August in most locations throughout the Gulf Region. Dissolved oxygen preferences for permanent estuary/coastal shoreline species encountered with CAMP sampling methodology is not well documented. The general pattern for oxygen levels in the estuary was higher quantities in the spring that fluctuated in the summer and generally increased again in the fall. Processes that allow oxygen input in the water column include photosynthesis by plants and mixing from the air due to turbulence. In locations where there was more organic matter, decomposition of organic matter could produce the lower oxygen levels recorded (Tchoukanova et al. 2003). Overall, most DO values are higher when compared to similar months and locations in 2006.

In New Brunswick, May values were down in the north and higher in the south than they were in 2006 (Weldon et al. 2007). For all five months, there were seven recordings above 10 mg/l in 2006 (four of those in May). In 2007, there were 14 recordings above 10 mg/l when comparing all locations in NB for the five months. Miramichi, Antigonish and Trout rivers had the highest oxygen values while Tabusintac, Mabou and Mill rivers had the lowest when comparing the full sampling season to the other locations in each province.

3.6 Nutrient Analysis

In 2007, each group was given 60 number coded 30 ml bottles to collect a water sample and a replicate at each station in their estuary or coastal location for each of the five months. The protocol for collection is outlined in Appendix 2 in Weldon et al. (2008). The groups were given a small cooler bag with an ice pack to keep samples cool until they returned to a location that had a freezer. These frozen samples were returned to DFO where the season's sample was sent to the Bedford Institute of Oceanography for nutrient analysis. For each sample the total micromoles of silicate, phosphate, nitrate (NO_2 + NO_3), ammonia (NH_3) and nitrite (NO_2) were determined. From the raw data the average was calculated for each baseline location.

A detailed breakdown of the preliminary trends of the five nutrient compounds collected in September 2006 is provided by Theriault and Courtenay 2008 (unpublished report). This report will only compare the results from September 2007 with September 2006 (Weldon et al 2008). The other four months will be summarized in Appendix 2. There will be gaps in the data that was the result of samples left at the BIO lab for analysis being un-noticed in the cooler until next day. However it turns out that only one gap for September exists so some preliminary general comparisons are possible.

In New Brunswick, out of 11 locations where results are available for the two years, increases and decreases are evident. A numerical difference of around 50% will be the arbitrary value for indicating a difference that denotes an increase or decrease. For silicates, increases in Lamèque, Shippagan and Scoudouc, decreases in Tabusintac, Miramichi, St. Louis and Richibucto occurred while Tracadie, Bouctouche, Cocagne and Jourimain remained about the same. Phosphates increased in Richibucto, decreased in Scoudouc and remained about the same in all other locations. Except for increases in Lamèque, Shippagan, Miramichi and Richibucto, nitrates remained about the same in all other locations. A noteworthy drop in ammonia in Scoudouc, smaller drops in Miramichi and Cocagne, and an increase in Richibucto are apparent while the other locations remain about the same. A nitrite increase in Richibucto, decreases in St. Louis and Scoudouc compare to the other locations remaining at about he same levels as 2006.

In Nova Scotia, overall, there were decreases for all nutrients in all locations except in Antigonish where increases were recorded for all nutrients except nitrite that remained about the same. The other exception was a slight increase for ammonia in Pugwash and River Philip. The level of the decreases (excluding Antigonish) exceeded the 50% level in 14 of 18 possible nutrient-location combinations. This group (>50%) includes all the decreases in silicates in Philip, Pugwash, Mabou and Pictou, in phosphates in Mabou and Pictou, in nitrates in Mabou, in ammonia in Philip, Pugwash, Mabou and Pictou and nitrites in Philip, Pugwash and Mabou. Decreases of less than 50% in ammonia in Philip, Pugwash and Pictou, and of nitrite in Pictou were the other values noted in **Table 9**.

In Prince Edward Island, overall levels of all nutrients were down everywhere compared to 2006. Any increases noted were for phosphates and nitrates only, and most were slight. These include a phosphate increase of less than 50% in Trout River, Basin Head and Montague-Brudenell and a similar less than 50% increase in nitrates in Basin Head and Pinette locations. Nitrate levels had considerably decreased in Mill River, 101.33 µM/L (2006) to 1.39 µM/L (2007) and this was the biggest drop noted for any of the CAMP data in the whole Gulf Region.

Table 9. Average nutrient content of five listed compounds (µM/L ± S.D.) per location for the 2007 season (n = 12). (µM/L = µg atom /L) (NA = not available)

	Silicate	Phosphate	Nitrate	Ammonia	Nitrite
	µM/L ± SD	µM/L ± SD	µM/L ± SD	µM/L ± SD	µM/L ± SD
N.B.					
Caraquet 2006	4.12 ± 0.57	0.37 ± 0.04	0.71 ± 0.04	0.87 ± 0.11	0.17 ± 0.00
2007	NA	NA	NA	NA	NA
Lamèque	3.37 ± 0.85	0.41 ± 0.10	0.41 ± 0.15	4.45 ± 1.58	0.19 ± 0.04
	6.69 ± 3.50	0.81 ± 0.45	1.65 ± 0.59	6.07 ± 6.47	0.14 ± 0.13
Shippagan	1.08 ± 0.32	0.35 ± 0.07	0.39 ± 0.12	1.40 ± 0.37	0.12 ± 0.03
	3.33 ± 5.22	0.63 ± 0.41	1.33 ± 1.62	2.13 ± 1.30	0.16 ± 0.08
Tracadie	4.29 ± 0.96	0.55 ± 0.06	0.13 ± 0.04	1.60 ± 0.31	0.05 ± 0.01
	6.83 ± 2.32	0.73 ± 0.40	1.12 ± 0.21	1.58 ± 0.52	0.13 ± 0.03
Tabusintac	16.07 ± 3.04	0.67 ± 0.04	0.88 ± 0.13	1.70 ± 0.61	0.15 ± 0.01
	9.57 ± 2.36	0.59 ± 0.17	1.30 ± 0.88	1.85 ± 0.74	0.17 ± 0.11
Miramichi	25.11 ± 6.70	0.56 ± 0.04	0.54 ± 0.14	3.31 ± 0.46	0.17 ± 0.03
	13.05 ± 10.36	0.94 ± 0.33	1.19 ± 0.28	1.39 ± 0.63	0.14 ± 0.05
St Louis	13.54 ± 2.35	0.74 ± 0.09	1.31 ± 0.48	1.73 ± 0.35	0.19 ± 0.02
	5.57 ± 2.03	0.85 ± 0.13	1.05 ± 0.20	1.50 ± 0.81	0.04 ± 0.06
Richibucto	6.28 ± 1.83	0.36 ± 0.05	0.47 ± 0.39	1.13 ± 0.14	0.09 ± 0.01
	3.72 ± 3.59	2.00 ± 2.31	6.85 ± 7.33	8.75 ± 12.55	0.88 ± 1.14
Bouctouche	5.53 ± 0.53	1.05 ± 0.05	0.86 ± 0.14	1.78 ± 0.17	0.18 ± 0.01
	7.61 ± 3.82	0.92 ± 0.47	1.17 ± 3.07	2.13 ± 1.47	0.14 ± 0.371
Cocagne	1.82 ± 0.35	0.53 ± 0.01	0.91 ± 0.10	5.80 ± 2.61	0.21 ± 0.04
	1.99 ± 1.56	0.56 ± 0.35	0.83 ± 0.23	1.93 ± 2.56	0.13 ± 0.07
Shediac	new				
	7.70 ± 4.79	0.56 ± 0.10	2.42 ± 3.63	0.962 ± 0.41	0.11 ± 0.04
Scoudouc	3.05 ± 1.80	2.18 ± 1.32	1.08 ± 0.39	34.32 ± 30.09	0.21 ± 0.05
	1.67 ± 0.83	0.44 ± 0.20	0.80 ± 0.10	2.53 ± 1.42	0.11 ± 0.03
Jourimain	0.54 ± 0.04	0.45 ± 0.05	0.71 ± 0.03	0.60 ± 0.14	0.16 ± 0.01
	0.85 ± 0.22	0.49 ± 0.11	0.79 ± 0.18	0.79 ± 0.67	0.11 ± 0.04
N.S.					
R. Philip 2006	6.08 ± 1.74	0.62 ± 0.13	0.91 ± 0.31	2.69 ± 0.21	0.23 ± 0.04
2007	2.51 ± 1.36	0.69 ± 0.05	0.65 ± 0.03	0.92 ± 0.68	0.08 ± 0.04
Pugwash	6.08 ± 1.74	0.62 ± 0.13	0.91 ± 0.31	2.69 ± 0.21	0.23 ± 0.04
	1.35 ± 1.38	0.68 ± 0.12	0.73 ± 0.08	1.16 ± 0.91	0.09 ± 0.03
Antigonish	2.51 ± 0.46	0.51 ± 0.12	0.09 ± 0.07	2.84 ± 0.55	0.12 ± 0.02
	4.59 ± 2.47	0.60 ± 0.10	0.58 ± 0.50	3.73 ± 2.88	0.11 ± 0.01
Mabou	22.66 ± 3.24	0.18 ± 0.02	2.30 ± 0.48	2.83 ± 0.44	0.20 ± 0.01
	10.69 ± 4.20	0.004 ± 0.01	0.69 ± 0.10	0.90 ± 0.32	0.06 ± 0.02
Pictou	7.30 ± 2.20	1.96 ± 1.09	1.89 ± 1.14	35.22 ± 32.71	0.52 ± 0.29
	3.80 ± 2.75	0.85 ± 0.20	1.09 ± 0.65	4.24 ± 6.74	0.20 ± 0.23

P.E.I.					
Mill River 2006	24.16 ± 1.93	0.38 ± 0.03	101.33 ± 12.63	10.50 ± 1.79	0.57 ± 0.07
2007	1.78 ± 1.46	0.37 ± 0.12	1.39 ± 0.59	2.26 ± 1.51	0.00 ± 0.00
Trout River	8.97 ± 2.74	0.54 ± 0.10	10.84 ± 3.64	4.02 ± 1.93	0.30 ± 0.07
	7.33 ± 7.56	0.79 ± 0.36	1.74 ± 1.92	1.69 ± 1.10	0.02 ± 0.04
Summerside	new				
	2.66 ± 1.13	0.52 ± 0.09	0.99 ± 0.07	5.40 ± 6.02	0.00 ± 0.00
Basin Head	3.02 ± 0.31	0.26 ± 0.02	1.86 ± 0.66	2.21 ± 0.29	0.12 ± 0.01
	2.80 ± 0.72	0.38 ± 0.16	2.47 ± 1.34	1.83 ± 0.54	0.02 ± 0.04
Pinette	12.53 ± 3.56	1.54 ± 0.23	0.72 ± 0.11	3.19 ± 0.44	0.20 ± 0.02
	8.58 ± 3.24	0.78 ± 0.11	1.38 ± 0.21	1.28 ± 0.78	0.12 ± 0.04
Murray	6.87 ± 1.71	0.83 ± 0.05	1.18 ± 0.84	1.21 ± 0.18	0.15 ± 0.02
	2.30 ± 1.86	0.49 ± 0.06	1.08 ± 0.33	1.00 ± 0.55	0.08 ± 0.05
Mont.-Bruden	1.02 ± 0.14	0.46 ± 0.04	1.00 ± 0.40	0.85 ± 0.05	0.22 ± 0.06
	0.45 ± 0.42	0.51 ± 0.07	1.02 ± 0.15	0.47 ± 0.20	0.09 ± 0.02

In **Appendix 2,** the results for the other four months will be summarized. This was the first year that water samples were taken for all five months for CAMP locations. The results are not totally complete as some samples were not analyzed. This will be indicated in the table. Some locations were lost completely and others were incomplete which would be reflected in averages being calculated with less than 12 samples at some locations.

Appendix 3 will once again provide summary pie charts of total percentages of the most abundant species at each location for the whole season (May to September). Because the maps showing samples sites are readily available in all previous reports, only the new locations will be included in this report. To find past reports, the following links to library archives will be useful:

2004 http://www.dfo-mpo.gc.ca/Library/319437.pdf

2005 http://www.dfo-mpo.gc.ca/Library/329182.pdf

2006 http://www.dfo-mpo.gc.ca/Library/332000.pdf

5.0 CONCLUSION

The fundamental objective of the CAMP program continues to be the development and continuation of an outreach program for DFO oceans and habitat staff to liaise with and engage the coastal communities in learning more about their estuaries and bays. The initial goal of developing a monitoring program that is NGO friendly has been realized. Baseline data have been collected for four years from a wide range of estuaries and bays in the Gulf of St. Lawrence. Full baseline CAMP locations sampled in 2007 increased from 18 to 24.

After four years of data collection, we have the minimum baseline information to test the hypothesis that animal assemblages can contribute to our knowledge about the health of these habitats. This analysis will be done after data from the fifth year (2008) is complete. The next steps for CAMP are now in the hands of the DFO and their associated university collaborators. The baseline data resulting from community efforts will be used to test the hypothesis that the numbers and types of near shore animals provide us with an indication of the overall health of these estuaries. The analysis of five years of data is planned to be available in the fall of 2009. Hypothesis such as whether the absence or presence or abundance of particular species reflect particular environmental problems or is it overall species diversity that provides the best single metric for estuarine health? When these and related questions have been addressed and the resulting conclusions have been returned to the participating community groups and the public at large, CAMP will have fulfilled its immediate objectives. However, it is recognized that as the CAMP evolves, there is always room for additional refinement. As such, the commitment to consultation with all stakeholders will continue.

NGO’s anticipate that the data they have gathered will be helpful in developing a useful tool to assist them to monitor the health and condition of their estuary. Improvements such as the enhanced participation of the Coalition ensure that gathered data is available to groups to assist them in planning future direction, identifying local areas of concern and determining the present status of their estuary under their mandate.

Besides a commitment to quality data recording, the community groups realize they have only had to contribute resources for one day a month to acquire these data. The integrated approach provided by the University partners, DFO and certain funding agencies has helped guide the development of the CAMP to a direction that will maximize output goals from minimal input.

There is an expectation that more specialized science could easily be developed from the outcomes of the present CAMP data. As various models of watershed management becomes more widely used, CAMP protocols and gathered information will become a key component in the overall management of a watershed.

ACKNOWLEDGEMENTS

This program was originally developed through the Oceans and Habitat Division, Oceans and Science Branch (OSB), Gulf Region DFO. Gulf Region NGO's remain onboard with tremendous enthusiasm for volunteers that oversee ecological programs across the region. Summer students, both employed and volunteering were an invaluable resource for data collection. Some funding for student salaries came from Interdisciplinary Studies in Aquatic Resources at St. Francis Xavier University, and grants to Dr. David Garbary from the Natural Sciences and Engineering Research Council of Canada. Other groups used portions of Environmental Trust funds to free up resources for the one day a month necessary to maintain the program.

A strengthened involvement by the Southern Gulf of St. Lawrence Coalition on Sustainability has provided a common link to all NGOs in the Gulf Region. They have and will continue to coordinate students to provide the NGOs with experienced manpower and vehicular assistance.

Also thanks to high school student Holly Vail for her help with sediment analysis during the winter as part of her Coop internship with DFO.

After the initial set-up of the pilot stage by several of the authors, the continued support of all stakeholders and continued consultation throughout the 2007 sampling season ensured that the program maintained strong links to the original concept.

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Appendix 1. List of Species Collected during the CAMP 2007

<u>fish</u>

alewife (gaspereau) (*Alosa sp.***)**
American sand lance (*Ammodytes hexapterus***)**
Atlantic silverside (*Menidia menidia***)**
Atlantic tomcod (*Microgadus tomcod***)**
banded killifish (*Fundulus diaphanus***)**
black spotted stickleback (*Gasterosteus wheatlandi***)**
blueback herring (*Alosa aestivalis***)**
brook (speckled) trout (*Salvelinus fontinalis***)**
cunner (*Tautogolabrus adspersus***)**
fourspine stickleback (*Apeltes quadracus***)**
ninespine stickleback (*Pungitius pungitius***)**
northern pipefish (*Syngnathus fuscus***)**
mummichog (*Fundulus heteroclitus***)**
rainbow smelt (*Osmerus mordax***)**
rock gunnel (*Pholis gunnellus***)**
shorthorn sculpin (*Myoxocephalus scorpius***)**
smooth flounder (*Pleuronectes putnami***)**
striped bass (*Morone saxatilis***)**
threespine stickleback (*Gasterosteus aculeatus***)**
white perch (*Morone americanus***)**
windowpane flounder (*Scophthalmus aquosus***)**
winter flounder (*Pseudopleuronectes americanus***)**
American Eel (*Anguilla rostrata***)**
Atlantic salmon parr (*Salmo salar***)**
Atlantic mackerel (*Scomber scombus***)**
Rainbow trout (*Salmo gairdneri***)**
White hake (*Urophycis tenuis***)**
Trout sp (*Salmo species***)**

<u>Invertebrates</u>

Clubbed tunicate (*Styela clava***)**
Violet tunicate (*Betrylloides violaceus***)**
Vase tunicate (*Ciona intestinalis***)**

<u>crustaceans</u>

grass shrimp
(*Palaemonetes vulgaris***)**
green crab
(*Carcinus maenas***)**
lady crab
(*Ovalipes ocellatus***)**
mud crabs
(*Xanthidae sp*.**)**
rock crab
(*Cancer irroratus***)**
sand shrimp
(*Crangon septemspinosa***)**

Appendix 2 Average nutrient content of five listed compounds (µM/L ± S.D.) per location for the 2007 season (n = 12) for the months of May, June, July and August. (µM/L = µg atom /L) (n/a = not available).

* means not all samples available		Silicate µM/L±SD	Phosphate µM/L±SD	Nitrate µM/L±SD	Ammonia µM/L±SD	Nitrite µM/L±SD
N.B.						
Caraquet	May	n/a	n/a	n/a	n/a	n/a
	June	n/a	n/a	n/a	n/a	n/a
	July	n/a	n/a	n/a	n/a	n/a
	Aug	n/a	n/a	n/a	n/a	n/a
Lamèque	May	2.93 ± 1.75	0.30 ± 0.39	0.67 ± 0.29	3.61 ± 3.52	0.15 ± 0.08
	June	8.11 ± 4.45	1.55 ± 0.24	0.78 ± 0.48	3.12 ± 1.34	0.19 ± 0.01
	July	10.70 ± 8.39	1.64 ± 0.50	1.17 ± 0.91	5.44 ± 7.67	0.26 ± 0.12
	Aug	14.39 ± 14.97	1.22 ± 0.59	1.77 ± 2.48	6.14 ± 12.93	0.29 ± 0.13
Shippagan	May	2.04 ± 4.28	0.36 ± 0.23	1.25 ± 2.69	3.11 ± 1.75	0.17 ± 0.13
	June	2.79 ± 3.62	0.53 ± 0.20	0.68 ± 2.24	1.45 ± 1.67	0.11 ± 0.11
	July	14.13 ± 6.05	1.32 ± 0.47	1.38 ± 1.98	2.14 ± 1.51	0.14 ± 0.09
	Aug	4.53 ± 5.62	0.87 ± 0.44	0.84 ± 1.78	2.02 ± 1.40	0.15 ± 0.09
Tracadie	May	10.61 ± 5.96	0.49 ± 0.24	0.79 ± 0.19	1.97 ± 1.24	0.13 ± 0.03
	June	7.02 ± 3.17	0.53 ± 0.15	0.68 ± 0.02	0.84 ± 0.35	0.07 ± 0.01
	July	6.47 ± 2.50	1.07 ± 0.42	0.99 ± 0.03	1.10 ± 0.52	0.11 ± 0.02
	Aug	5.04 ± 1.61	1.08 ± 0.51	1.04 ± 0.05	1.17 ± 0.39	0.11 ± 0.03
Tabusintac	May	n/a	n/a	n/a	n/a	n/a
	June	15.52± 7.29	0.54 ± 0.44	0.86 ± 0.16	1.75 ± 0.96	0.12 ± 0.02
	July	10.14 ± 3.33	0.54 ± 0.44	0.71 ± 0.07	1.05 ± 0.61	0.09 ± 0.01
	Aug	7.49 ± 1.71	0.83 ± 0.38	0.90 ± 0.04	1.94 ± 0.64	0.11 ± 0.02
Miramichi	May	n/a	n/a	n/a	n/a	n/a
	June	18.13 ± 9.57	0.40 ± 0.15	1.09 ± 0.36	1.75 ± 1.17	0.17 ± 0.08
	July	n/a	n/a	n/a	n/a	n/a
	Aug	16.21 ± 10.35	0.44 ± 0.14	0.99 ± 0.13	1.15 ± 0.64	0.13 ± 0.04
St Louis *	May	10.58 ± 6.74	0.26 ± 0.11	2.14 ± 0.98	2.68 ± 0.27	0.21 ± 0.05
*	June	21.43 ± 2.35	0.22 ± 0.04	1.14 ± 0.24	1.16 ± 0.04	0.13 ± 0.00
	July	n/a	n/a	n/a	n/a	n/a
	Aug	7.86 ± 1.70	1.30 ± 0.27	0.84± 0.04	1.27 ± 0.52	0.16 ± 0.54
Richibucto	May	18.07 ± 8.95	0.05 ± 0.39	0.80 ± 0.30	1.43 ± 1.08	0.12 ± 0.07
*	June	2.42 ± 0.48	0.31 ± 0.01	0.79 ± 0.01	2.95 ± 2.32	0.05 ± 0.00
	July	n/a	n/a	n/a	n/a	n/a
	Aug	3.57 ± 3.85	0.75 ± 0.31	1.00 ± 0.14	7.82 ± 9.31	0.15 ± 0.54

Appendix 2 (continued)

* means not all samples available		Silicate µM/L±SD	Phosphate µM/L±SD	Nitrate µM/L±SD	Ammonia µM/L±SD	Nitrite µM/L±SD
Bouctouche	May	14.25 ± 2.54	0.45 ± 0.11	5.52 ± 4.77	4.51 ± 2.14	0.30 ± 0.06
	June	8.12 ± 1.13	0.79 ± 0.29	1.05 ± 0.36	3.43 ± 2.60	0.22 ± 0.15
*	July	n/a	n/a	n/a	n/a	n/a
	Aug	7.50 ± 5.04	1.64 ± 0.17	2.83 ± 4.32	3.30 ± 1.50	0.19 ± 0.54
Cocagne	May	9.18 ± 2.72	0.28 ± 0.15	1.04 ± 0.12	2.12 ± 2.27	0.20 ± 0.09
	June	6.23 ± 3.98	0.45 ± 0.21	0.47 ± 0.33	0.60 ± 0.14	0.11 ± 0.00
	July	7.04 ± 0.16	0.57 ± 0.00	0.81 ± 0.00	0.60 ± 0.14	0.11 ± 0.00
	Aug	1.98 ± 1.65	1.06 ± 0.37	0.62 ± 0.23	2.26 ± 3.33	0.20 ± 0.09
Shediac	May	6.31 ± 4.30	0.21 ± 0.08	1.61 ± 1.92	1.71 ± 0.70	0.14 ± 0.04
	June	n/a	n/a	n/a	n/a	n/a
*	July	5.75 ± 0.97	1.61 ± 0.12	0.90 ± 0.08	2.53 ± 1.05	0.12 ± 0.02
	Aug	n/a	n/a	n/a	n/a	n/a
Scoudouc	May	4.01 ± 3.03	0.37 ± 1.92	0.72 ± 6.10	1.41 ± 10.60	0.19 ± 0.94
	June	5.06 ± 2.89	0.93 ± 1.67	0.92 ± 5.33	3.65 ± 9.36	0.16 ± 0.82
*	July	1.79 ± 0.14	0.53 ± 0.03	0.81 ± 0.02	1.32 ± 0.85	0.08 ± 0.02
	Aug	1.78 ± 0.79	3.41 ± 3.27	0.86 ± 0.23	4.07 ± 5.20	0.18 ± 0.47
Jourimain	May	n/a	n/a	n/a	n/a	n/a
	June	n/a	n/a	n/a	n/a	n/a
	July	n/a	n/a	n/a	n/a	n/a
	Aug	n/a	n/a	n/a	n/a	n/a
N.S.						
River Philip	May	n/a	n/a	n/a	n/a	n/a
	June	5.16 ± 2.24	0.21 ± 0.04	0.78 ± 0.05	2.17 ± 0.71	0.08 ± 0.02
*	July	2.84 ± 1.35	0.50 ± 0.20	0.79 ± 0.08	3.49 ± 2.41	0.08 ± 0.02
	Aug	4.69 ± 3.01	0.52 ± 0.14	0.76 ± 0.03	3.43 ± 1.19	0.08 ± 0.02
Pugwash	May	6.73 ± 3.92	0.22 ± 0.14	1.07 ± 0.35	2.70 ± 2.32	0.12 ± 0.03
	June	1.84 ± 0.80	0.36 ± 0.19	0.62 ± 0.04	1.52 ± 0.76	0.07 ± 0.01
	July	3.31 ± 1.46	0.70 ± 0.32	0.64 ± 0.07	1.69 ± 0.83	0.07 ± 0.03
	Aug	2.54 ± 1.48	0.70 ± 0.32	0.64 ± 0.07	1.69 ± 0.83	0.07 ± 0.03
Pictou	May	6.14 ± 2.30	1.96 ± 3.93	1.54 ± 0.92	21.14 ± 44.31	0.34 ± 0.44
	June	12.13 ± 5.98	0.79 ± 0.75	2.68 ± 2.51	7.42 ± 6.68	0.43 ± 0.52
	July	15.33 ± 8.52	3.78 ± 6.72	2.46 ± 1.94	6.24 ± 6.56	0.67 ± 0.96
	Aug	9.60 ± 5.93	1.51 ± 1.43	1.53 ± 1.17	11.87 ± 18.92	0.22 ± 0.18
Antigonish	May	5.72 ± 2.34	0.18 ± 0.13	0.30 ± 0.05	0.88 ± 0.72	0.06 ± 0.01
	June	15.96 ± 11.95	0.29 ± 0.17	0.75 ± 0.45	1.83 ± 0.90	0.14 ± 0.04
	July	6.41 ± 2.46	0.51 ± 0.31	0.45 ± 0.11	1.79 ± 1.41	0.08 ± 0.02
	Aug	16.31 ± 7.32	0.34 ± 0.14	0.71 ± 0.72	1.75 ± 0.73	0.12 ± 0.05
Mabou	May	7.43 ± 2.20	0.11 ± 0.04	0.93 ± 0.11	1.69 ± 0.37	0.07 ± 0.01
	June	10.93 ± 5.32	0.09 ± 0.07	0.95 ± 0.27	1.34 ± 0.44	0.11 ± 0.05
	July	7.69 ± 4.43	0.09 ± 0.05	0.68 ± 0.06	1.35 ± 0.54	0.15 ± 0.01
	Aug	8.73 ± 9.12	0.13 ± 0.07	1.05 ± 0.36	1.45 ± 0.41	0.10 ± 0.03

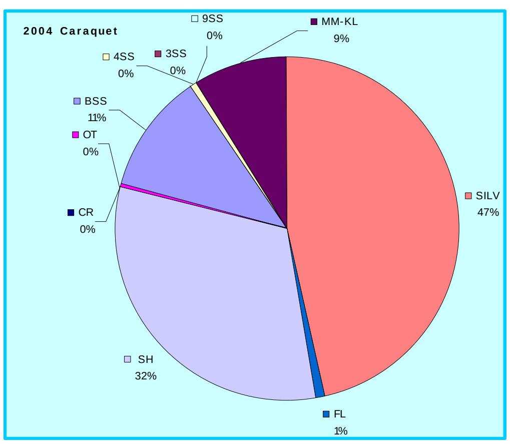
Appendix 2 (continued)

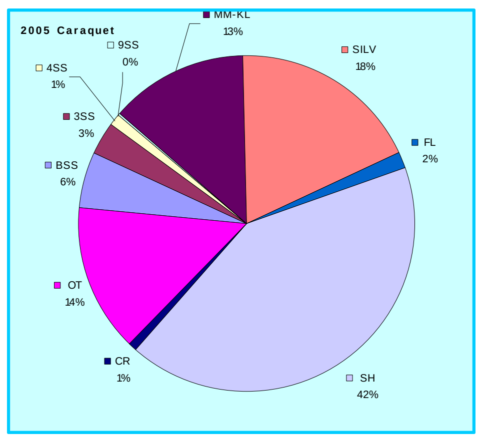
* means not all samples available		Silicate µM/L±SD	Phosphate µM/L±SD	Nitrate µM/L±SD	Ammonia µM/L±SD	Nitrite µM/L±SD
P.E.I.						
Mill River	May	12.57 ± 3.16	0.35 ± 0.25	68.10 ± 33.91	1.69 ± 0.73	0.90 ± 0.22
	June	12.82 ± 10.02	0.43 ± 0.19	29.44 ± 35.03	1.52 ± 1.15	0.33 ± 0.19
	July	5.69 ± 2.75	1.93 ± 0.81	2.82 ± 4.30	3.11 ± 4.81	0.29 ± 0.190
	Aug	12.42 ± 4.49	1.15 ± 0.24	2.82 ± 4.30	3.11 ± 4.81	0.29 ± 0.19
Trout River	May	11.94 ± 5.52	0.46 ± 0.18	24.44 ± 25.76	1.14 ± 0.94	0.39 ± 0.26
	June	14.98 ± 9.38	1.40 ± 0.92	10.69 ± 14.33	1.57 ± 1.08	0.05 ± 0.07
	July	8.05 ± 4.81	1.37 ± 0.57	0.71 ± 0.48	0.67 ± 0.20	0.12 ± 0.08
	Aug	11.16 ± 5.32	1.41 ± 0.51	3.66 ± 5.68	2.07 ± 1.38	0.17 ± 0.08
Summerside	May	4.30 ± 5.09	0.71 ± 0.67	38.73 ± 50.36	1.51 ± 0.92	0.57 ± 0.49
	June	4.67 ± 3.11	0.55 ± 0.29	8.94 ± 11.20	2.23 ± 1.39	0.36 ± 0.31
	July	5.48 ± 5.00	0.55 ± 0.38	31.81 ± 54.39	2.13 ± 2.38	0.70 ± 0.88
	Aug	7.42 ± 5.45	0.69 ± 0.20	22.41 ± 29.50	2.35 ± 1.85	0.70 ± 0.72
Basin Head	May	n/a	n/a	n/a	n/a	n/a
	June	5.03 ± 0.87	0.93 ± 0.53	6.02 ± 5.27	2.21 ± 0.91	0.25 ± 0.09
	July	2.76 ± 1.08	0.45 ± 0.23	1.71 ± 1.92	1.49 ± 0.77	0.12 ± 0.05
	Aug	9.94 ± 2.27	0.90 ± 0.66	9.92 ± 8.76	3.00 ± 2.16	0.28 ± 0.06
Pinette River	May	n/a	n/a	n/a	n/a	n/a
	June	2.49 ± 1.01	0.35 ± 0.10	0.82 ± 0.06	2.47 ± 1.22	0.00 ± 0.00
	July	3.91 ± 1.44	0.88 ± 0.24	0.48 ± 0.08	1.54 ± 1.07	0.09 ± 0.02
	Aug	9.75 ± 2.72	0.94 ± 0.15	0.85 ± 0.35	1.28 ± 0.78	0.12 ± 0.04
Murray River	May	3.23 ± 0.96	0.37 ± 0.08	0.83 ± 0.07	0.81 ± 0.55	0.09 ± 0.01
	June	4.99 ± 4.21	0.29 ± 0.11	1.04 ± 1.26	1.89 ± 2.95	0.06 ± 0.04
	July	5.96 ± 2.88	0.58 ± 0.09	0.56 ± 0.12	3.13 ± 2.81	0.08 ± 0.01
	Aug	2.80 ± 3.27	0.82 ± 0.61	0.46 ± 0.53	0.28 ± 1.21	0.06 ± 0.07
Mont.-Brud	May	3.54 ± 0.43	0.57 ± 0.17	0.43 ± 0.15	0.53 ± 0.35	0.07 ± 0.03
	June	0.86 ± 0.17	0.36 ± 0.09	0.69 ± 0.08	1.99 ± 1.24	0.01 ± 0.03
	July	2.59 ± 1.40	0.76 ± 0.18	1.26 ± 1.02	1.91 ± 2.32	0.13 ± 0.04
*	Aug	4.09 ± 2.31	0.90 ± 0.36	1.28 ± 1.59	2.12 ± 3.59	0.07 ± 0.02

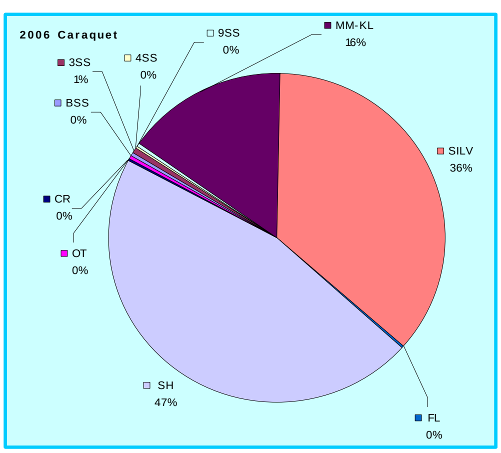
Appendix 3. Map of each Estuary/Coastal Shoreline Location Showing Sampling Sites plus four (if available) Pie Charts Summarizing the Season Total Percentages of the Most Abundant Species for the 2004, 2005, 2006 and 2007 Sampling Seasons.

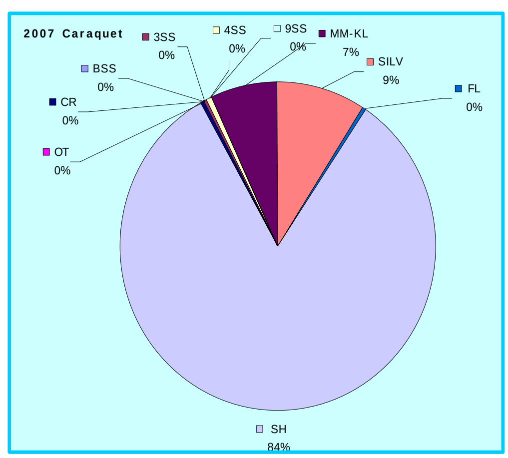
Caraquet / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



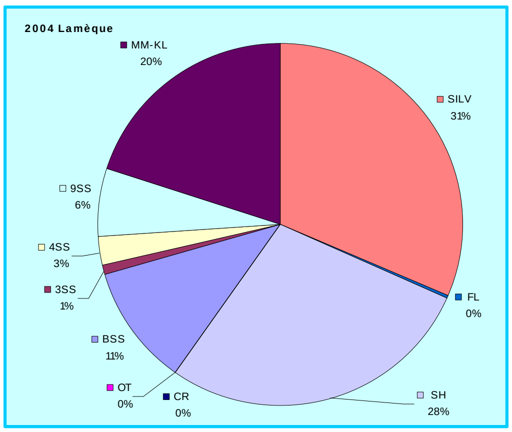


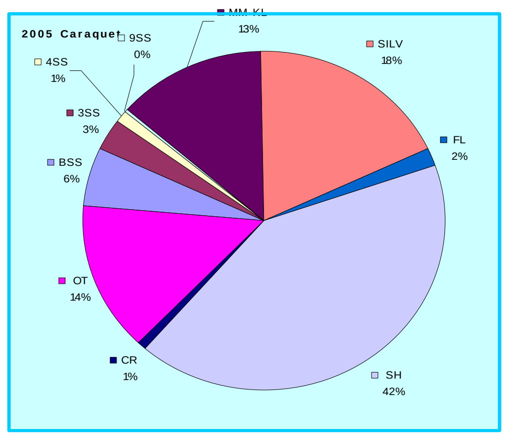


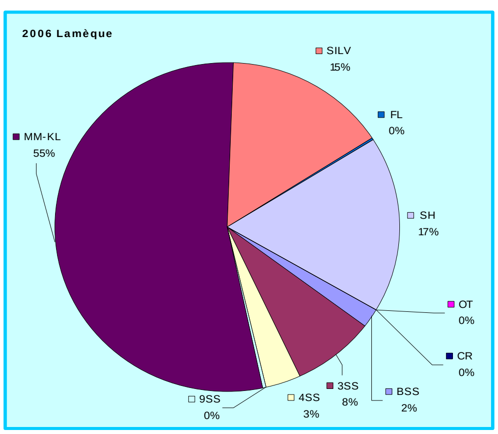


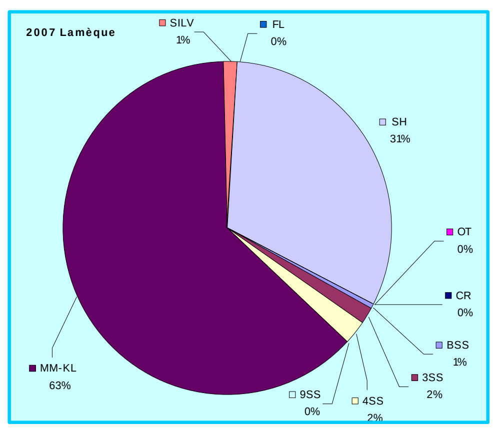
Lamèque / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



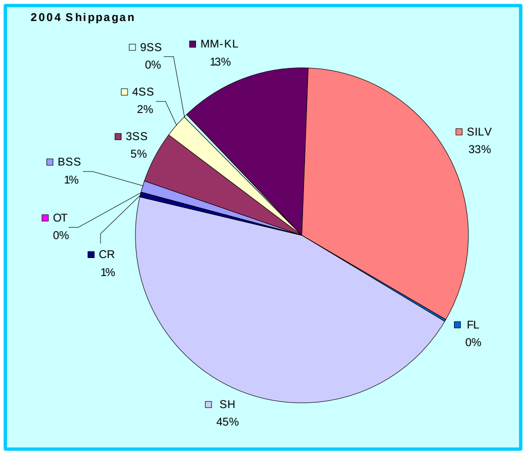


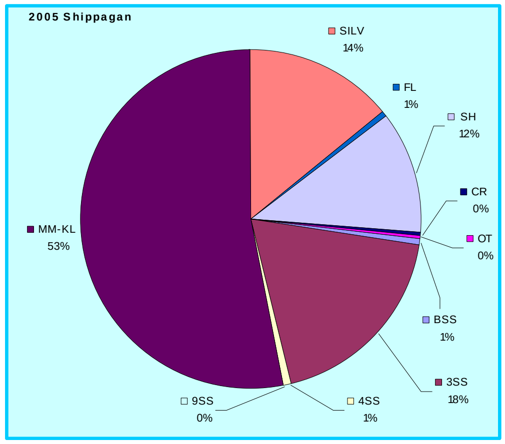


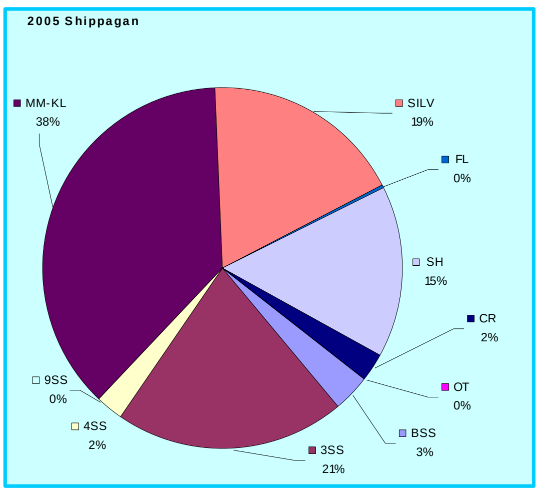


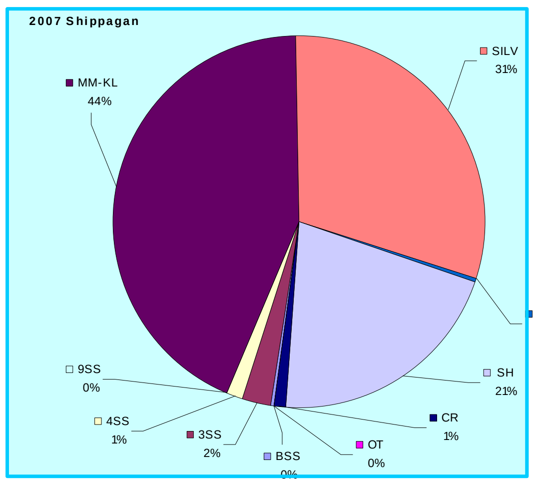
Shippagan / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



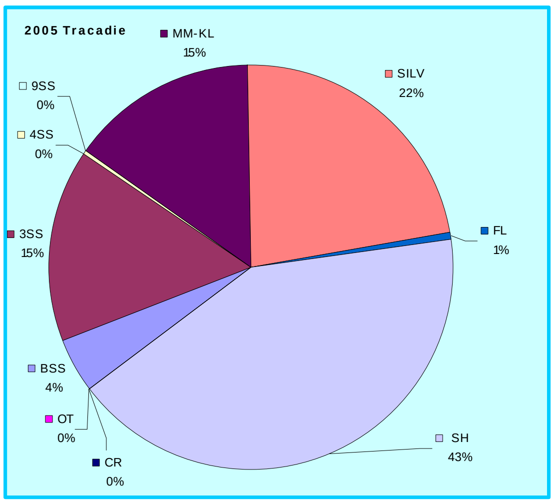


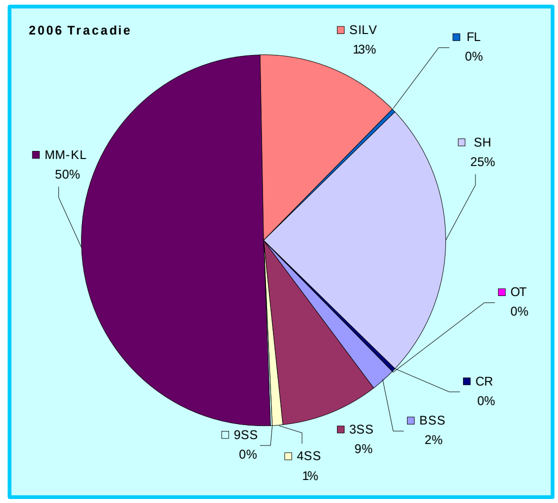


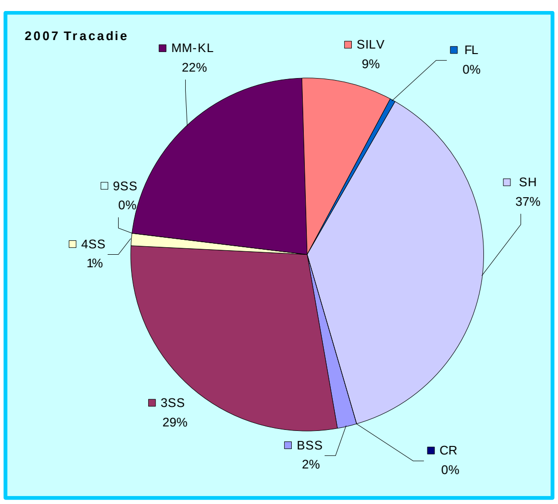


Tracadie / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

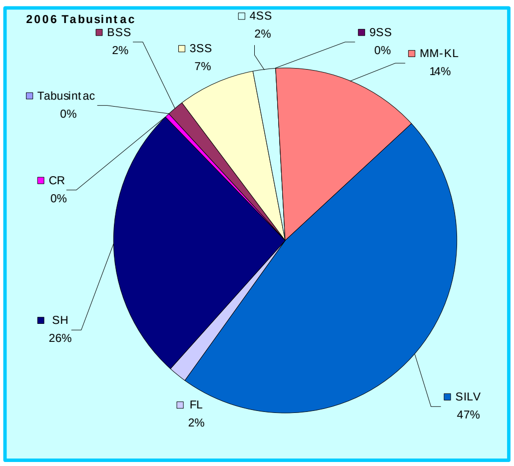


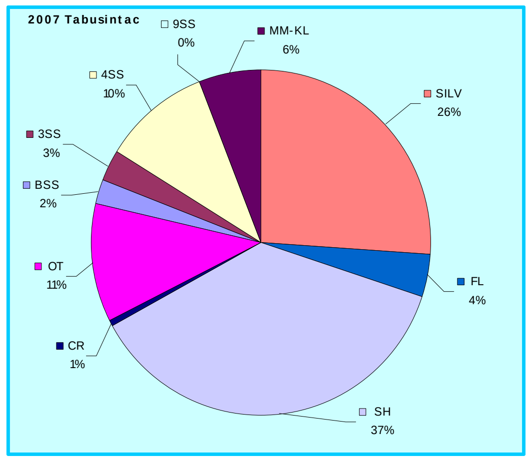




Tabusintac / New Brunswick

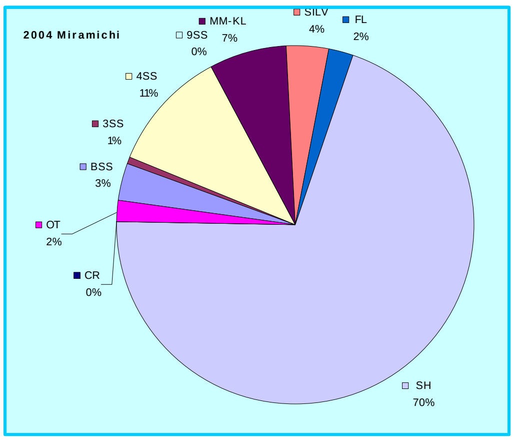
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

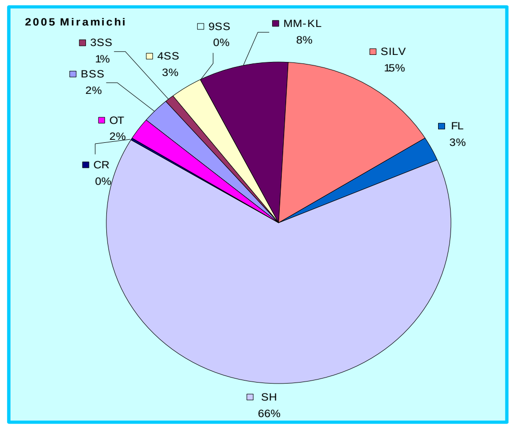


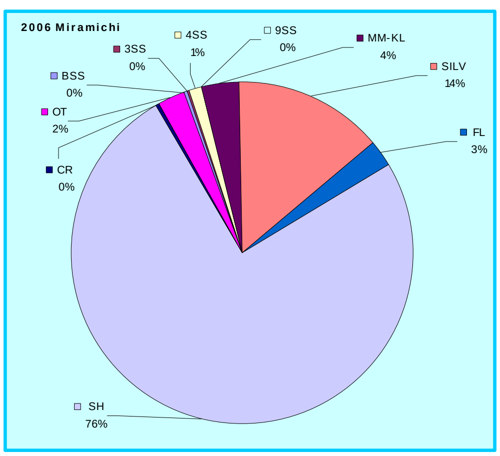


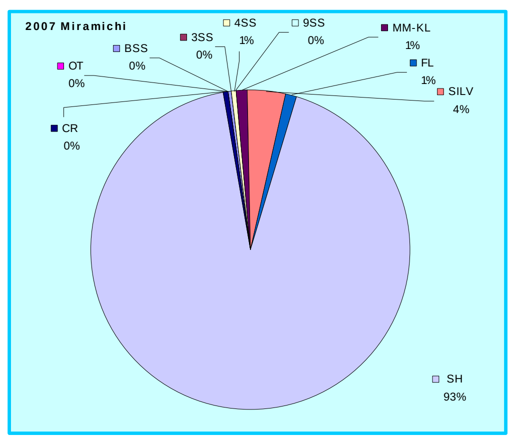
Miramichi / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



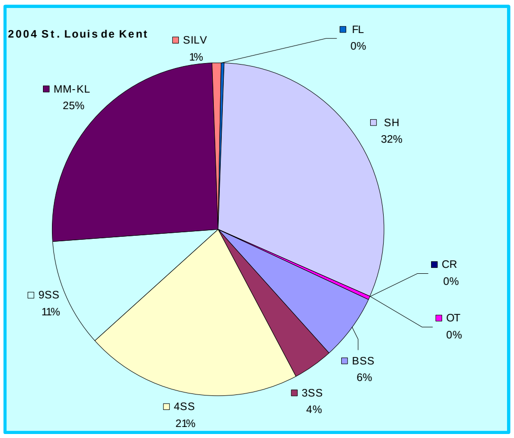


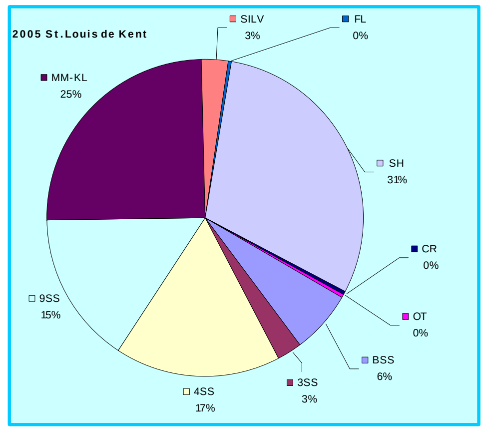


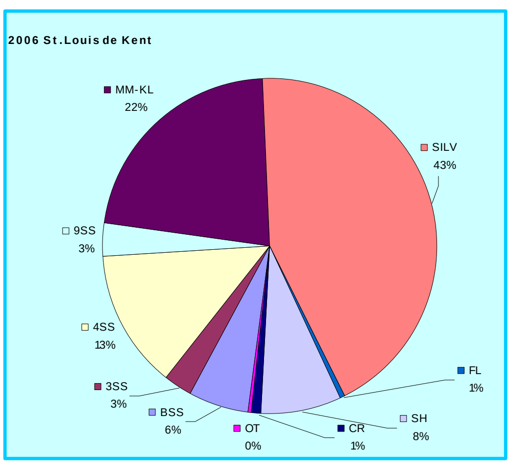


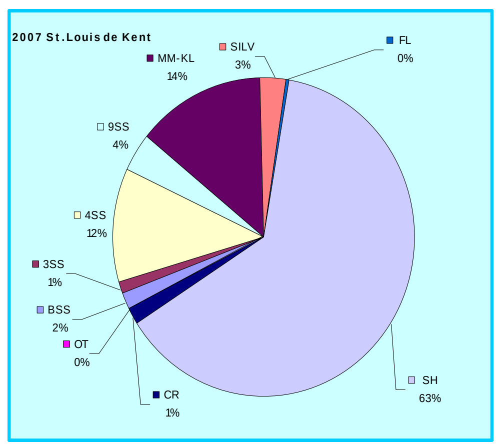
New Brunswick / St. Louis de Kent

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



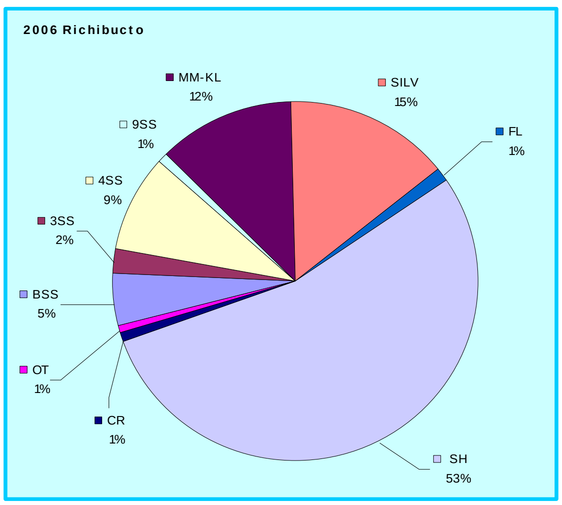


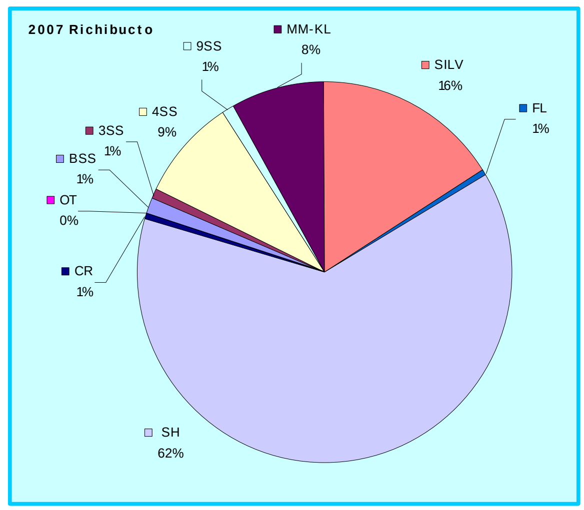




Richibucto / New Brunswick

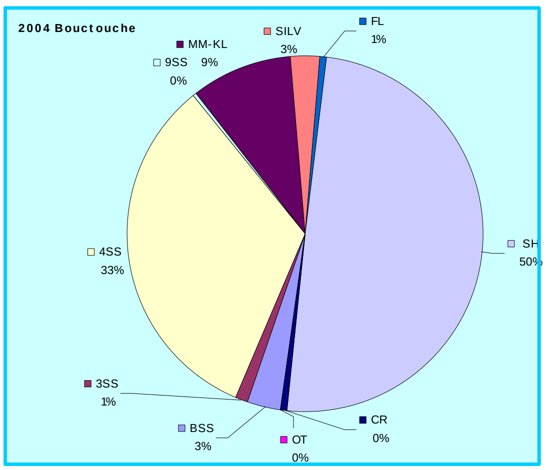
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

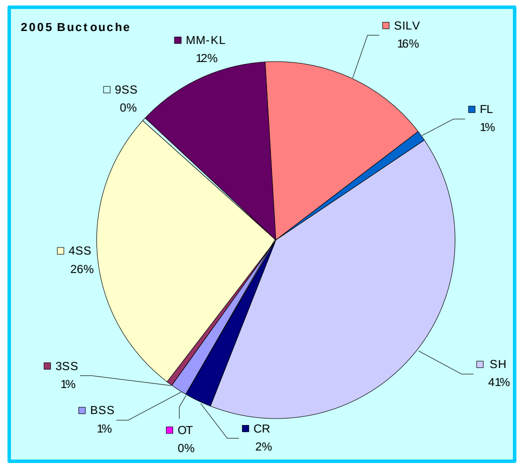


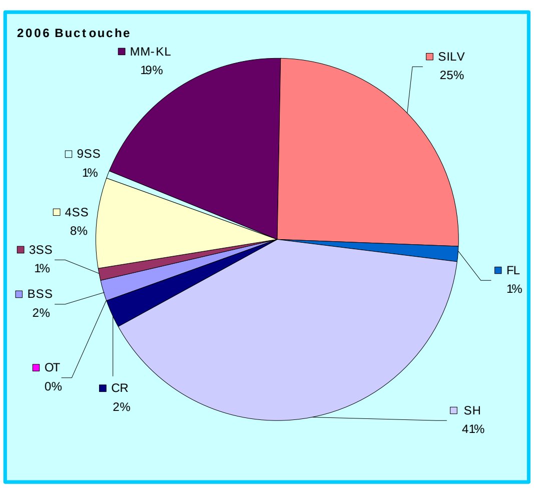


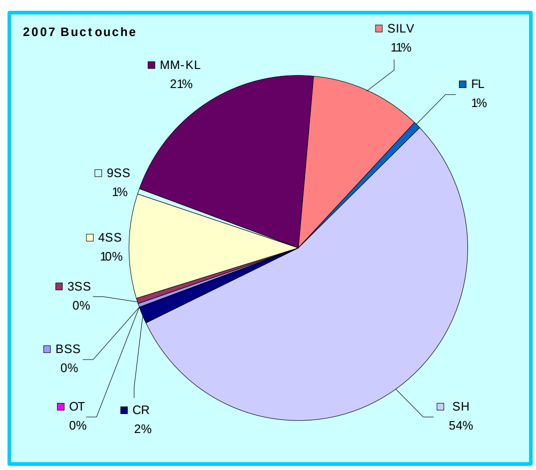
Bouctouche / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



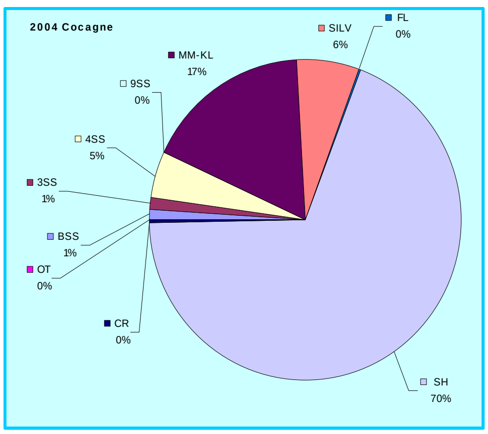


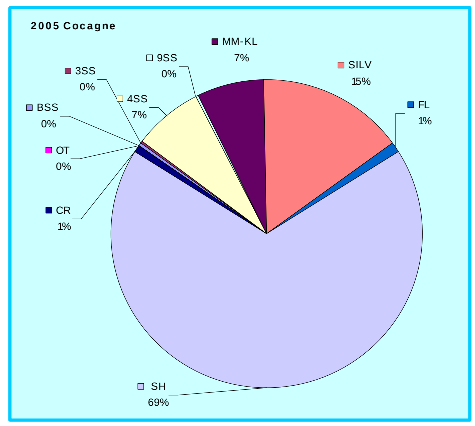


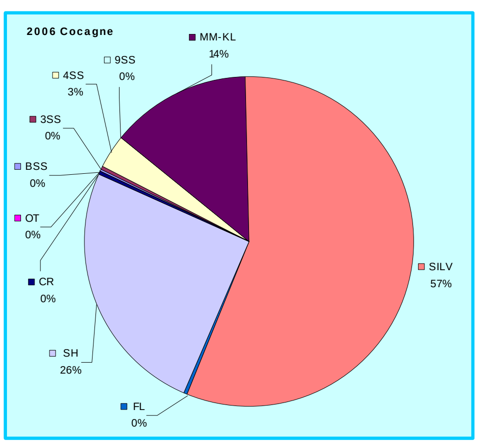


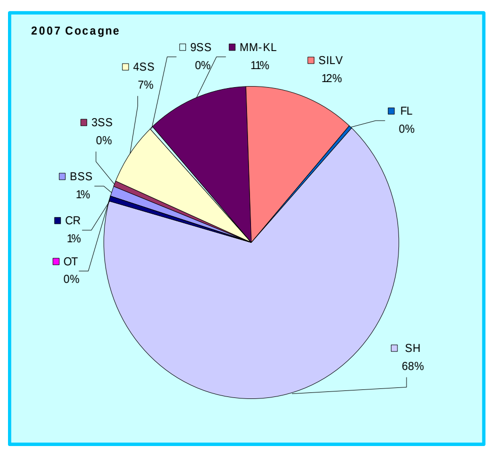
Cocagne / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



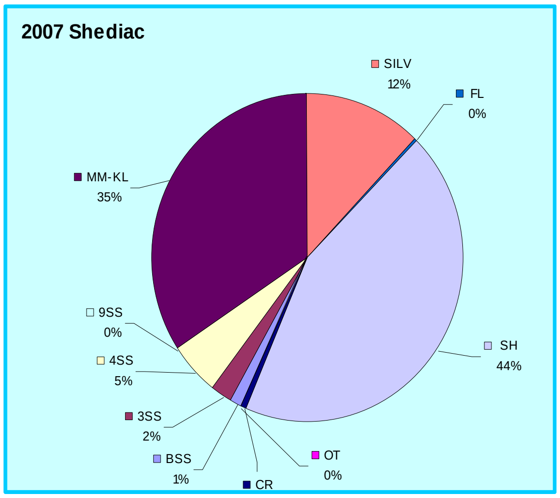






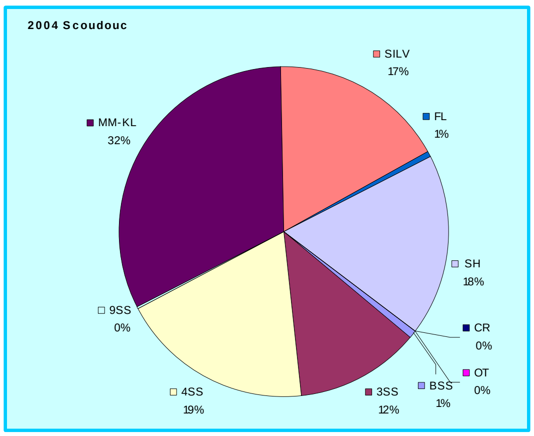
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

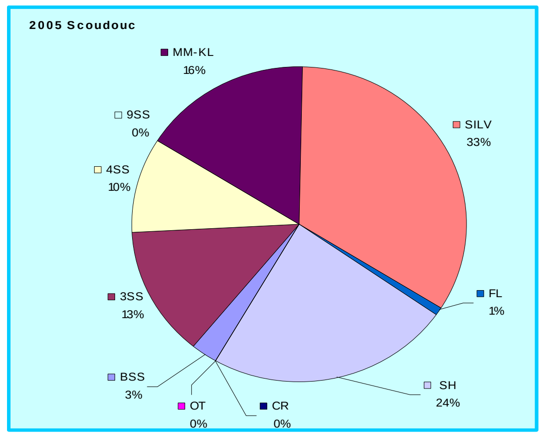
Shediac River / New Brunswick

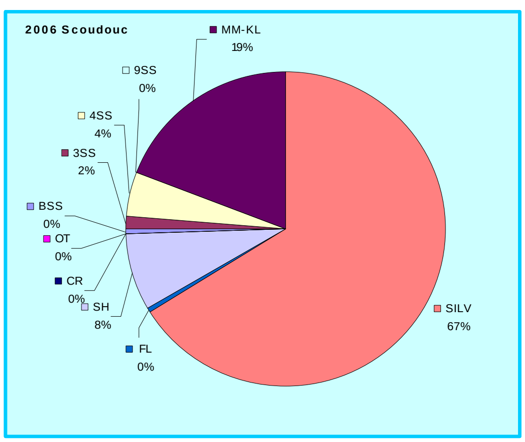


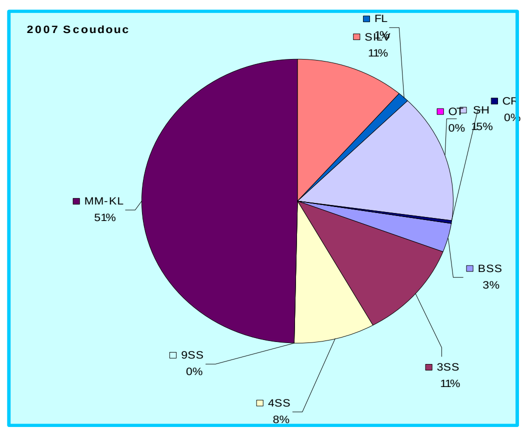
Scoudouc River/ New Brunswick
(in Shediac)

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



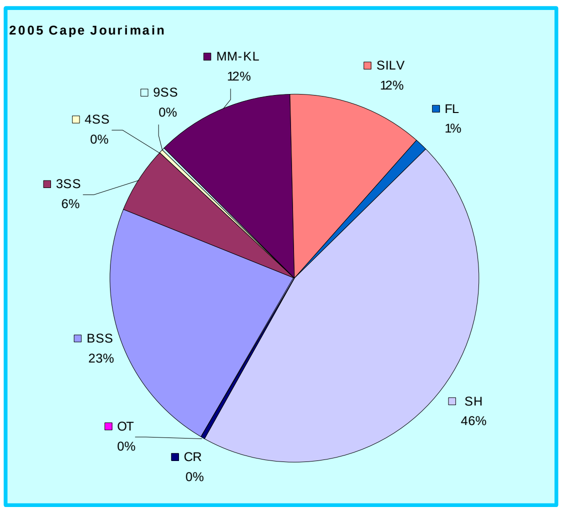


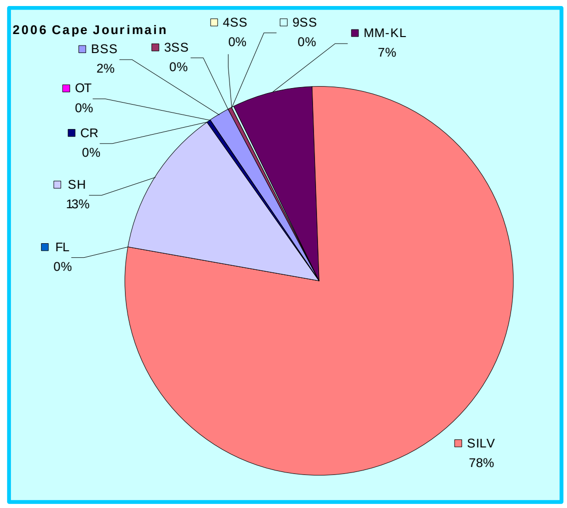


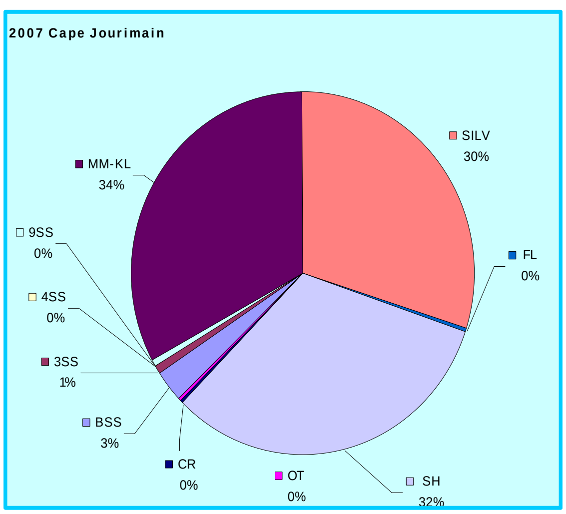


Cape Jourimain / New Brunswick

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



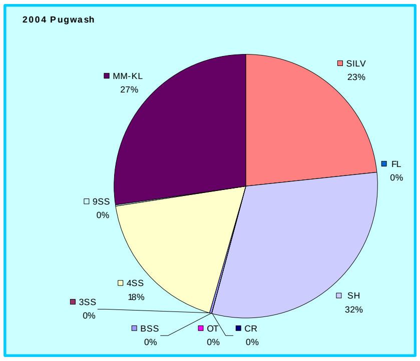


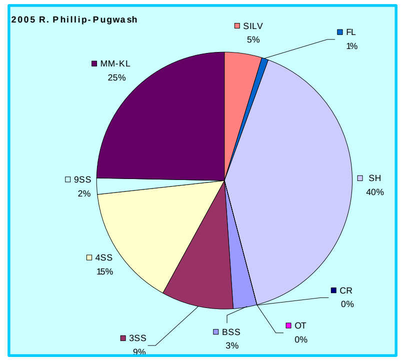


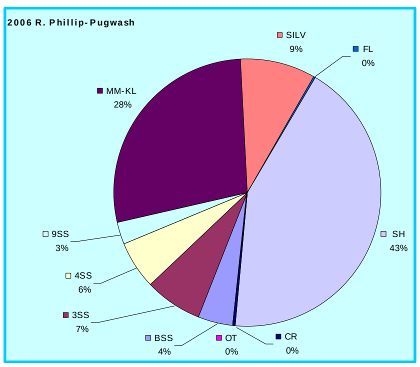
River Philip - Pugwash / Nova Scotia (2004-2006)

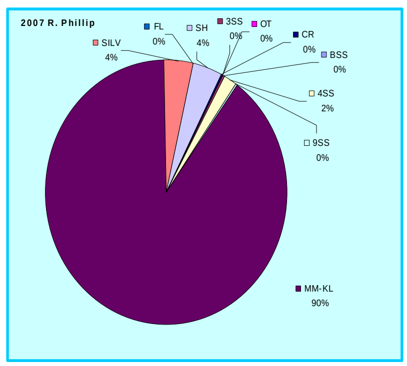
River Philip 2007

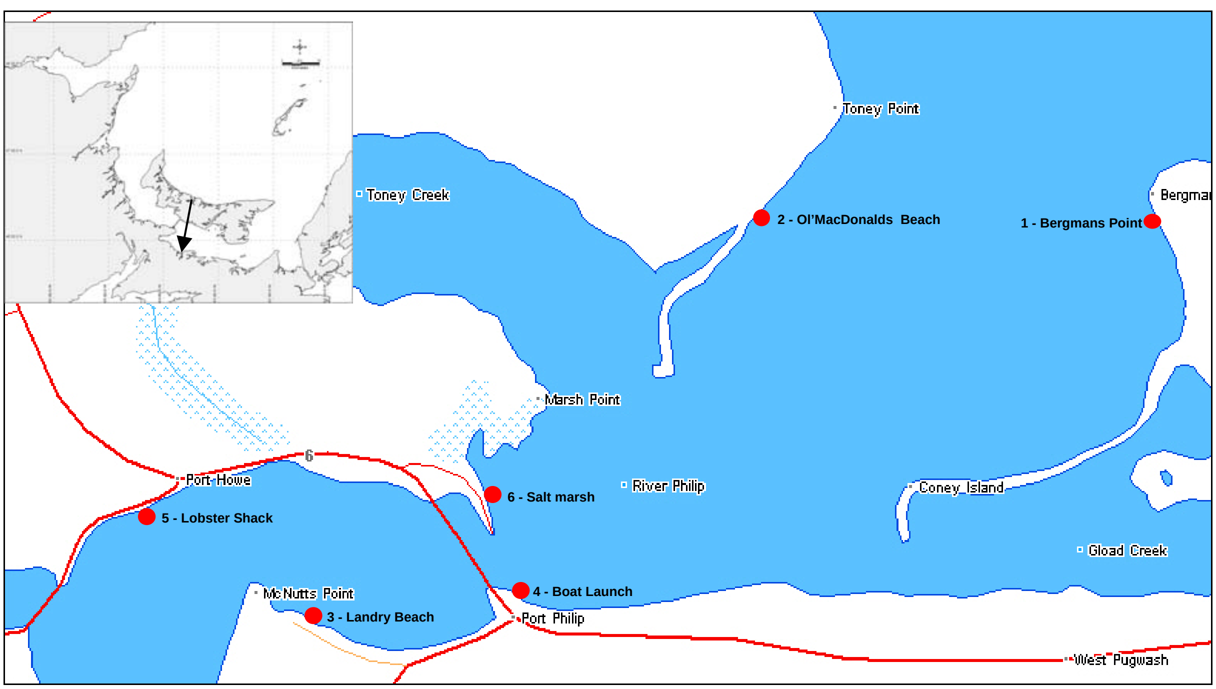
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)





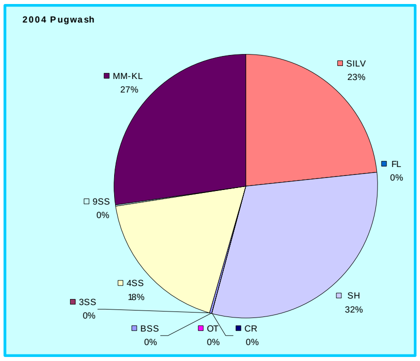


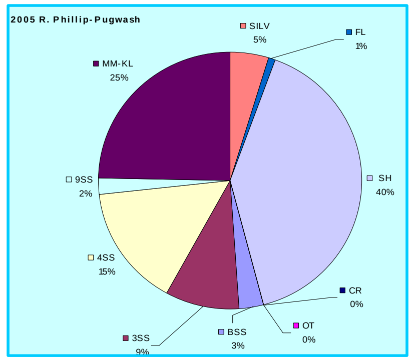


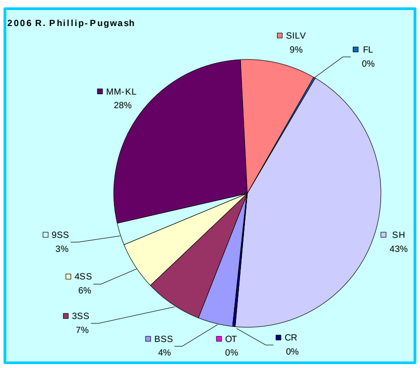


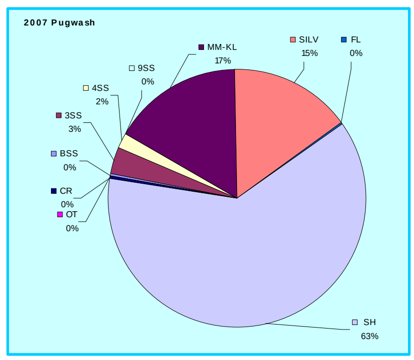
River Philip - Pugwash / Nova Scotia
(2004-2006)
Pugwash 2007

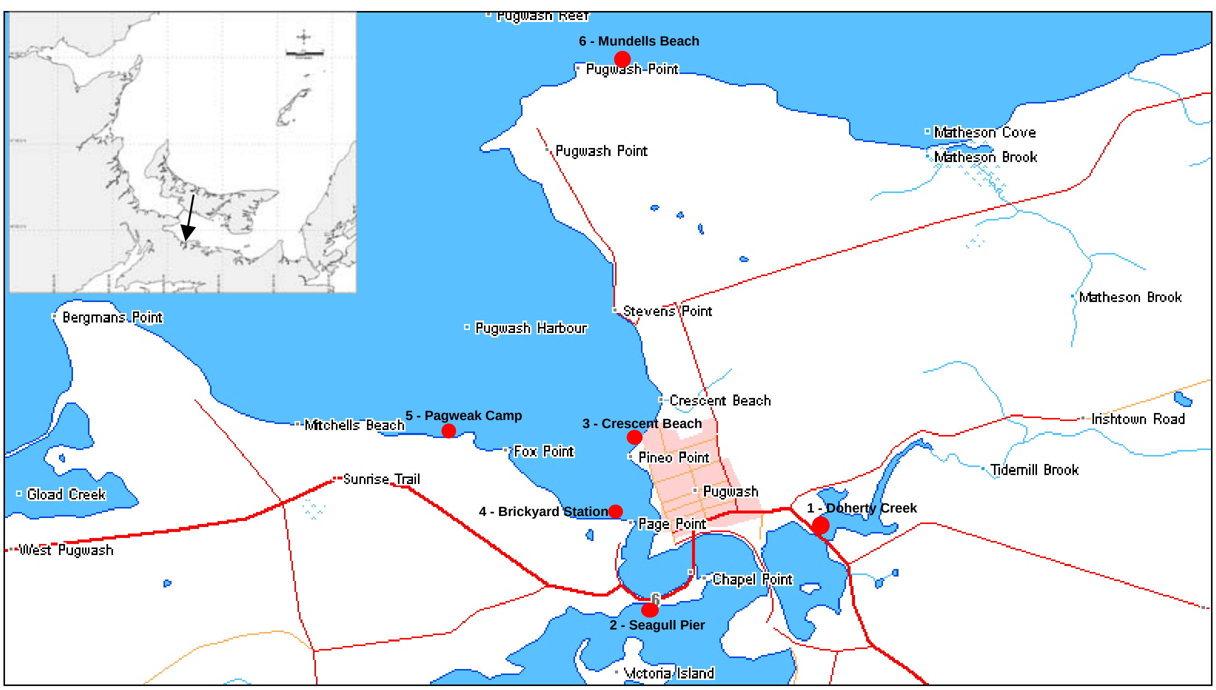
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)





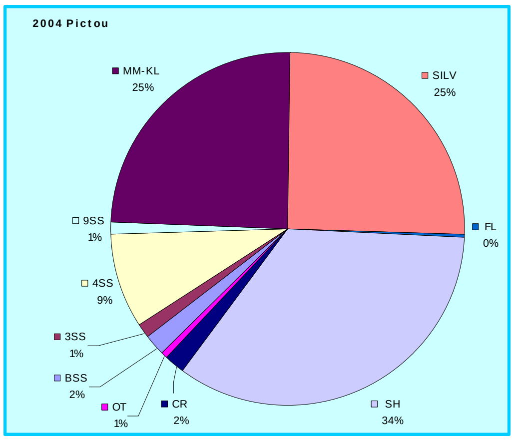


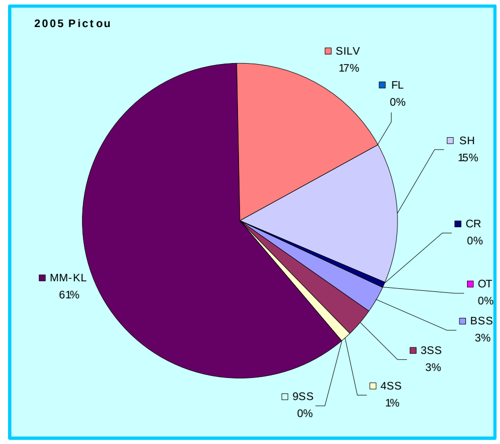


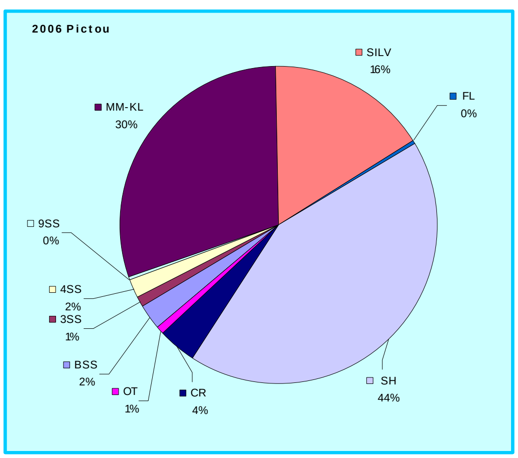


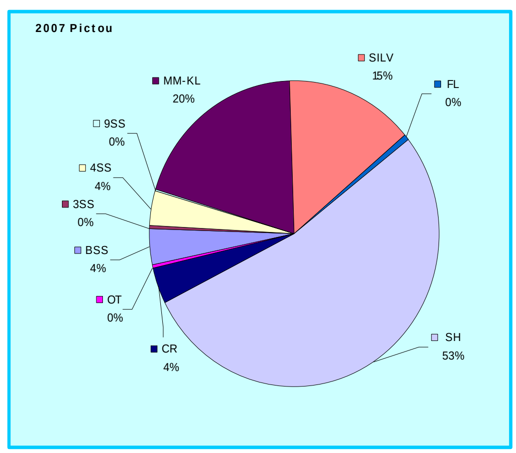
Pictou / Nova Scotia

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



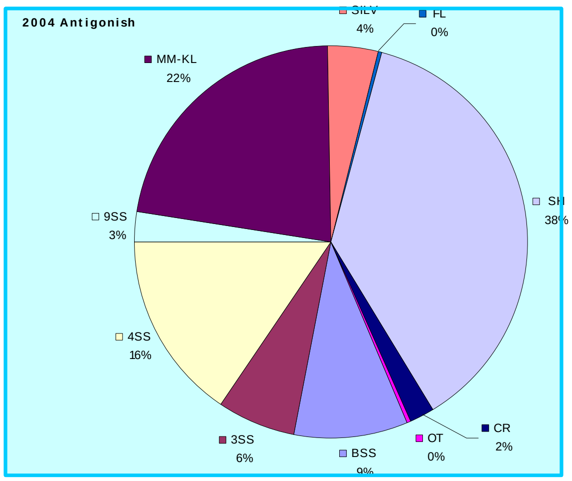


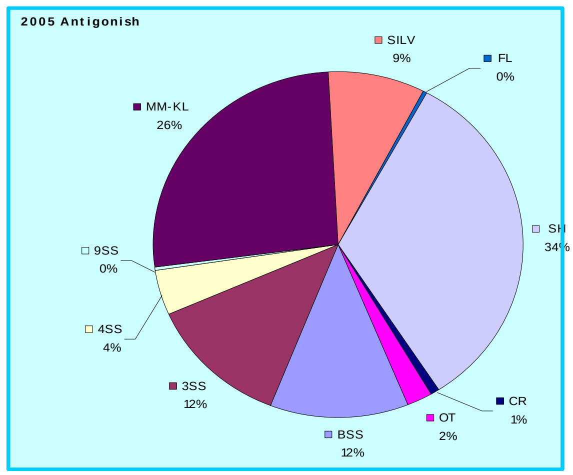


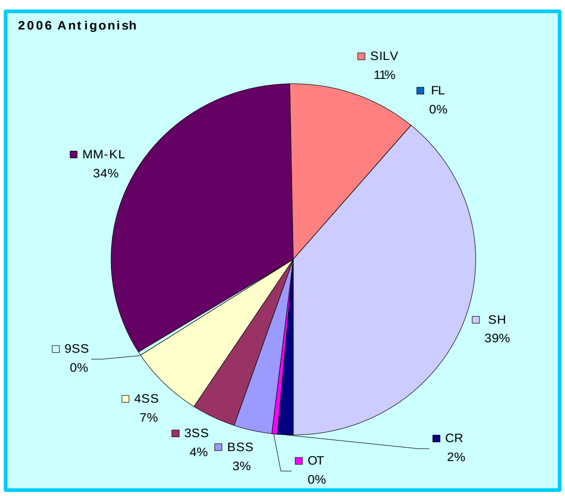


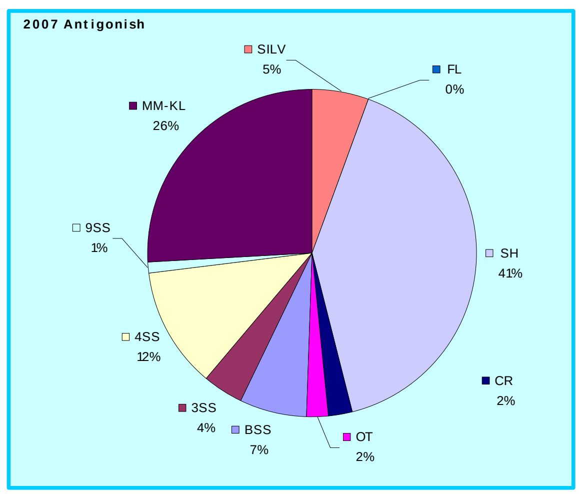
Antigonish / Nova Scotia

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



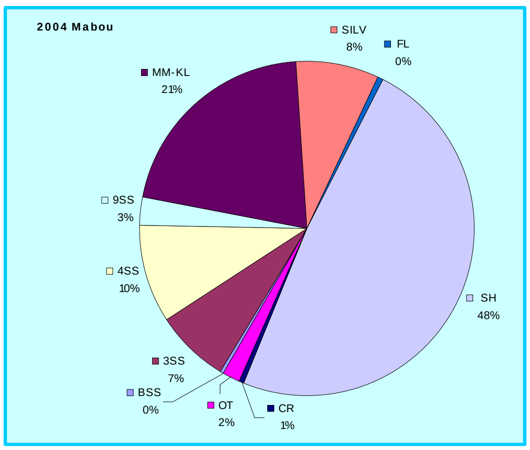


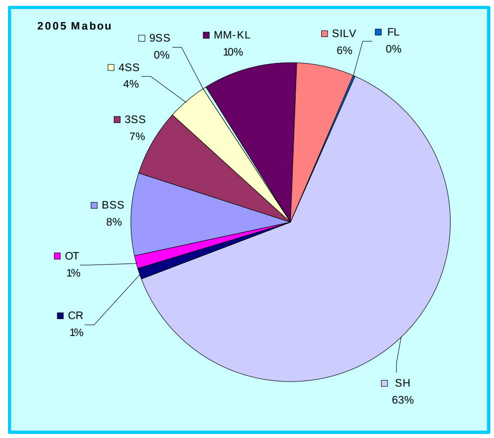


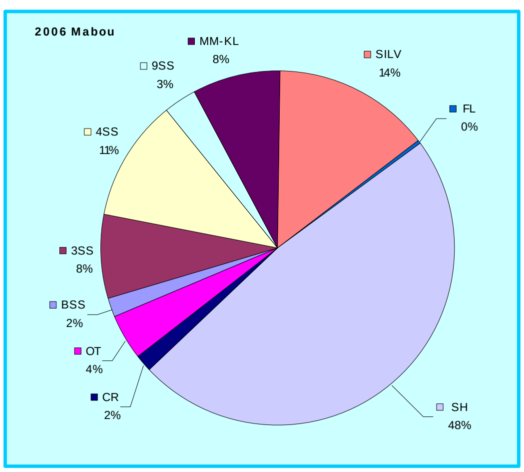


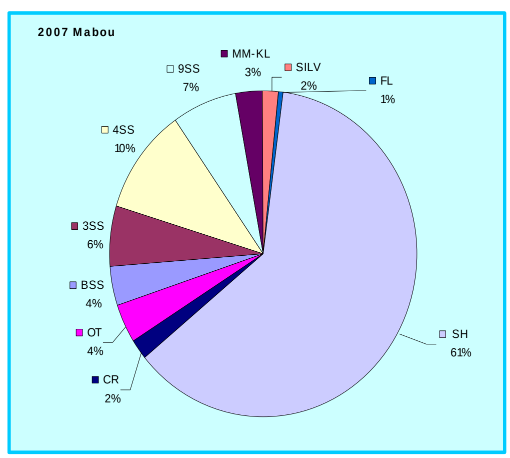
Mabou / Nova Scotia

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



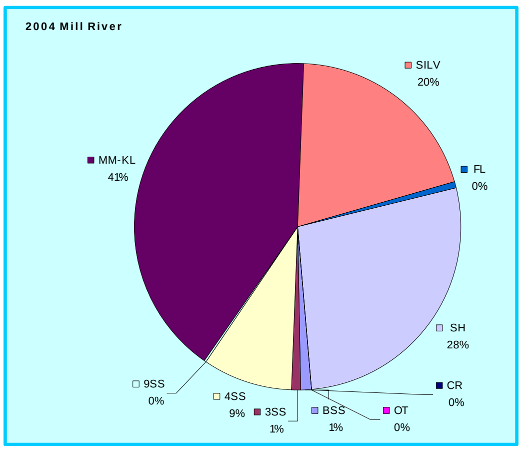


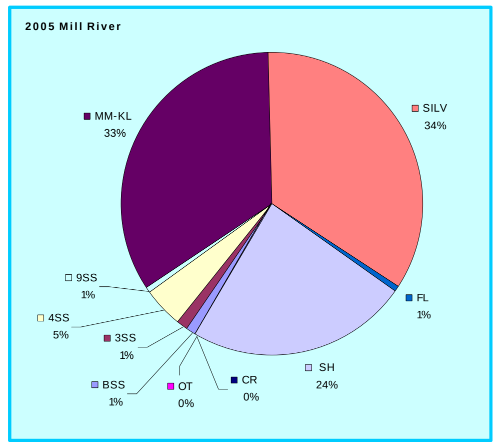


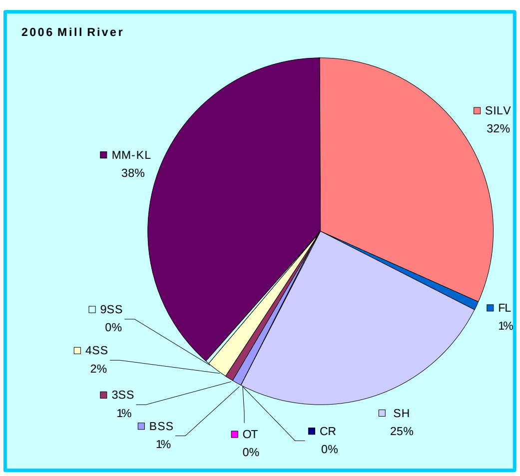


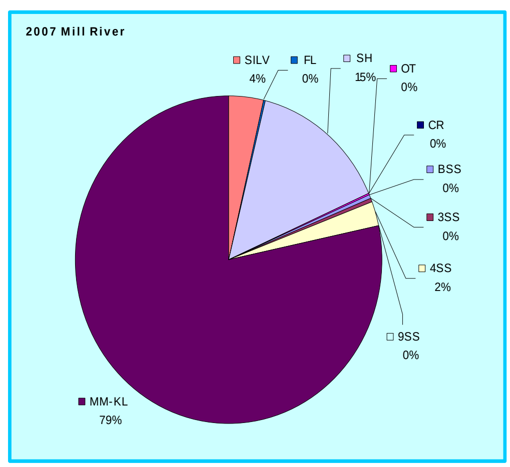
Mill River / Prince Edward Island

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)



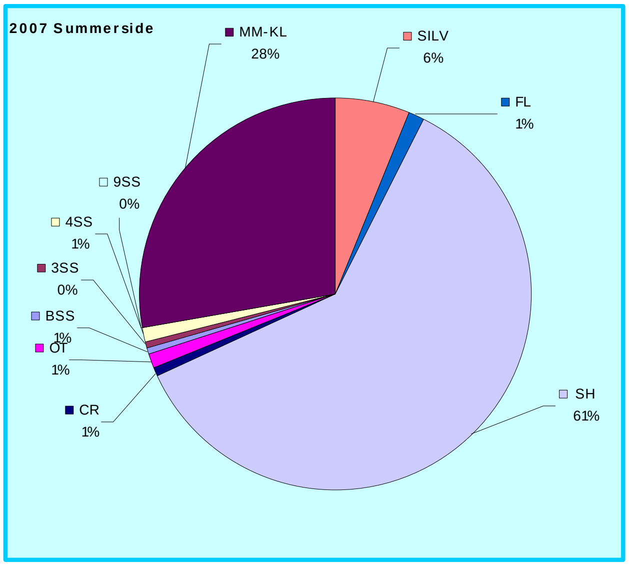


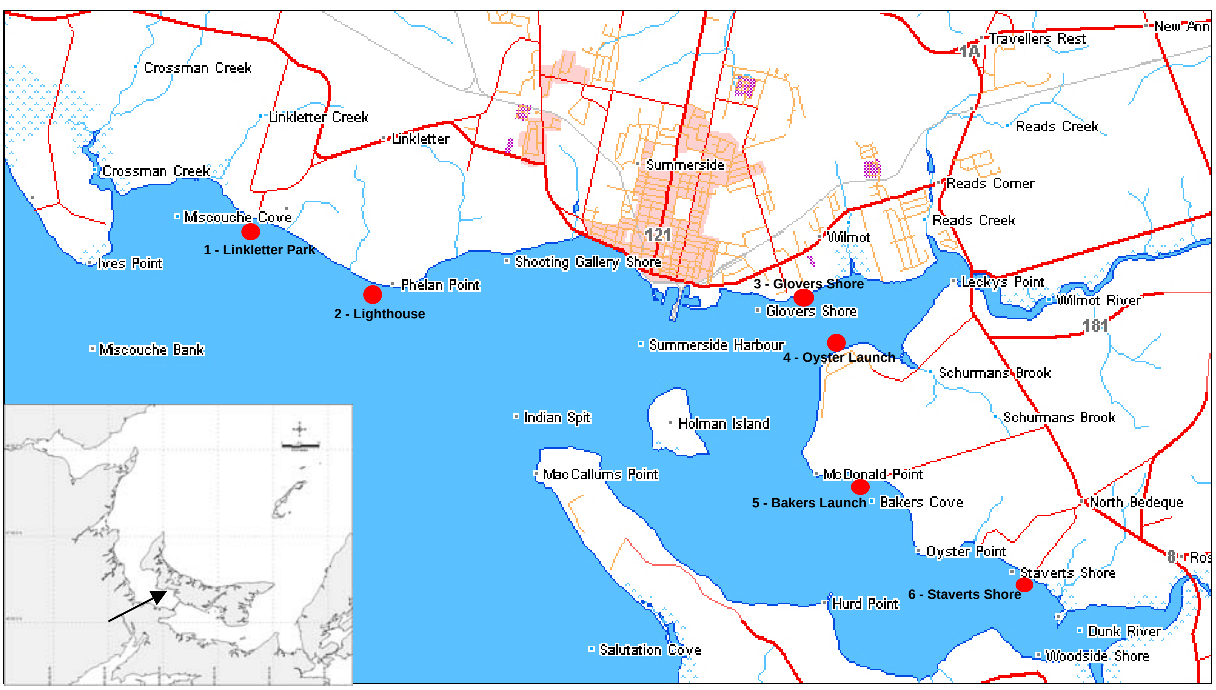




Summerside / Prince Edward Island

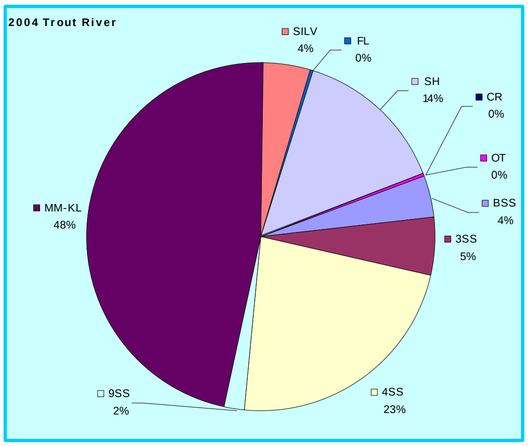
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

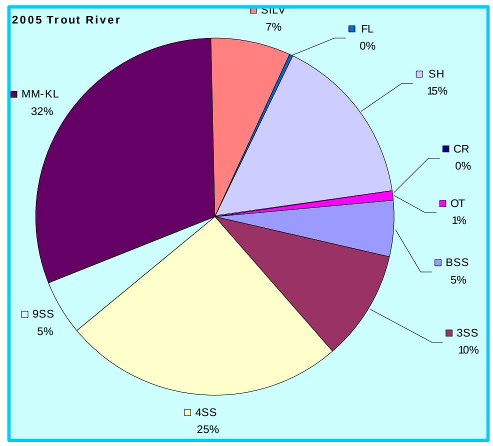


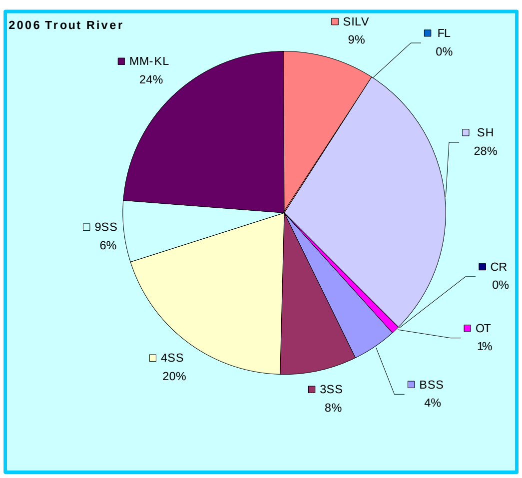


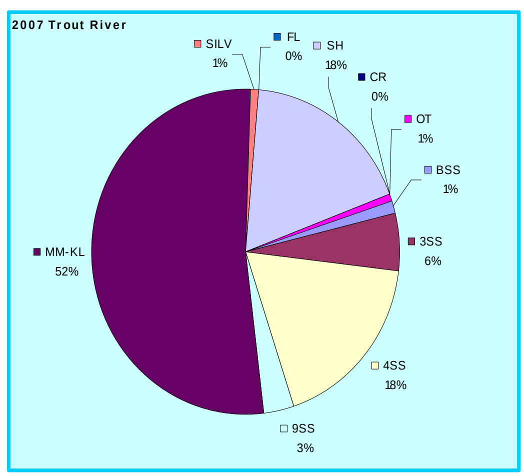
Black Spot Stickleback (BSS)
3 Spine Stickleback (3SS)
4 Spine Stickleback (4SS)
9 Spine Stickleback (9SS)
Mummichog/Killifish (MM-KL)
Atlantic Silverside (SILV)
Flounder Species (FL)
Shrimp Species (SH)
Crab Species (CR)
Other Species (OT)

Trout River / Prince Edward Island



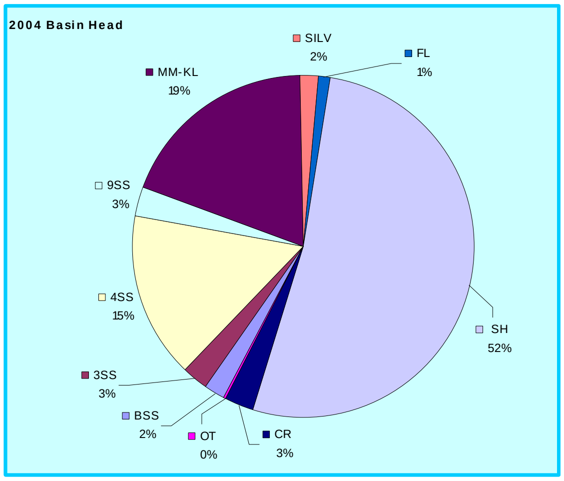


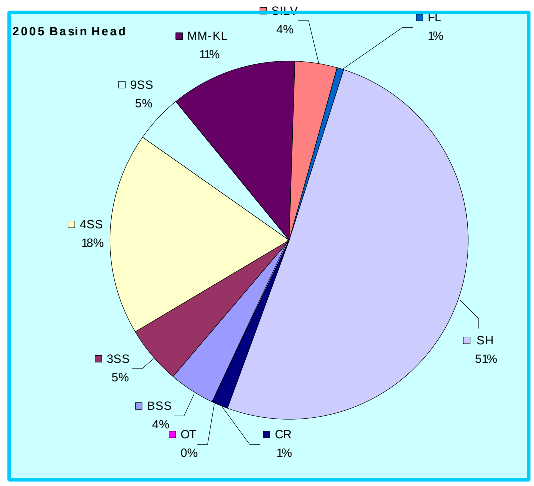


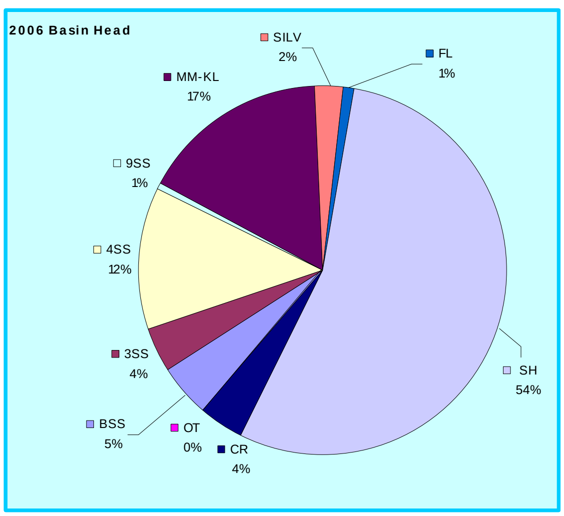


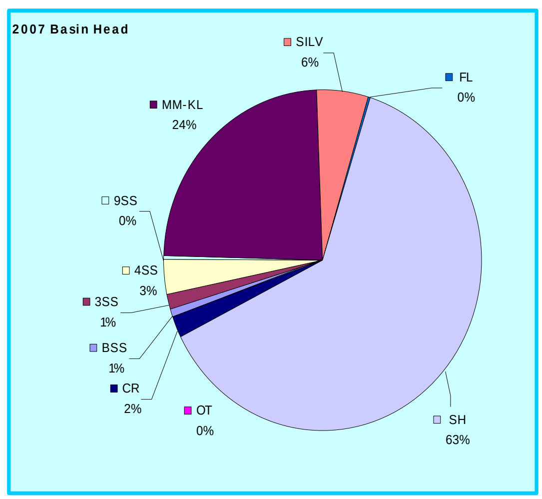
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

Prince Edward Island / Basin Head



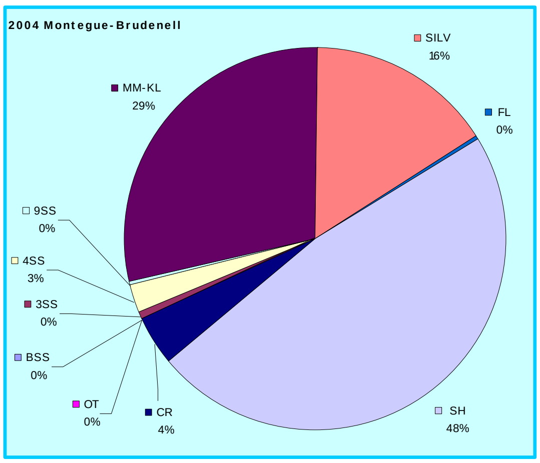


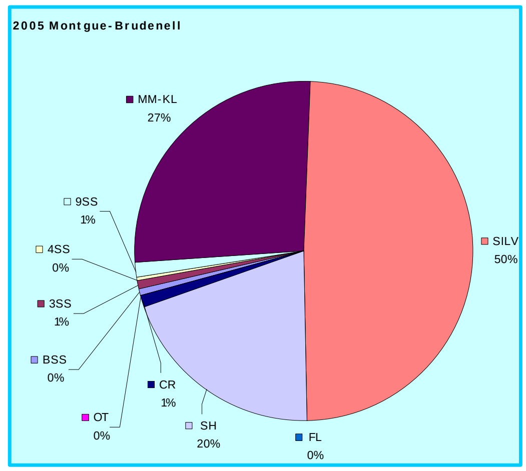


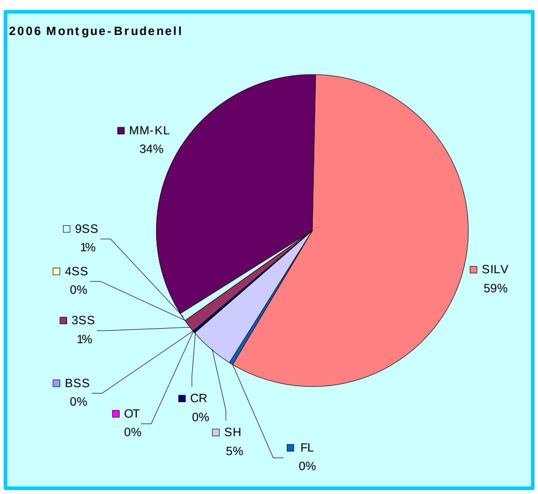


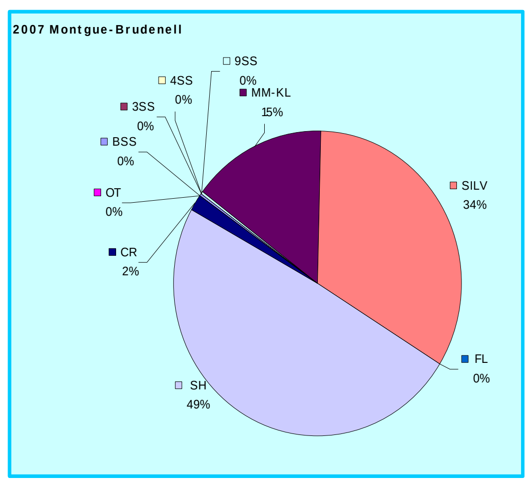
Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)

Prince Edward Island / Montague-Brudenell



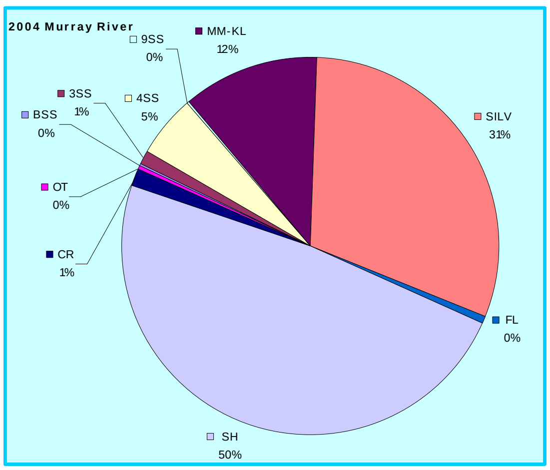


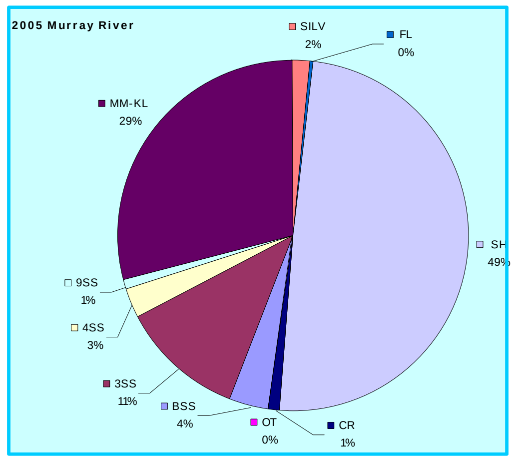


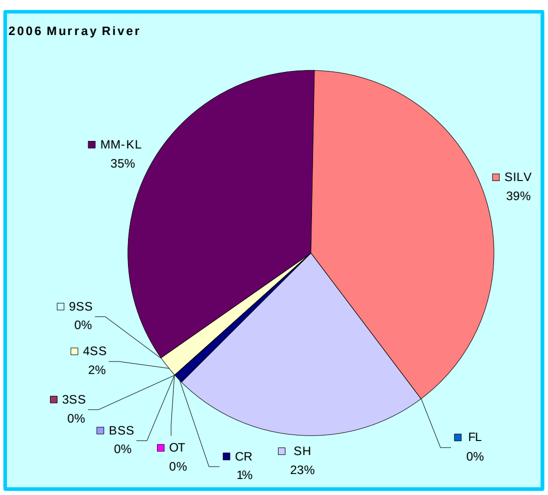


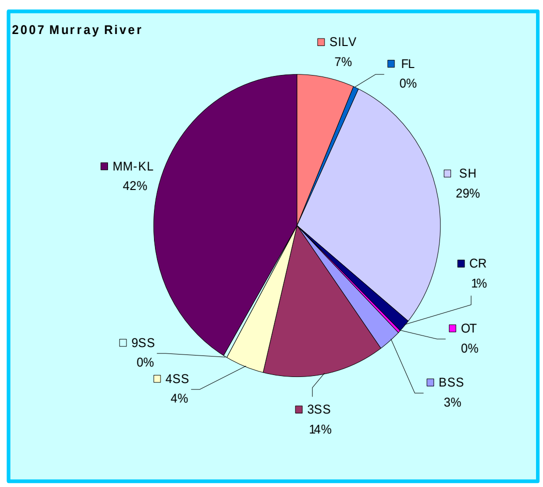
Prince Edward Island / Murray River

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)









Prince Edward Island / Pinette River

Black Spot Stickleback (BSS)	Atlantic Silverside (SILV)
3 Spine Stickleback (3SS)	Flounder Species (FL)
4 Spine Stickleback (4SS)	Shrimp Species (SH)
9 Spine Stickleback (9SS)	Crab Species (CR)
Mummichog/Killifish (MM-KL)	Other Species (OT)