

Report on Sea Lice Management in New Brunswick

Prepared by Atlantic Canada Fish Farmers Association

NOVEMBER 2013

The following report provides an overview of the status of sea lice management in New Brunswick. This report is an update to previous reports issued in 2011 and 2012. Data for this report is generated from the Decision Support System which is a data collection system developed by the Atlantic Veterinary College (AVC) at the University of Prince Edward Island. This system is maintained by the AVC, with costs covered by Atlantic salmon farming industry; data are submitted by salmon farmers. Provincial fish health personnel have ongoing access to this data; AVC or regulators perform third party audits of the salmon farm lice counts to verify accuracy in reporting. To further support this system and ensure data accuracy, the ACFFA supported the AVC in the development of a sea lice monitoring certification program for farm technicians. This ensures accurate counts are made based on the Sea Lice Monitoring Program within the New Brunswick Fish Health Regulations and the Integrated Pest Management Plan for Sea Lice.

Salmon is New Brunswick's largest agri-food export. Salmon production can reach over 35,000 tonnes annually with a farm gate value that can reach up to \$280 million. The industry contributes over \$122 million (direct, indirect and induced) to the provincial GDP and is responsible for over 2500 jobs. Salmon farming is a primary employer in Charlotte County, NB with 16 per cent of the workforce is employed in aquaculture.

New Brunswick salmon farming companies are family-owned, and also operate in Nova Scotia and/or Newfoundland. No one is more committed to finding sustainable solutions to all farm operations than salmon farmers who work hand-in-hand with colleagues at the federal, provincial and community level.

The men and women of Atlantic Canada's aquaculture industry have a proud history of marine stewardship and have always prided themselves on farming Canadian waters with care.

Like all farmers, salmon farmers are guardians of their animals and take appropriate measures to care for the health and wellbeing of their stock. Preventing disease and parasites are the top priorities. Like all farmers, salmon farmers are also stewards of the environment in which they operate. For over thirty four years, New Brunswick salmon farmers have worked diligently to find ways to enhance their environmental management practices to ensure that future generations can farm the seas and safeguard the marine environment that supports the livelihoods of their friends and neighbours.

The three Bay Management Area System implemented in New Brunswick not only supports improved environmental management but it has also provided the basis to improve fish health management practices including sea lice management. Principles within the BMA system include:

- Reduced fish or rearing density on the farms
- Mandatory fallowing of production sites and the bay management area to help break pathogens and support breaking the life cycle of sea lice
- Ensuring only salmon stocked in a single year are present at each farm site and within each management area; preventing older farmed salmon, which may have already been exposed to parasites, from transferring it to incoming smolts

Salmon farmers use sea lice treatments as a last resort only. However, like other farmers, they rely on the professional advice of veterinarians who have access to approved products when their animals are infected by a pathogen or threatened by parasites. Sea lice treatments may be authorized only through a veterinarian's prescription. All prescriptions and treatments are reported to regulators.

The following report provides a historical overview of challenges faced by salmon farmers in New Brunswick in sea lice management since 2008; the development of an integrated pest management plan for sea lice management; R&D that supports product authorizations and farm management practices; and an overview of the sea lice population in the Bay Management Areas of New Brunswick since 2009.

In 2013 salmon farming companies continue to prepare a coordinated sea lice management and treatment strategy that includes maintaining lice thresholds in each Bay Management Area, product rotations and synchronized treatments. The year started off very well with relatively stable lice populations on most farms leading into the traditional spring 'clean-up' using Interlox Paramove®50. Lice populations remained stable through the summer, with the number of gravid females allowed to increase marginally only on those farms that were to be harvested.

While high water temperatures in some areas of New Brunswick were not observed until late summer; these temperatures again held for an extended period causing increased lice populations in October. However, early data indicates that except for this rise, lice populations were kept lower than in the past four years.

In this overview report, the sea lice populations are reported monthly by Bay Management Area. These data are obtained from an analysis of the sea lice counts submitted by each farming site within the specific BMA. The data in this report represent the average sea lice count for adult female lice, which are arguably the most critical life stage to control and the life stage generally reported by other jurisdictions.

BACKGROUND

Sea lice are a naturally occurring ecto-parasitic crustacean that can weaken the fish and increase their susceptibility to potentially fatal secondary infections. Sea lice cannot be eliminated from wild salmon, other wild sources or the environment; therefore, salmon farmers have developed management practices to reduce the likelihood and severity of infestation.

All farmed salmon enter the marine environment certified disease and parasite free; however, because lice travel on wild fish, ocean currents and even in zooplankton they can move freely between both wild and farmed fish. Elevated water temperatures and salinity can result in increased lice populations.

Beginning in 2000, salmon farmers around the world had access to an anti-parasitic chemotherapeutic, emamectin benzoate – the active ingredient in SLICE®. This was the only product available for use in Canada until 2009.

In 2008, New Brunswick farmers observed a reduced efficacy to SLICE®. Beginning at that time, the New Brunswick salmon farming industry worked with federal and provincial governments, scientists and the National Fish Health Working Group to research and evaluate effective alternative options for controlling sea lice and to promote overall fish health management. Because the European aquaculture industry had access to a variety of sea lice management tools for over a decade, the Atlantic Canadian salmon farming industry collaborated internationally, and continues to do so, on evaluation and research of new

management opportunities. The goal is always to find tools that will enhance and/or complement farm management practices already in place.

Efforts by salmon farmers to make real and lasting progress have been very difficult. The inability to make progress in achieving regulatory approvals for a full suite of treatment options - fundamental to an effective integrated pest management approach - has been frustrating. Timely authorizations or access to permits have not always been available to support the evaluation or use of products under alternative delivery methods, such as well boats (whose use instead of tarpaulins result in a 75 per cent reduction in the quantity of product required for each treatment). Canada is the only jurisdiction that requires separate approvals from companies producing the active ingredients in treatment products used in commercial sea lice treatment products.

Not all products are appropriate for all life stages of lice. Management of sea lice is further complicated by environmental conditions. Sea lice numbers are also impacted by a variety of environmental factors including salinity and water temperature.

In addition to issues impacting access to treatment options, records maintained by salmon farmers show that water temperatures in New Brunswick waters continue to increase. We began to see a trend of increases by 2 degrees centigrade above historical levels in 2009; this trend continued in 2010 and in 2012 we saw that these record high water temperatures remained for longer periods than we have seen in the past.

As a result, an increase in the prevalence of sea lice in the Bay of Fundy was observed in both 2009 and 2010 and again, in some areas, in 2012. Because of high temperatures and lack of stable access to sea lice treatment products production was cut back in 2011 and again in 2012 which is impacting both jobs and revenue in the province.

SEA LICE CHEMOTHERAPEUTANTS

There are a range of compounds available internationally for sea lice management. These include:

- | | |
|-----------------------|---------------------|
| 1. Avermectins: | SLICE®, Ivermectin |
| 2. Chitin Inhibitors: | Calicide |
| 3. Organophosphates: | Salmosan |
| 4. Pyrethroids: | AlphaMax, Excis |
| 5. Hydrogen Peroxide: | Interox Paramove 50 |

All of these products have been available for many years in other jurisdictions including Norway, the UK and Chile. In the USA, Maine has used Excis, Avermectins and Interox Paramove 50. Extensive international research is therefore available to provide data to support Canadian risk assessments through Health Canada, in support of Emergency Drug Releases or Emergency Registrations pending local monitoring and surveillance data collection to support full registrations of the products. Local scientific research and monitoring and surveillance are being carried out to support Canadian product registrations; however, scientific permits, EDRs and/or ERs must be granted to enable this field work to be conducted.

Access to a variety of compounds is critical since many products are not effective on all life stages of the sea louse or under all environmental conditions. Having multiple products does not contribute to

increased chemical use. In fact, having a variety of products ensures that all are used strategically and generally results in an overall decrease in chemical use.

Health Canada's Pest Management Regulatory Agency, responsible for authorizing the use of bath treatment products through an Emergency Registration, only does so for periods of up to one year. This process must be repeated annually pending full registration of the product in Canada – which requires scientific research and monitoring to support the application.

The following products have been or are currently available for use in Canada:

SALMOSAN®

Salmosan® was previously registered and administered on New Brunswick farms in the 1990s; however, the registration lapsed when SLICE® was introduced. The Province received an ER for Salmosan® in November 2009. This permit was also subject to scientific monitoring; to date, sediment and water quality testing has shown little to no impact as a result of Salmosan® treatments.

An ER permitting the use of Salmosan® through well boat treatments was granted in August 2010. However in 2010, PMRA imposed a limit of 2800 grams per day of Salmosan®; allowing the treatment of approximately 2 net pens per day, depending on size, at a farm site. This restriction meant that on-farm sea lice could not be completely eliminated and additional treatments were required. To avoid the risk of tolerance the farming industry avoided using the product in 2011 and again in 2012. It should be noted that the ER approval granted in June 2013 for product use to June 2014 was changed to reflect data provided by the ACFFA and the Province so there is no longer a limit on the number of cages that can be treated per day. The maximum daily dose limit (2800g) was also removed.

Pending full license approval of Salmosan®, yearly applications for access to this product must be submitted to PMRA. Due to the timing of the approval in 2010 (November 4, 2010) and conditions that had to be met prior to use, many salmon farms had no sea lice treatment product available for several weeks at a time when water temperatures remained high and new generations of sea lice were developing. This resulted in a significant increase in sea lice populations and impact to farm fish health that were beyond the control of the salmon farmer and is another example of where regulatory bottlenecks impact IPMP for sea lice.

The application process for full federal licensing of this product is underway. We anticipate that the application process will be completed in 2014.

INTEROX PARAMOVE®50

Interox Paramove®50 is a hydrogen peroxide product, benign in the environment, degrading quickly to water and oxygen. This product is relatively effective on all stages of sea lice; however, it is not recommended for use when water temperatures exceed 12 degrees centigrade. The product is most effective and economical when administered in well boats; however, in 2013 a new delivery technology is being evaluated using a full tarp system.

Approval for use of this product through an ER was first received June 11, 2010; product delivery followed with a first application on June 26, 2010. However, by this time water temperatures in the area with the highest sea lice counts were already 14 plus degrees – well above the recommended high of 12.

Like Salmosan®, new applications for use have been submitted annually. Over time the salmon farming industry has developed protocols to enable the use of this product with minimal negative impact to our

farm stock at temperatures above 12 degrees, using a lower dose; however, this also means reduced efficacy.

Research has been done on the efficacy of using Interlox Paramove[®] 50 are part of a neutralizing agent for the active ingredients in other sea lice chemotherapeutants. Lab studies with favourable results have been completed; however, field trials are pending as a result of restrictions in access of the various sea lice treatment products and conflicting regulatory processes.

Full product registration of Interlox Paramove[®]50 is in progress with PMRA and expected to be complete in early 2014.

CALICIDE[®]

Calicide[®] is an in-feed treatment and use has been approved through Health Canada's Veterinary Drug Directorate. However, because Calicide[®] affects only early life stages of the sea louse, so to be effective it must be used in conjunction with bath treatments that affect later stages of the sea louse.

AVERMECTINS

Avermectins such as SLICE[®] and Ivermectin continue to be used from time to time in first year fish. These products are used as in-feed treatment under a veterinary prescription.

ALPHAMAX[®]

This is the first alternative bath product recommended for use by the National Fish Health Working Group. Monitoring of this product was conducted for ten years in Norway; the results of this monitoring study indicated there was no impact to wild fishery harvests of crab, prawns or lobster. The product has also been available for use for over ten years in the UK.

In 2009, an Emergency Registration for AlpaMax[®] enabled trials in Bay Management Area 2A area where tolerance to SLICE[®] was most evident. This emergency registration was in place for the period July to October, 2009 and was conditional upon a comprehensive monitoring and surveillance program. This work was conducted by the Department of Fisheries and Oceans, Environment Canada, the NB Department of Agriculture and Aquaculture and the NB Department of Environment with cooperation by the salmon farming industry.

All field research and scientific monitoring conducted on AlphaMax[®] in 2009 indicated that this product posed little to no risk to the marine environment or to non-target species when used as prescribed.

A second approval was granted in 2010 for the period October to December 31 in well boat use only. It too, was conditional upon a second comprehensive monitoring and surveillance program. Due to restriction on use, this product was used on an extremely limited basis in BMA 1 only. Results from scientific field trials once again indicated that this product poses little to no risk to the marine environment or to non-target species.

This product has not been used since 2010.

RESEARCH AND ALTERNATIVE MANGEMENT OPTIONS

The ACFFA plays an active role in working with researchers from government, academia and private institutions, and with industry at the regional, national and international level to support a collaborative

and coordinated research to support effective sea lice management. Generally research focuses on five key areas:

1. Regulatory Research
 - To support the evaluation, licensing and use of new treatment options
2. Environmental Dynamics
 - To provide necessary answers regarding potential risk to the marine environment and non-target species as a result of sea lice management activities
3. Management Practices
 - To support salmon farmers to improve on-farm sea lice management practices
4. Novel Treatments / Green Technology
 - Evaluation of non- chemical management options in addition to new technology to reduce the potential environmental impact of sea lice management
5. Modelling
 - Collecting and using data to evaluate the effectiveness of sea lice management activities and/or to provide information on means of improving the effectiveness of new or current technologies

Since 2010 significant financial and human resources have been invested by industry into ensuring research critical to improving our knowledge and understanding of sea lice dynamics and management. Between 2010 and 2012, industry investment resulted in leveraging support from federal and provincial governments and the expansion of research collaborations. Since that time there have been significant cuts to research funding and support by governments impacting new research collaborations. Industry continues to invest in evaluating new products, development of novel treatments and new technology.

The ACFFA regularly publishes proceedings from research workshops at <http://www.atlanticfishfarmers.com/research-program-project-reports.html>. Results from all collaborative research is made public through workshops, communication with stakeholder groups at a variety of meetings, industry and DFO websites, etc. Interim research data from private research is also often available at these workshops and published as part of workshop proceedings.

Some significant findings that we can report from this research program include:

- To date no sea lice bath treatments have resulted in mortality to non-target species when the sea lice treatment product is used as prescribed in regulation
- There has been no impact to the sediments as a result of sea lice treatments
- The Decision Support System has been created and records all sea lice population data; these data are verified by a third party audit and the data are now being used to evaluate the effectiveness of sea lice management
- A certification program has been established for sea lice monitors to ensure accurate sea lice data are reported from farm sites
- Well boats and tarps have been introduced to ensure all sea lice bath treatments are performed in closed systems, significantly reducing potential environmental impact and the quantity of products required for effective sea lice treatments
- We have been successful in neutralizing the active ingredient, deltamethrin, in a laboratory by over 80 per cent using Fenton's Reagent (hydrogen peroxide plus iron)

Local research is continuing. Projects underway include:

- Evaluation on the use of cunner fish as a sea lice cleaner fish,
- Effectiveness of mussels as a filter for sea lice nauplii,
- Effectiveness of sea lice traps, and

- Hydrological surveys in Aquaculture Bay Management Area 2B

Internationally, feed companies have developed formulations using natural ingredients that inhibit sea lice from attaching to farmed salmon or boost the salmon's immune system. These feeds are being used in Norway and in the EU. While these feed ingredients can be consumed by humans and fish that have been fed these ingredients can be imported for sale, they are not currently available in Canada because they are not on the Canadian Food Inspection Agency's list of approved ingredients for feed products. Innovations in technology to mechanically remove and/or collect sea lice, also continues.

NON TARGET SPECIES

There has been a range of field research and scientific monitoring conducted on all sea lice bath treatments both in Canada and in other jurisdictions. All research on AlpaMax[®] indicated that this product poses little to no risk to the marine environment or to non-target species when used as prescribed. Sediment and water quality testing also showed little to no impact resulting from the use of Salmosan[®] treatments. The data from research conducted by Fisheries and Oceans Canada and the NB Department of Agriculture Aquaculture and Fisheries have been reported publicly by federal and provincial researchers. Data was shared with fishery and conservation organizations at a variety of meetings hosted by the ACFFA, by DFO and by NBDAAF and are also available on the ACFFA and DFO websites.

There have been no significant changes in the landings for the traditional fishing sector over the past five years and lobster landings have increased steadily.

There is no scientific evidence that sea lice from farmed salmon have had a negative impact to wild species populations in New Brunswick. Wild salmon populations in Atlantic Canada fluctuate in a similar manner in areas both with and without salmon farms.

To view lobster and other wild fishery data visit <http://www.dfo-mpo.gc.ca/stats/commercial/sea-maritimes-eng.htm>

SEA LICE MANAGEMENT ON FARMED SALMON 2009 - 2013

SLICE[®] was used exclusively for sea lice management on salmon farms up until July 2009. Based on an evaluation of sea lice bath treatments available in other countries, a decision was made to begin evaluating alternative treatments with AlphaMax[®] in July 2009. Since that time New Brunswick salmon farmers have also evaluated Salmosan[®] and Interlox Paramove[®]50.

2009

In June 2009, an emergency registration for AlphaMax[®] was granted with the use by New Brunswick salmon farmers limited to BMA 2A only. The product was applied as a bath treatment in skirted net pens. Extensive environmental monitoring was conducted in addition to non-target species testing.

In November 2009 an emergency registration for Salmosan[®] was obtained.

Water temperatures in BMA 1 Passamaquoddy Bay hit record high temperatures, tolerance to SLICE® was increasing so farmers in this area were left with virtually no treatment option from the spring through to November.

Traditionally winter, when water temperatures drop, is a time when sea lice will die naturally and there is seldom a new set of lice on a farm from December to March. However, the winter of 2009/2010 saw higher than normal water temperatures continue. This factor, combined with the higher than normal lice loads left on the fish because of inadequate treatments options in the summer and fall of 2009, made it critical that the industry take aggressive action in March / April of 2010 to prevent lice populations from escalating and to safe-guard the health of farmed salmon stocks.

2010

All of the salmon farming companies worked together to prepare a coordinated treatment plan that included establishing treatment thresholds in each Bay Management Area and a synchronized treatment strategy. Salmon farmers also invested in well boat technology; ultimately three well boats were available for use in New Brunswick during 2010. Well boats supported the introduction and use of Interlox Paramove®50, an environmentally benign hydrogen peroxide product, resulting in increased treatment efficacy and ultimately a significant reduction in the quantity of treatment product required for each treatment.

However, the aggressive treatment plan could not be fully implemented. Interlox Paramove®50 approval was not obtained until July so Salmosan® was the only product available. By the time Interlox Paramove®50 was approved, water temperatures had exceeded the recommended 12 degrees; however, the treatment dose was adjusted to accommodate the higher water temperatures, although this impacted treatment efficacy.

Lice populations in Bay Management Area 1 increased significantly through the summer where second year fish were located. This was due to higher than normal water temperatures (2 degrees C higher than the historical high), the inability to fully utilize Interlox Paramove®50, and restrictions on the use of Salmosan® and later AlphaMax®.

2011

The salmon farming companies again prepared a coordinated treatment strategy that included establishing treatment thresholds in each Bay Management Area, product rotations and synchronized treatments.

The strategy could not be fully implemented because the only products available were Interlox Paramove®50 and Salmosan®. Farmers avoided the use of Salmosan® because of concerns that restrictions on the use of the product could lead to the development of tolerance. This approach was successful because water temperatures remained in the normal range and salmon were stocked in areas of New Brunswick that traditionally have lower water temperatures, and/or where sea lice do not normally pose a serious threat.

Sea lice data in 2011 indicated that having timely access to the appropriate treatment options enabled salmon farmers to control this parasite. However; it was also evident that it continued to be critical to ensure that a fully operational integrated pest management plan is implemented and supported by access to a suite of treatment products. Having access to a single product is not in the best interests of fish health management. A variety of treatment products does not mean increased use of

therapeutants; it means that the correct product is used strategically to obtain optimal results resulting in an overall decrease in the number of treatments required and the amount of product used, regardless of the environmental factors such as water temperatures.

2012

Salmon farming companies again prepared a coordinated treatment strategy that included establishing treatment thresholds in each Bay Management Area, product rotations and synchronized treatments.

In late 2011 salmon farmers were forced to make the critical decision not to stock all salmon farms in BMA 1 which is prone to high water temperatures. Despite three years of local scientific research and monitoring supported by international research, our industry still did not have the stable access to a variety of treatment options to implement a fully operational integrated pest management plan. Access to in-feed sea lice inhibitors is also not an option because of continued regulatory constraints. This resulted in lost jobs, lost market access, a significant reduction in provincial tax revenue from this industry, and a critical loss to industry competitiveness.

In 2012 water temperatures once again hit record high levels throughout southwest Bay of Fundy. Not only did temperatures reach as high as 18 degrees in some areas of BMA 1, but temperatures of 14 to 16 degrees were maintained for an extended length of time throughout the region.

The salmon farming industry once again relied on Interlox Paramove®50 for the majority of its sea lice treatments. We have been cautioned that sea lice can also develop a resistance to this product so it is becoming even more critical that salmon farmers throughout Canada have access to a full suite of treatment options.

2013

By early this year both Interlox Paramove®50 and Salmosan® were in the full application process with Health Canada's Pest Management Regulatory Agency. Full registration for these products is anticipated to be complete in 2014. Both products were available to salmon farmers throughout 2013 through an emergency registration.

Salmon farming companies continue to prepare a coordinated sea lice management and treatment strategy that includes maintaining lice thresholds in each Bay Management Area, product rotations and synchronized treatments.

Management of sea lice this year started off very well with relatively stable populations on most farms leading into the traditional strategic spring treatment using Interlox Paramove®50. Lice populations remained stable through the summer, with the number of gravid females allowed to increase marginally only on those farms that were to be harvested.

High water temperatures in some areas of New Brunswick were not observed until late summer; however, these temperatures again held for an extended period and caused an increase in lice populations in October. However, early data indicates that except for this rise, lice populations were kept lower than in the past four years.

Interlox was used for early lice control but Salmosan® in full tarps was used to support the fall 'clean up' of lice on farms. During 2013 the NB salmon farming industry also tested a new delivery system for bath treatments in full tarps that supports a better mixing and improved treatment efficacy.

It should be noted that in 2013 Admiral Fish Farms closed their operations. The financial losses this company experienced in 2010 and into 2011 as a result of not having timely access to effective sea lice chemotherapeutants was a contributing factor.

SUMMARY OF TREND ANALYSIS 2009 - 2013

In 2010, the Atlantic Canada Fish Farmers Association, on behalf of the New Brunswick salmon farming industry, and with support from the Province of New Brunswick, worked with the Atlantic Veterinary College at the University of PEI to develop a data base to house the on-farm sea lice data to enable industry to analyze the efficacy of treatment products and support improved sea lice management. This database also provides regulators with reports on sea lice management.

The reports following come from this system. While there has been a significant effort to include data from 2009, not all data entry for that year has been complete. 2009 data are not available for BMA 3A or 3B.

Appendix A includes charts for each Bay Management Area containing the average count, by month, for adult female *Lepeoptherius salmonis* sea lice. These lice are considered the most critical to the management of sea lice populations within a salmon farm. Information specific to the management area is provided on each chart.

Note that the Y-axis scale (numbers of lice) varies from one graph to another.

HISTORICAL TREND ANALYSIS BY BAY MANAGEMENT AREA

BMA 1 - Trend Analysis

2009 – The only product available for treatment is SLICE®; farms are just being stocked

2010 - Counts coming into the spring are reasonable and pose no threat to farm fish health or other species. Treatments in spring bring numbers down; however, lice numbers begin to increase in late June because approvals for use of hydrogen peroxide and access to well boat were delayed. Water temperatures increase (2 degrees C higher than historical high) causing lice numbers to increase. Treatments using reduced levels of Interlox Paramove®50 and Salmosan® administered through to October; but efficacy reduced due to restrictions on use (water temps and regulatory). Full concentration of Interlox used in November; numbers are drastically reduced.

2011 – Increased lice count in March is normal; timely treatment using Interlox Paramove® results in significant drop and numbers are being maintained well below five. Fish being harvested

2012 – Fish in this area are harvested into February; stocking of smolt begins in April. An in feed treatment of Ivermectin has maintained lice numbers well below two throughout this monitoring period. A strategic treatment in the fall with Interlox Paramove®50 was scheduled. Water temperatures reached as high as 18 degrees in some areas of this Bay.

2013 – These fish were stocked in 2012. Lice numbers remained relatively low well into the winter. Treatments began in this area in April. Farms were treated using Interlox Paramove®50 in well boats until September when some Salmosan® started to be used based on water temperature. Where a well boat was not available, full tarps were used.

BMA 2A Trend Analysis:

2009 – Approval to use AlphaMax® on a trial basis beginning in June 2009; numbers maintained at low level; spike in October occurred because fish were being harvested so no treatment was conducted on the remaining farm

2010 – First year smolts were being stocked into this BMA in 2010; lice counts maintained at low level but increased in August to December at which time there was a strategic treatment with Interlox Paramove® 50

2011 – Counts spike in the spring which is a normal trend with treatments planned and conducted using Interlox Paramove®50. This timely application results in maintaining lice number at one or less throughout the summer and into the fall. Numbers began to increase; however, lice were again eliminated during the late fall strategic treatment using Interlox Paramove®50.

2012 – This area contains second year fish in the process of being harvested. Spikes in sea lice numbers are a result of farms avoiding treatment because harvesting was either underway or scheduled. Farms treating to reduce numbers used Interlox Paramove® 50 with some Salmosan® when water temps are high.

2013 – This area was stocked in 2013. Lice numbers have remained below one gravid female throughout the monitoring period. Any treatments administered were done using in-feed products.

BMA 2B Trend Analysis:

2009 – No fish stocked in this area.

2010 – Water temps are cooler in this area. Sea lice on first year smolts were managed through use of Interlox Paramove and/or Salmosan. Spikes in July and November managed using Interlox Paramove® 50

2011 – Counts spike in the spring which is a normal trend; spring treatment using hydrogen peroxide; timely application results in maintaining lice numbers well below one through to October. Lice are once again treated as part of the end of year strategic treatment with Interlox Paramove®50 and counts are reduced below two.

2012 – Fish in this area are now in the final grow-out phase. Spring treatments are done using Interlox Parmove®50. Water temperatures are in the 14 degree range; however, any treatments required prior to harvest are done using Interlox Parmove®50 at a reduced dose.

2013 – Water temperatures in this area of Grand Manan are generally cooler in the summer. Fish were stocked in this area in 2013 and lice numbers remained well below one gravid female. Any treatment administered was done using in-feed products.

BMA 3A - Trend Analysis:

2009 – No data available

2010 – Water temps are cooler in this area. Sea lice abundance is managed through use of Interlox Paramove®50 and/or Salmosan®. Harvesting of fish stocked in 2008 begins.

2011 – Stocking of fish began in April / May. Counts remain low; sea lice abundance is managed through the use in-feed treatments.

2012 – Counts are maintained at very low levels with Interlox Paramove®50 until mid-summer when water temperatures begin to rise. Fish in this area being treated using Interlox Paramove® 50 at an adjusted dose level.

2013 - This area contains second year fish scheduled for harvest. Spikes in sea lice numbers were accepted because fish were being harvested from farms and use of treatment products were avoided. Any treatments in this area in the spring or pending harvest were done using Interlox Paramove® 50.

BMA 3B Trend Analysis:

2009 – Data only available from a single farm as database is established;

2010 – Water temps are traditionally cooler in this area. Sea lice abundance on farms is managed through use of Interlox Paramove®50 and/or Salmosan. Fish stocked in 2008 began to be harvested

2011 – Smolts are stocked in April/ May. Counts remain low well into the fall when a strategic treatment using Interlox Paramove®50 is used throughout the area resulting in numbers below three going into the winter.

2012 - Sea lice numbers begin to increase as water temperatures remain at levels well above 14 degrees. Strategic treatment using Interlox Paramove®50 or Salmosan® begins in October and numbers drop significantly.

2013 - This area was stocked in 2011 so lice numbers were allowed to increase on farms where harvest was either underway or scheduled. The farm that required a spring treatment used Interlox Paramove® 50. No other treatments were required until late fall when Salmosan® was used in full tarps.

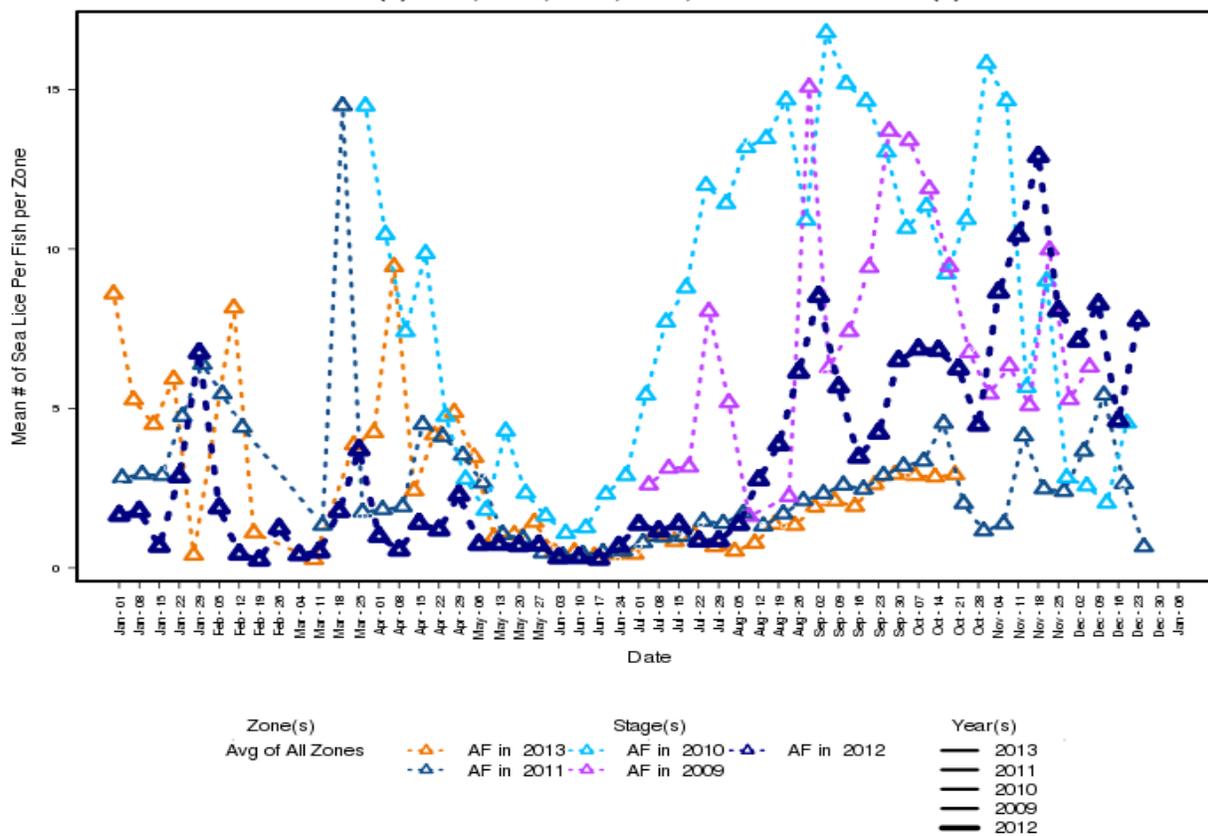
See Appendix A for the annual mean number of sea lice per fish for each Aquaculture Bay Management Area for 2013.

The following graph provides data on the mean number of adult female sea lice in New Brunswick for the past five years. This data demonstrate that the salmon farming industry has been relatively effective in keeping adult female lice populations at a manageable level. However, effectiveness cannot be maintained without access to a variety of management tools. These tools must include research support to develop non-chemical management options such as the use of cunner fish as cleaner fish, evaluation of lice traps, etc. Research and monitoring is also critical to the approvals of new sea lice medicines. Sea lice inhibitors in new feed formulations offer great promise but require changes to allowable feed ingredients. While the use of medicines and therapeutants is always a last resort, access to these products, approved for use in other countries for over ten years, must also be supported and new research needs to be encouraged.

The access to a full suite of tools would considerably alter the graph below to provide fewer and smaller peaks. Having multiple products does not contribute to increased chemical use. In fact, having a variety of products ensures that all are used strategically and generally results in an overall decrease in chemical use. A fully operational integrated pest management approach for sea lice will also mean fewer losses and/or downgrades of fish, increased employment, and a strengthened New Brunswick economy attributable to a stronger farmed salmon industry offering greater potential for growth.

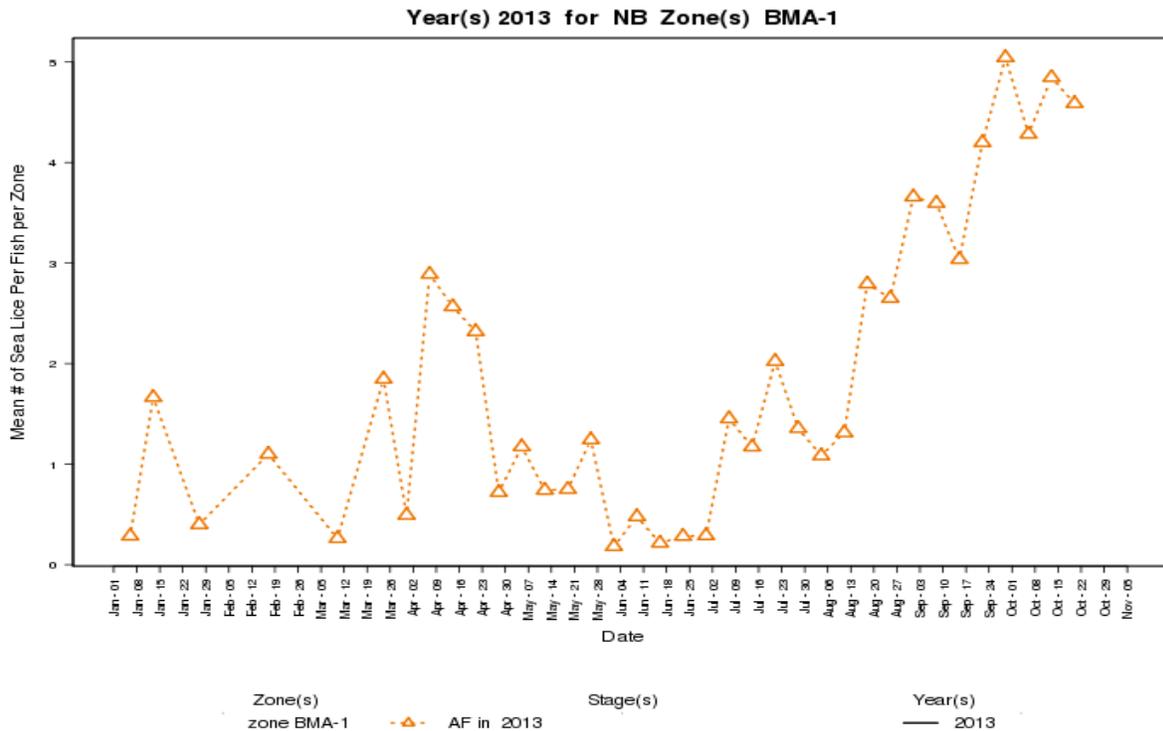
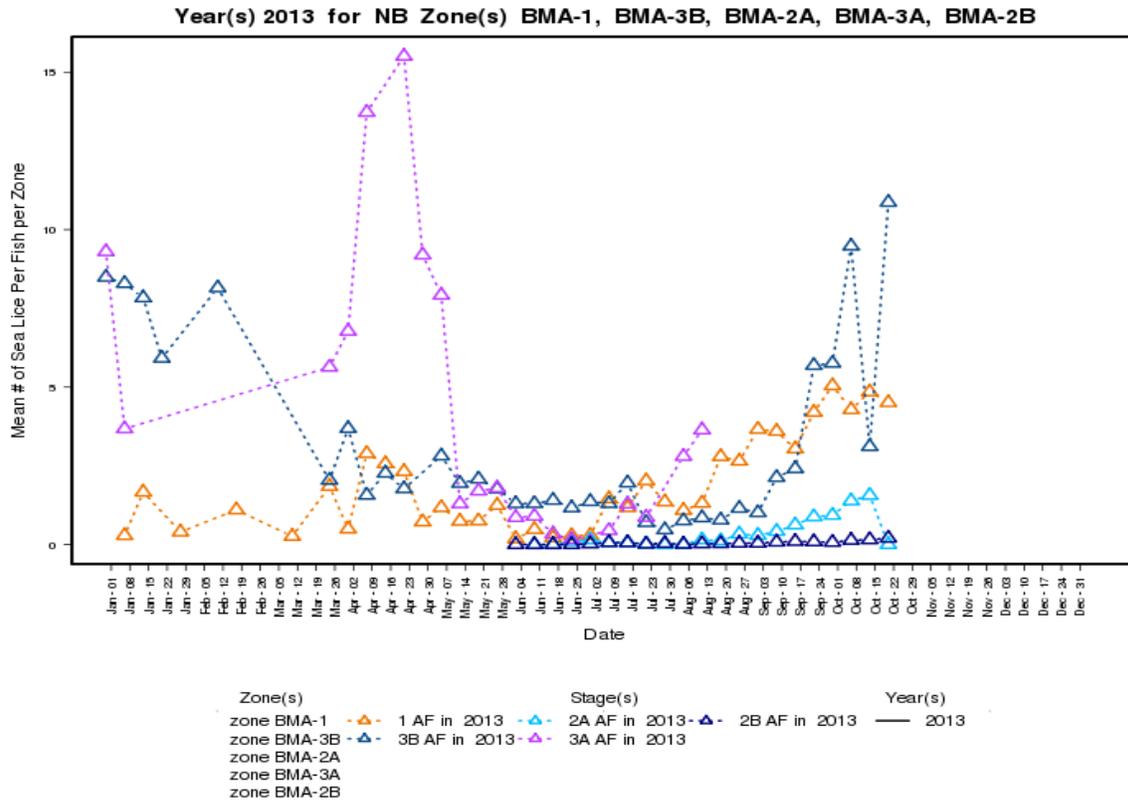
Finally, Canada's regulatory and policy framework for aquaculture must become more responsive to enable the salmon farming industry to adopt new research, technology and other innovations in a more timely manner. This is not only critical to effective fish health management but will ensure our salmon farming companies remain competitive.

Year(s) 2013, 2011, 2010, 2009, 2012 for NB Zone(s)

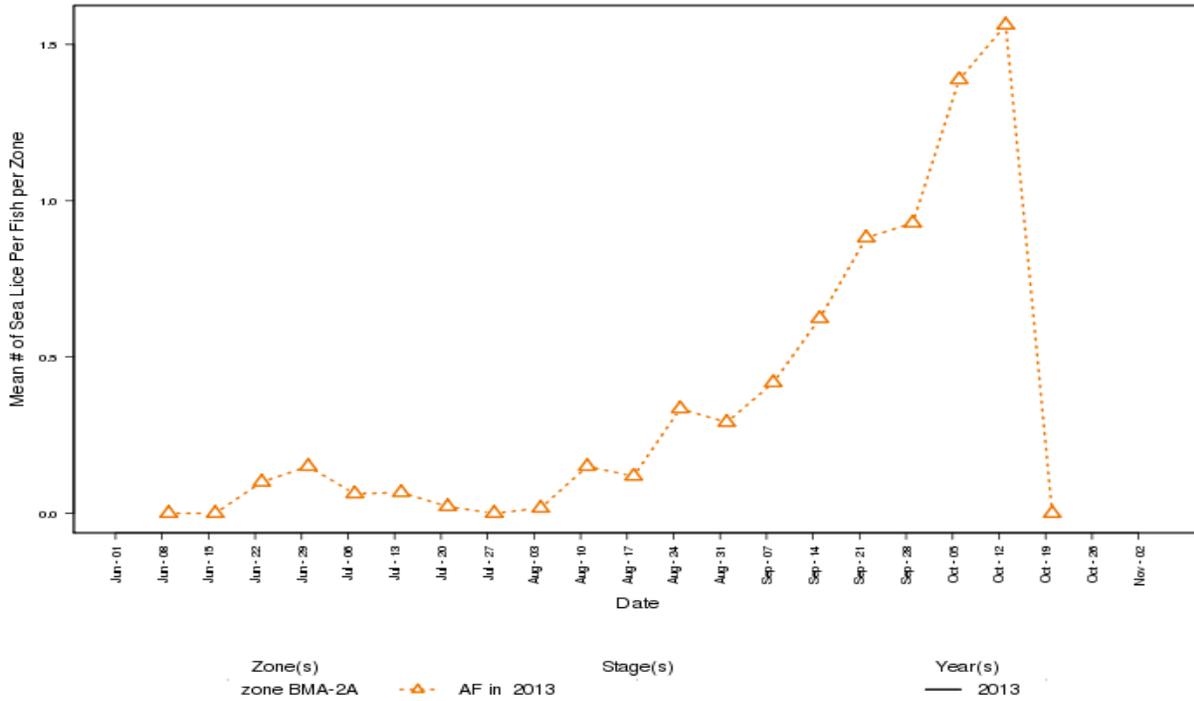


APPENDIX A

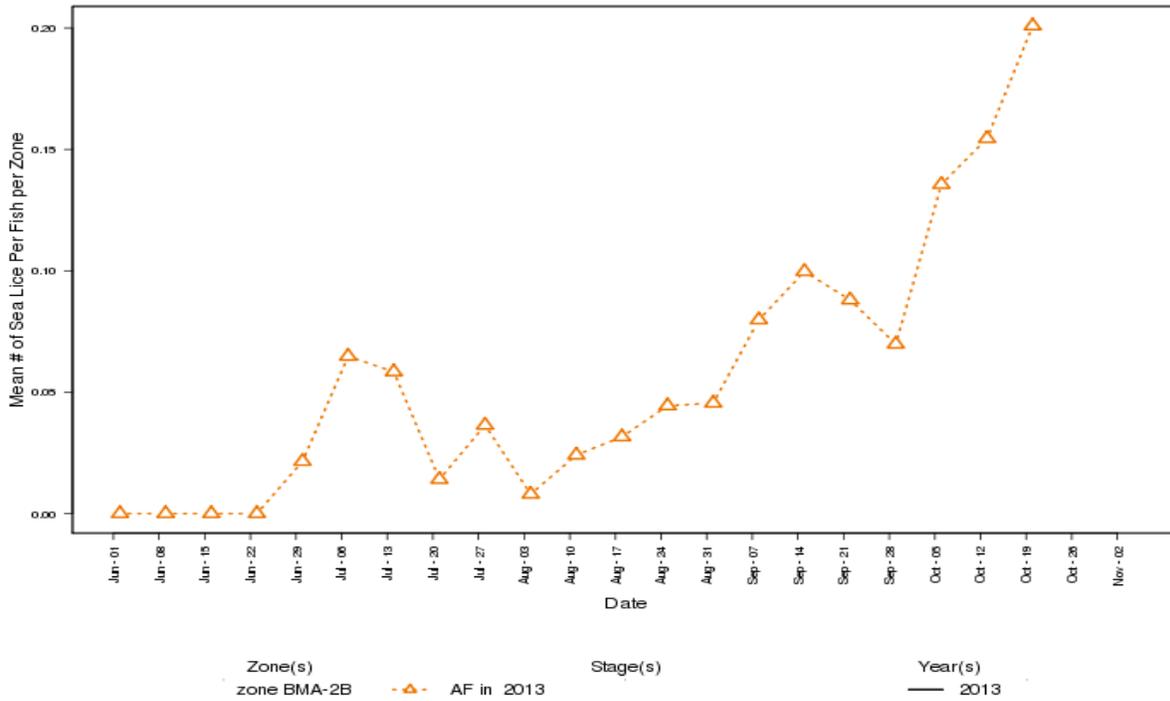
Aquaculture Bay Management Areas Sea Lice Data 2013

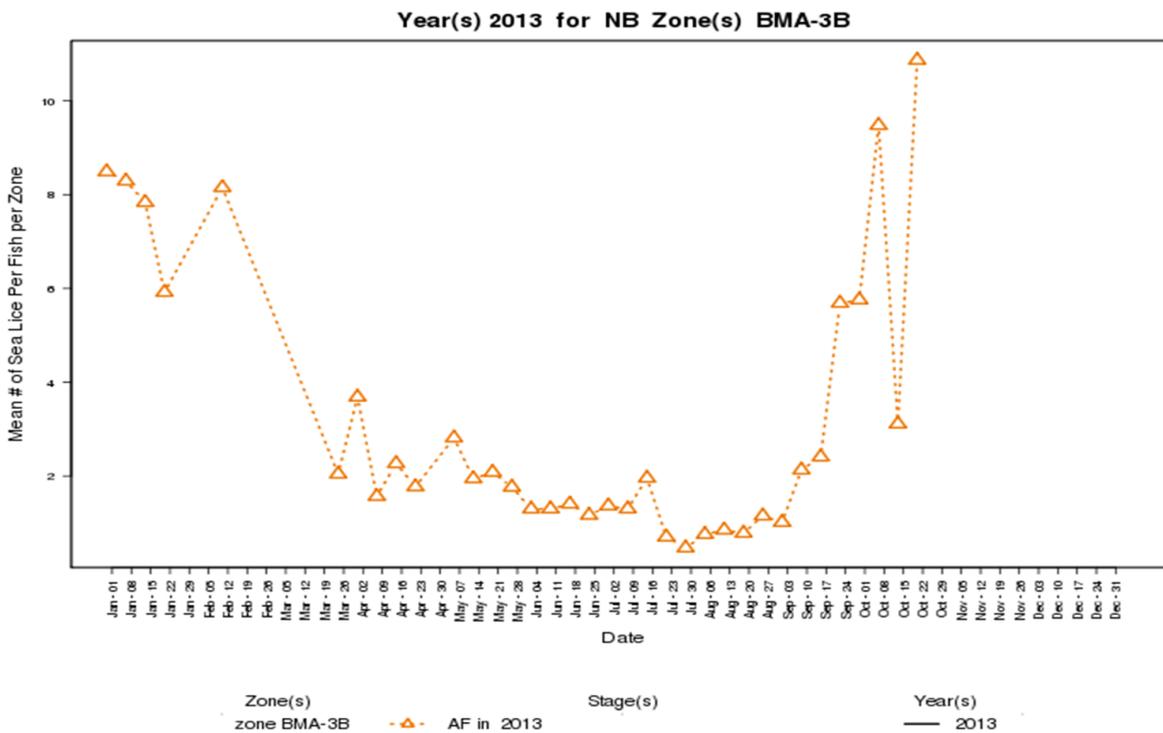
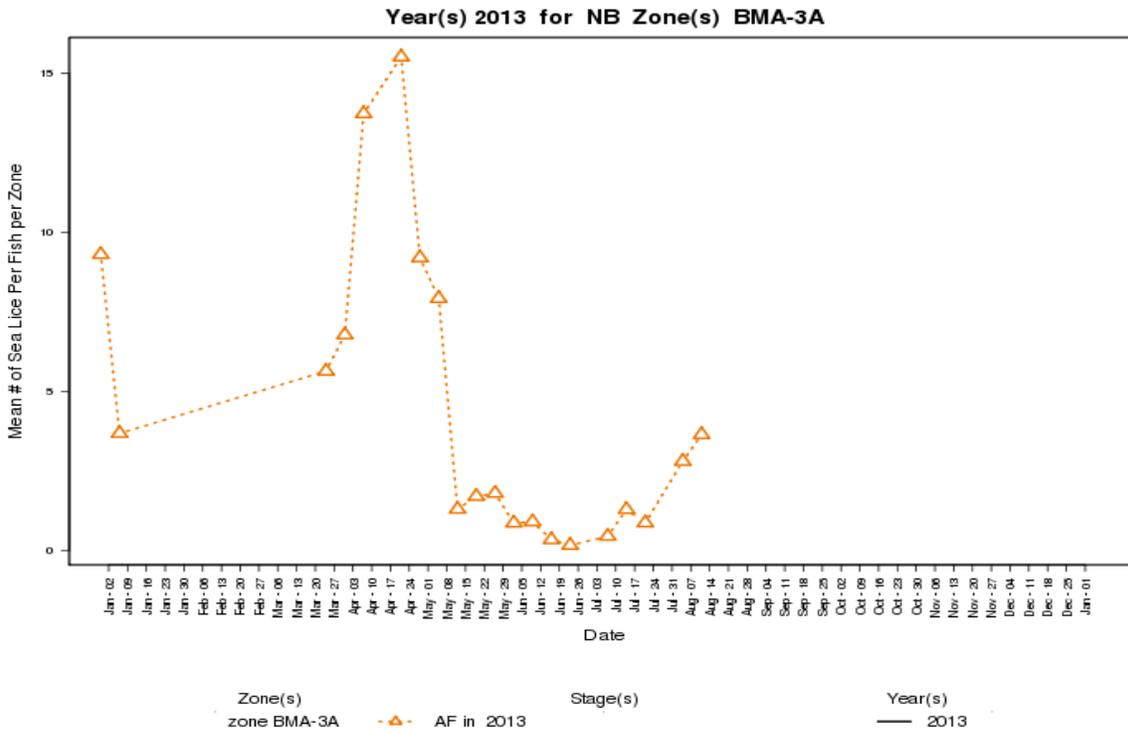


Year(s) 2013 for NB Zone(s) BMA-2A



Year(s) 2013 for NB Zone(s) BMA-2B





APPENDIX B

Aquaculture Bay Management Areas of New Brunswick

