New Brunswick, Canada

## Sea Lice Integrated Pest Management

Multi-National Sea Lice R & D Meeting

Bergen, Norway

February 10 & 11, 2010

Presentation Overview

- Background on New Brunswick Situation
- Development of IPMP & Research Direction
- Summary of Research Projects
- Next Steps

Geography/Oceanography Background

- Bay of Fundy is a very productive high energy environment.

- High wild fishery value including lobster, high tidal range & associated currents and high natural organic content in the water column.

- New Brunswick (NB) aquaculture industry produces 35-40,000MT annually of salmon in the Bay of Fundy

Tidal currents (knots)
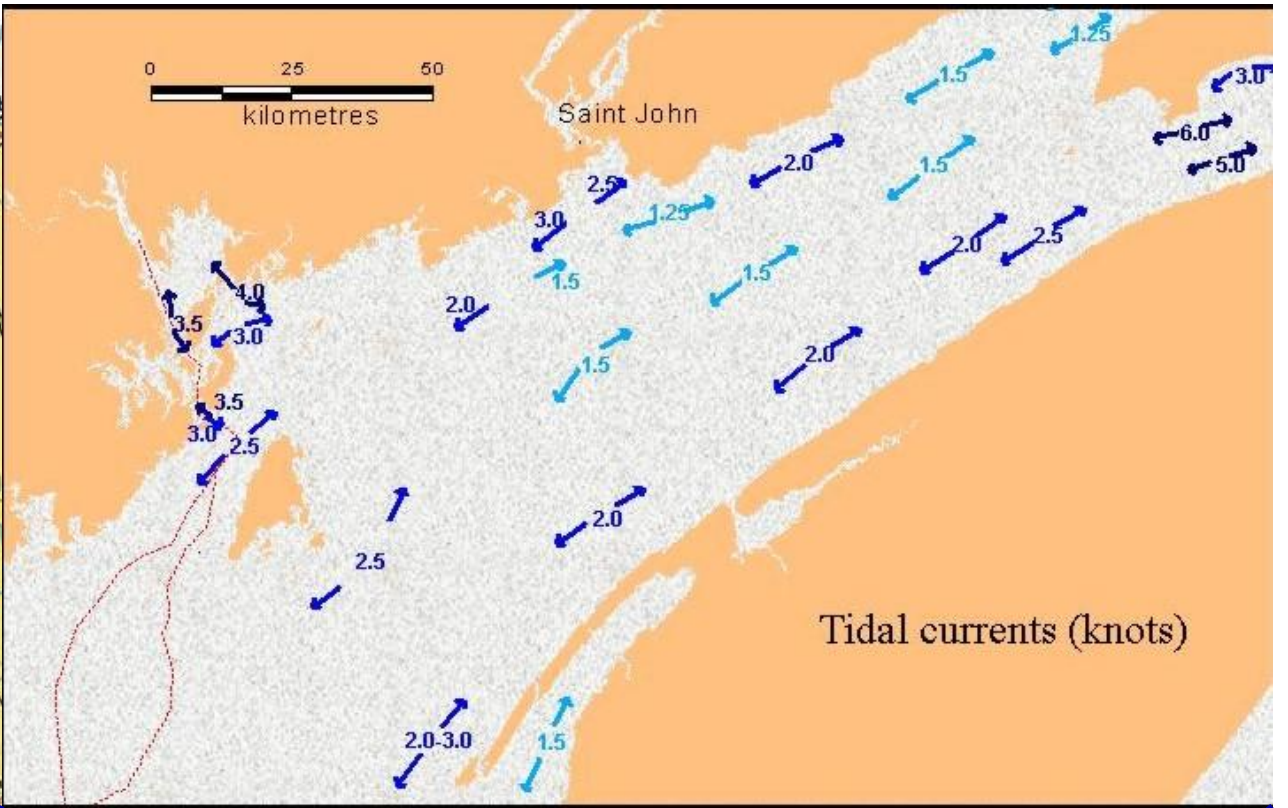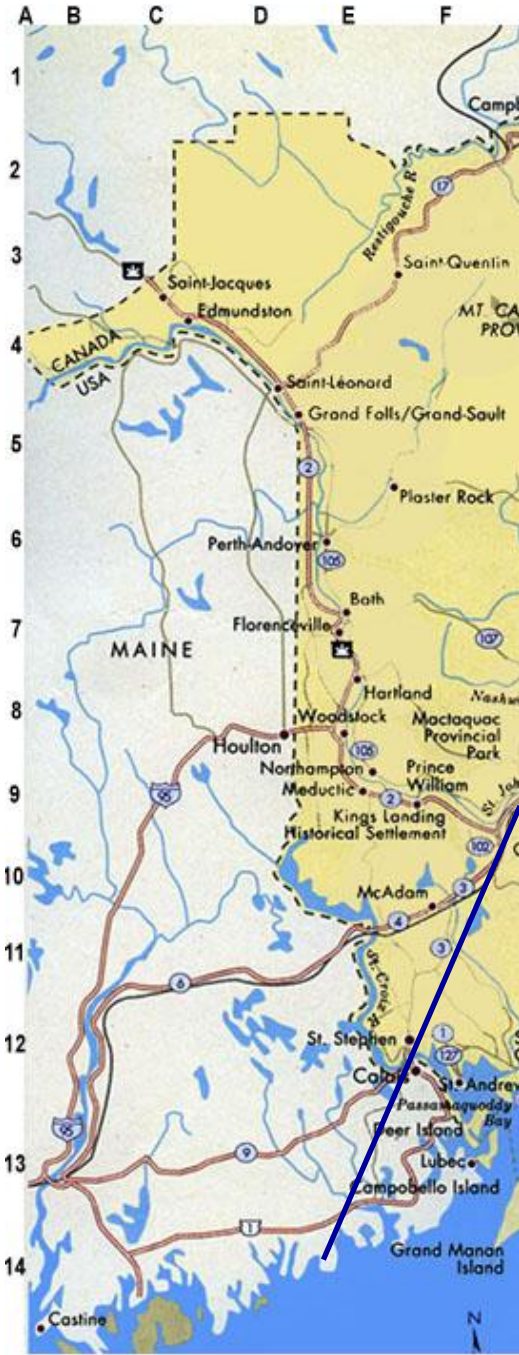
Industry Background
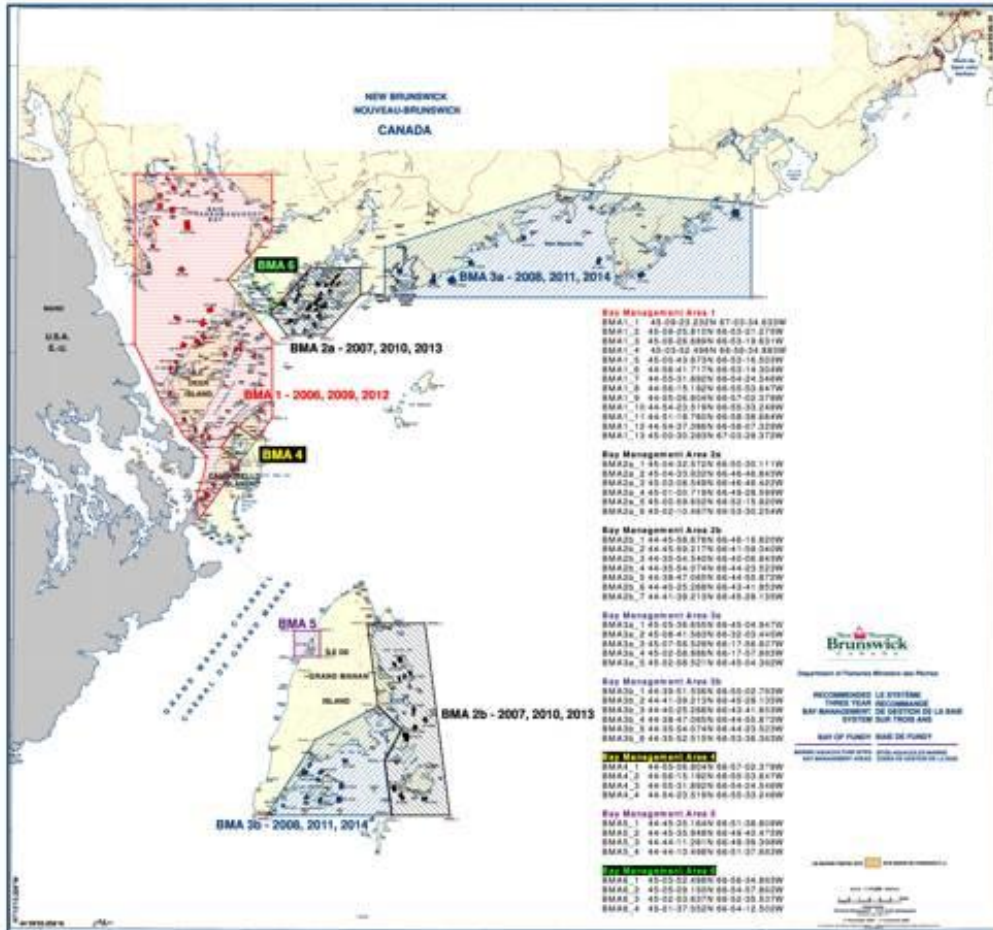
- Since 2006 NB industry operates on a 3 Bay Mgmt Area system for stocking to enhance fish health

Sea Lice Background

- SLICE only sea lice treatment during 2000 - 2009

- Between 2006 and 2009 use of SLICE was reduced by 50% - due to fallowing, reduced stocking, etc.

- Bioassay work in 2008 indicated resistance to SLICE in some farming areas with widespread resistance now apparent in all areas of NB

- AlphaMax – June 2009 in a single Bay Management Area

- Salmosan – October 2009 – all Bay Management Areas

- Calicide – October 2009 (drug under Health Canada so available throughout Canada using Emergency Drug Release)

Sea Lice Background

- Target dose on bath treatments not being achieved – still had excellent results on all but adult female lice

Average Deltamethrin Concentrations for Test Cage #2 July 2009
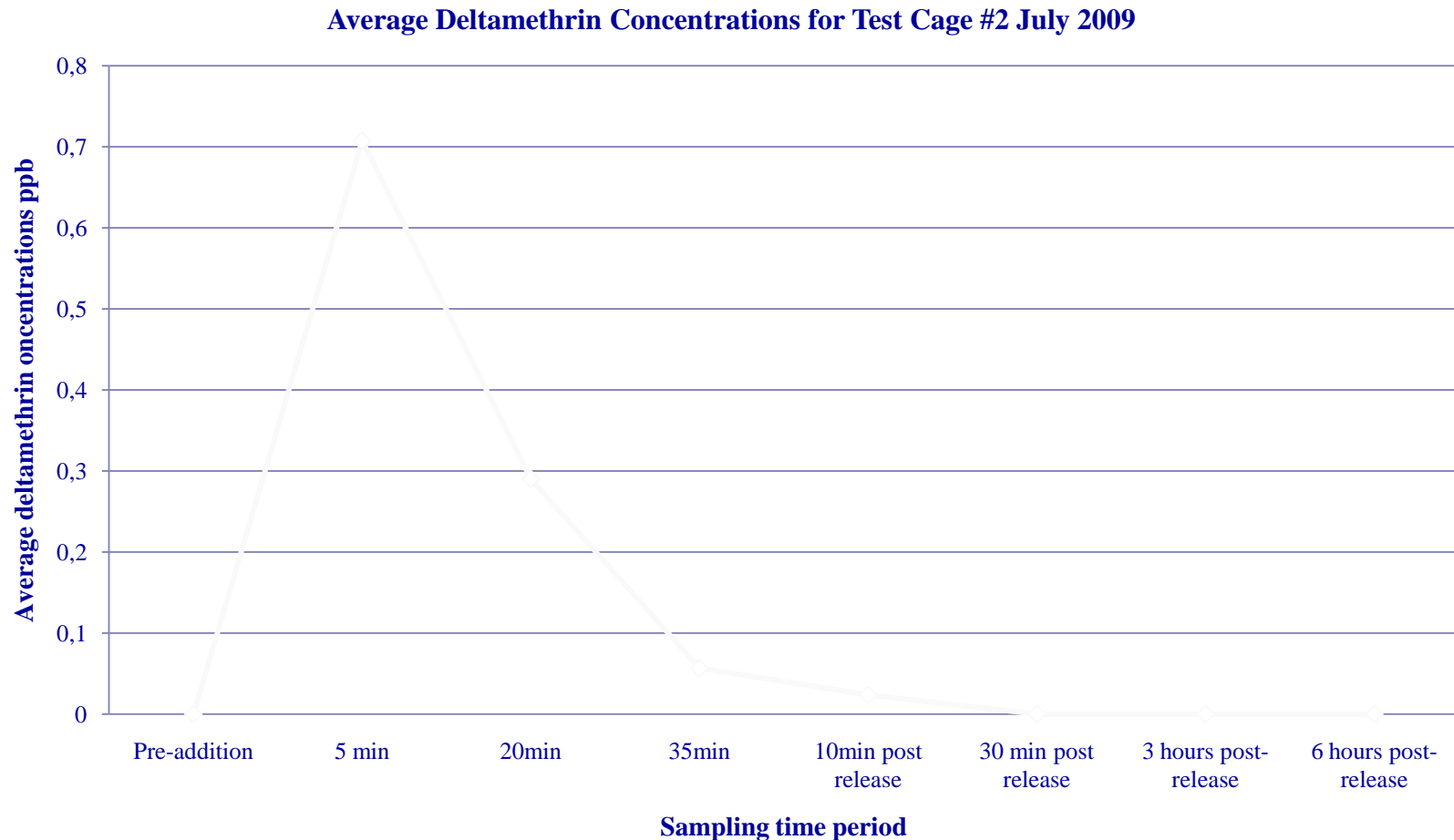
IPMP Development

- IPMP development now national priority in Canada
  - NB is acting as lead for national template
- NBSGA hosted IPM Meeting December 7th
  - Included pharmaceutical & international salmon farming individuals
- NBSGA hosted research development workshop January 21 & 22
- Synchronized industry wide treatment strategy under development for 2010

Research Strategy

Primary Topic Areas:

- Regulatory Research

- Management Practices

- Environmental Management

- Novel Treatments/Green Technology

- Modelling

Regulatory Research

Regulatory Research supports access to new sea lice treatments and much of this research can be used by the pharmaceutical company in its application for license

***Environmental Lab Study* – 2010**

- Informs questions re: threshold/dose/time/response

- Impact on non-target species

- Monitoring – bioassays, clinical efficacy, mode of action

- Prevention – rotate chemical families, containment

Environment Field Study – 2010

Dispersion Study using flourescein (dye) - several projects that support access to bath treatments

- Tank Study
  - Provide preliminary results and capability in preparation for more extensive field studies that are being planned for the Spring-Summer 2010

- Field Study
  - *in situ* releases of dye from cages with fish along with current measurements and ongoing development of transport and dispersal models
  - Informs environmental modeling, exposure/fate, treatment efficacy, delivery of treatments, tarps versus skirts, etc.

Management Practices

On-Farm Standard Operating Practices – **2010**

SOPs will be informed by dye study in tank and field for:

- Delivery of treatment

- Data collection – lice counts and life stages; environmental data (i.e. water temps).

- Efficacy of treatment – determine trigger

- Synchronization of treatments between farms

- Monitoring will include sensitivity monitoring, treatment efficacy data, bioassay, etc.

Environmental Management

- Provides marine environmental data to inform enhanced farm management practices for sea lice.

- Farm management practices could include improved husbandry practices, net cleaning, feeding times, smolt entry, avoidance strategy, net depth, etc.

- Projects begin in 2010 and will include:

Field Study - factors affecting sea lice populations such as: wild reservoirs, seasonality of lice abundance

Bay Management Areas for IPM – define based on hydrological and seasonal factors to inform treatment synchronization, stocking, etc.
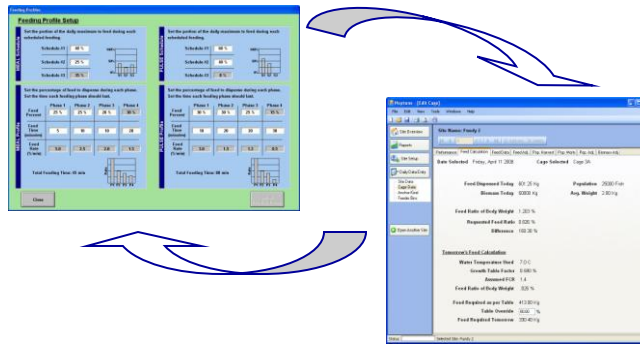
Explore Other Management Options

- Explore gel pack to neutralize treatments

- Cage side testing kits to determine organics/appropriate treatment dose

- Containment options (i.e. well boats)

Open Ocean Feeders

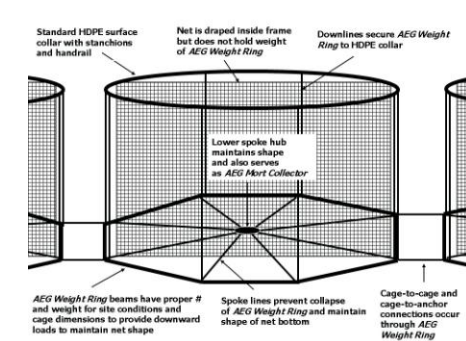# Site Management Software

Fish Sizing Sonar

Towable Feeders

AEG

ECO-Bath System

Jeyco Moorings

Service Platforms

Fish Transfer Tank

Containment Systems

ECO-Bath System Design Criteria

- Must minimize fish stress and eliminate mortality during the entire treatment process.

- Must be effective to kill and remove all sea lice from treated fish.

- Must be cost-effective and efficient to ensure adoption and use throughout the industry with a target to treat 4-6 cages per day.

- Must dramatically reduce the total quantity of pesticides required to treat an entire site.

- Must fully contain he treatment bath water including sea lice and pesticides after treated fish stock is removed.

Novel Treatments/Green Tech

The exploration of non-chemical treatment options in the management of sea lice and will include:

- Screen wastewater from harvest boats - spring 2010

- Mussel lines to filter planktonic lice - spring/ summer 2010

- Hydrogen peroxide – to optimize treatments - summer/fall 2010

- Lice traps literature review (i.e. pheromones, light, engineering solutions, etc.) – 2010

- Literature review on efficacy of Immunostimulants (i.e. pulse treatments of β glucans and marine bacteria versions of β glucans, up-regulate macrophages to prevent sea lice settlement, etc.)

- Survey of potential indigenous fish – 2010

- Disease resistant families – ongoing

- Vaccine development at appropriate target stage – long term

Other options not ranked: Rubbing post with trap to prevent reattachment); Upwelling; Fresh water dilution; Repellent in diet to prevent copepodid from attachment; Dropping nets to lower depths

Modelling

Environmental Sea Lice Dynamics – begin in 2010; ongoing long-term

- Hydrological model that has been used to define the bay management areas for disease; this model will be used to refine/define sea lice management zones taking into consideration the following factors:

- On farm & Between farm

- Off farm pressures/reservoirs

- Importance of temperature

- Larval dispersal

Decision Support System – 2010 and beyond

Computer based model using on farm data obtained through regular on-farm sea lice monitoring and bioassay data.

Will support the following model work*:*

- Risk Factor Study - Farm management and environment

- Treatment Efficacy – Reality of how treatments work

- Larval Dispersal – Model will be developed between data from DSS and hydrological model

- Lice population genetics

- Resistance Mechanism – will be ongoing at the population level

Immediate Next Steps

- February 19 – all research project proposals submitted to NBSGA

- By March 15 – meeting with all research funders

- By March 15 – endorsement by all companies for implementation of synchronized 2010 sea lice treatment strategy

- April 1 – Research collaborative agreements in place and research begins based on govt FY

Ongoing NBSGA Role

- Research Program Coordination

- Communication to industry, funders, other area stakeholders and public

- National collaboration on IPMP and fish health

- Host meeting in November to report on spring/summer research and review/update IPMP and research strategies

Thank You

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