SALSEA North America Research Strategy

North American Research Strategy - Study of Atlantic Salmon Marine Ecology

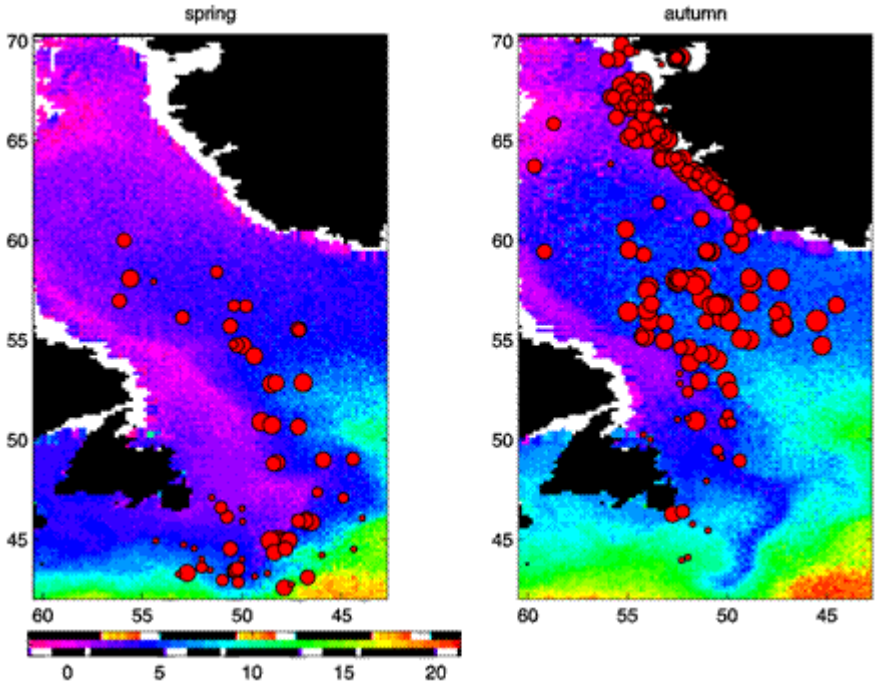
Atlantic salmon stocks have declined in both Europe and North America and much evidence been changes in their ecology and survival in the ocean phase. Concerns about increases in m salmon prompted a number of workshops and meetings to consider factors contributing to m present knowledge of the marine ecology of salmon is insufficient to explain the significant c salmon abundance since the late 1970s.

What we know about salmon ecology at sea

It is evident from trawling for postsmolts at sea, from acoustic tracking of postmolts in fjords surface waters that postsmolts spend at least some time in the upper portion of the water colu applied and retrieved from postsmolts and kelts show diurnal differences in water depth and

Growth in the marine environment is rapid, weight increases 75-fold between the smolt stage stage, and over 200 fold from smolts to 2SW salmon. Marine-phase Atlantic salmon are prim pelagic to mid-water feeders.

From catch rates during research vessel surveys in the Northwest Atlantic, 1965-2001, salmo at sea surface temperatures (SSTs) between 3 and 13°C with peak catch rates at 7.5°C. No sa at SSTs higher than 13.5°C.



Research vessel catch rates (circles, log of salmon caught per mile-hour of gear fished) for northwest Atlantic and corresponding mean sea surface temperature in spring and autumn 2001 (Reddin 2006).

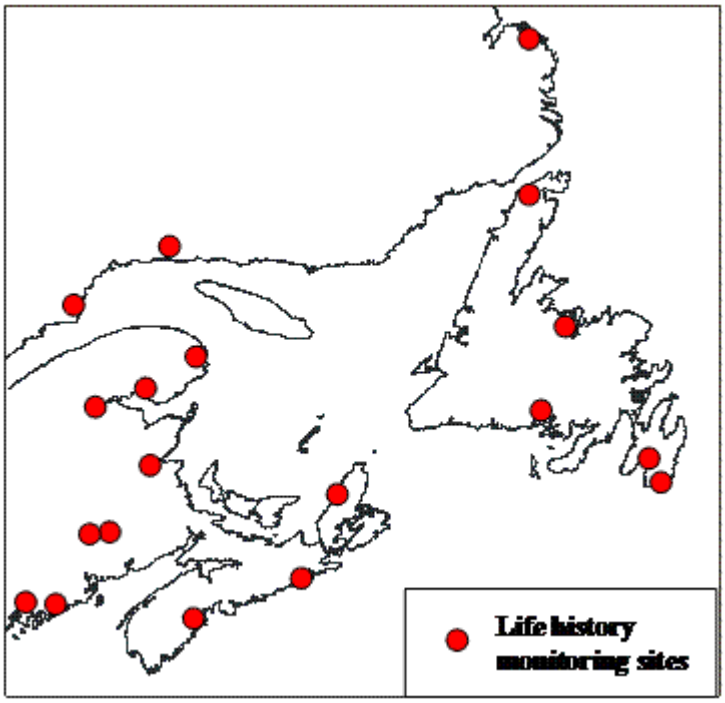
The historical information on marine mortality, marine distribution, migration and ecology was derived from monitoring programs in rivers, sampling of commercial Atlantic salmon fisheries, from marine recoveries of previously tagged and released smolts, from tagging of adult salmon at sea, and from a limited number of tar research surveys for Atlantic salmon. Advances in pelagic trawling techniques and in parallel, developments storage tags, and acoustic tags provide opportunities for collecting new information on salmon distribution, behaviour and the physical environment.

Research Strategy

The research strategy consists of three inter-related activities which build on existing index rivers programs eastern North America. Research activities are linked to the overall marine research program (SALSEA) adv by NASCO. Different but complementary information on marine ecology of salmon can be obtained with th research approaches.

Life History Monitoring:

- These programs provide data on life history parameters, feeding, disease status, parasite communities, an overall marine mortality and provide data to test factors associated with survival of salmon over a broad geographic range.
- Index rivers monitoring program delivered by DFO, the province of Québec, and the US in 16 rivers of e North America.
- Sampling at West Greenland delivered by an international effort including Greenland home rule governm Canada, the US, and several European countries.



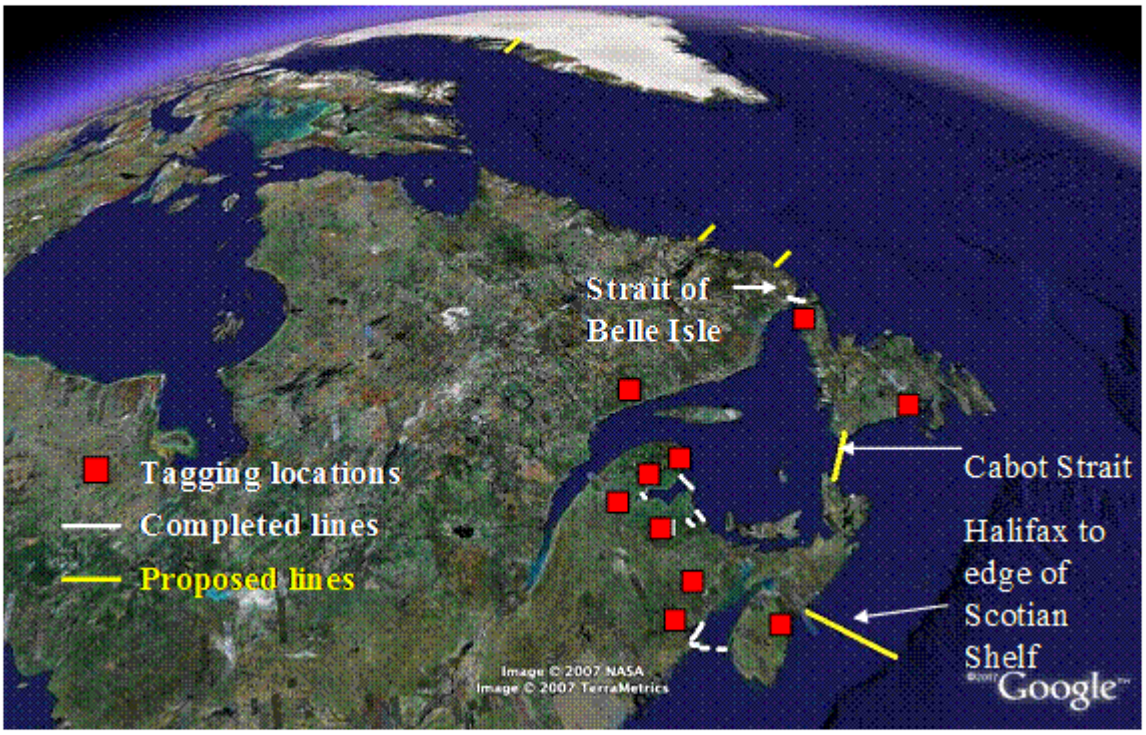
Location of life history monitoring projects to assess Atlantic salmon smolt and surviving adult character

Electronic technologies:

- Acoustic tracking work led by the Atlantic Salmon Federation is facilitated by access to suitable salmon for tagging from the index rivers program
- Research consists of implanting minituarized acoustic transmitters in salmon smolts which can later be d by stationary acoustic receiving stations at various points in the migration, from inriver, estuaries, nearsh offshore.
- Investements by the Atlantic Salmon Federation have resulted in receiver lines being deployed in the Str Belle Isle since 2006 which has provided new information on migration rates, timing, and synchronizatio movements of post-smolts and salmon kelts 800 to 1,000 km from their home rivers.

Acoustic technology used to quantify migration rates, timing, synchronization and mortality rates at sea of wild Atlantic salmon smolts and salmon kelts from rivers in the northwest Atlantic.

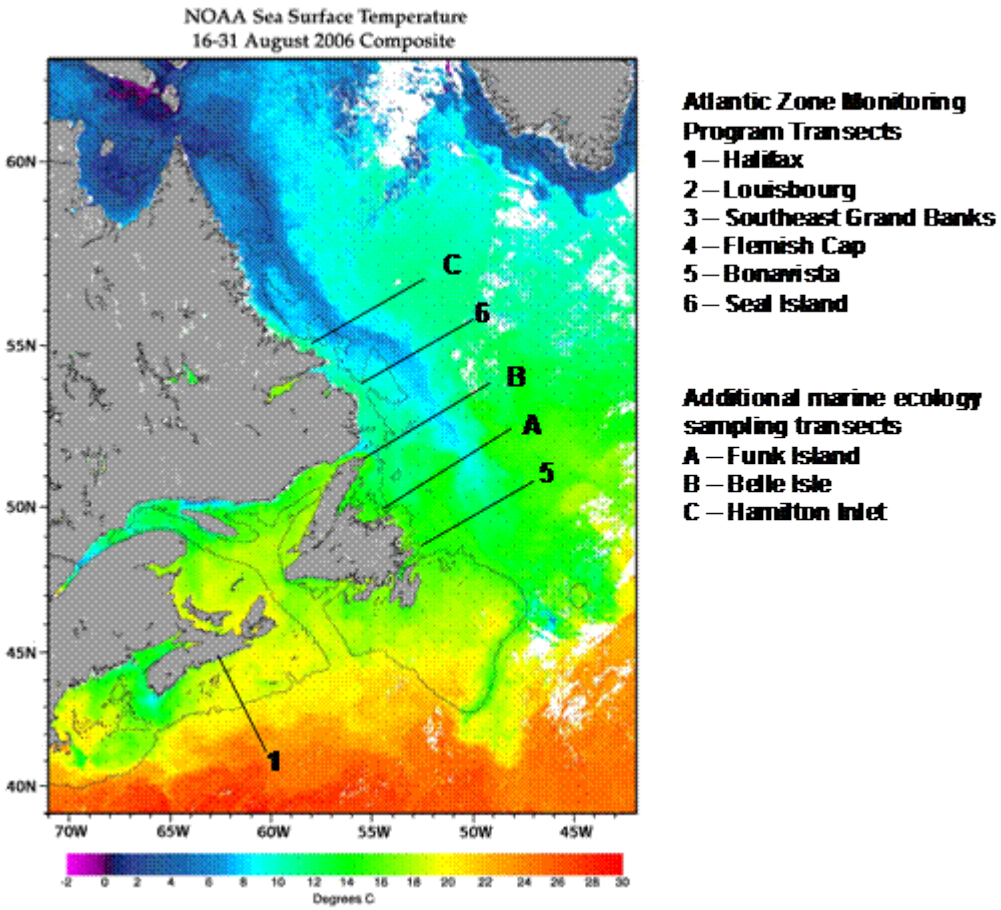
- Acoustic tracking programs have provided information on the migration rates, migration corridors and re survivals during the first two months at sea.
- Receiver lines have been deployed in the Strait of Belle Isle since 2006 and have provided new informat migration rates, timing, and synchronization of movements of post-smolts and salmon kelts 800 to 1,000 from their home rivers.
- These activities will be enhanced in the coming years with the deployment of infrastructure by the Ocean Tracking Network, a $35 million (Can) investment by the Canadian Foundation for Innovation.



Existing and proposed nearshore and offshore acoustic receiver lines for quantifying marine mortality, mig routes and speed, and synchrony among stocks in the Northwest Atlantic.

Marine capture surveys

- The marine survey will be delivered as an international program involving the three Atlantic provinces D regions, the province of Quebec, and personnel from USA NOAA.
- Marine capture surveys will sample the upper column pelagic ecosystem during the period correspondin early postsmolt phase (August) of Atlantic salmon.
- The survey design would address hypotheses of post-smolt distribution (mixing of stocks, mixing of mat and non-maturing components) and oceanographic features.
    - For example, based on reported temperature preferences of salmon at sea, few post-smolts are expect waters above 10ºC. Sea surface temperature plots indicated that in recent years, 2006 for example, temperatures below 10ºC in August occurred only off Labrador with much warmer te nperatures on t northeast coast, Grand Banks and southern areas presumably making these areas unsuitable for salmo Implications of this associated with climate change scenarios are obvious.
- Catches of post-smolts will provide information on distribution and relative abundance of salmon in an intermediate location and time than that provided by the life history monitoring program and internationa sampling at West Greenland.
- Data on relative abundance of other species, including macroplankton aggregations, will provide informa the distribution of salmon within this larger pelagic ecosystem.
- August is the priority sampling month.
- Survey transects designed to characterize the nearshore versus offshore distribution of postsmolts. Some transects would duplicate those monitored as part of the Atlantic Zone Monitoring Program (AZMP).



Transects sampled during the 2008 survey in the northwest Atlantic using pelagic surface trawls. Compar mean sea surface temperatures for the second half of August 2006 are shown.

The 2008 marine survey was conducted by the DFO Canadian research vessel CCGS Wilfred Templem

Questions to be addressed using data from the marine research survey

- Where are the early marine phase nursery areas of Atlantic salmon?

- Are stocks from the greater than 600 rivers in eastern Canada mixed at sea?
- What are the other components of the pelagic community occupied by Atlantic salmon?
- What prey are they consuming relative to what is available?
- Are they being consumed by other fish predators within the pelagic zone?
- What has been their marine growth profile and how does it differ from the profile of subsequent survivor following year?
- What is their disease profile compared to profiles of outgoing smolts?
- What is the parasite community and does it differ in smolts going to sea from adults returning?
- Are maturing (grilse) and non-maturing (multi-sea-winter) salmon mixed at sea or have they segregated different parts of the ocean?
- Are there aquaculture escapees in the same areas as the wild fish?