

NORTHEAST FISHERY CENTER FY 1997 BIOACTIVITY REPORT

STUDIES PERFORMED: Fiscal year 1997 was a time of diverse biological and technical work for NEFC. Most (but not all) studies performed by Center biologists and our partners were related to Atlantic sturgeon and Atlantic salmon restoration as follows:

Study Number and title:

- L-97-01 Effect of water temperature and hardness on uptake of calcein marks in larval Atlantic salmon caudal fin tissue.
- L-97-02 Effect of two Atlantic salmon broodstock diets upon reproductive success.
- L-97-03 Procedure for the International Shipment of sturgeon from the Northeast Fishery Center.
- L-97-04 Effect of density on mortality of Atlantic salmon eggs and larvae in Heath-style incubator trays at White River National Fish Hatchery.
- L-97-05 Atlantic Salmon Fertility Studies, 1996, Effect of Billard's Diluent Upon Fertilization Success
- L-97-06 Atlantic Salmon Fertilization Trials, 1996 Merrimack Domestic Eggs, Evaluation of Billard's Diluent, Pooling of Milt and Effects of Time Upon Fertilization Success

OTHER BIOLOGICAL INVESTIGATIONS PERFORMED:

- L97A Exploration of methods for batch marking American eel elvers.
- L97B Investigation of blue heron degradation at Big Brown fee-fishing facility.
- L97C Capture and transport of Atlantic sturgeon broodstock from the Hudson River.
- L97D Induction of spermiation in Atlantic sturgeon captured in 1991 as juveniles from the Delaware River.
- L97E Initiation of feeding in captive Atlantic sturgeon broodstock.
- L97F Evaluation of attachment of pseudo-sonic tags in domestic 3-yr old Atlantic sturgeon.
- L97G Fish Health Inspection Services provided to National Fish Hatcheries in Region 5.
- L97H Initiation of the National Wild Fish Health Survey
- L97I Implementation of a Pro-Active Fish Health Management Program at Various Atlantic Salmon Facilities

PUBLICATIONS:

Jodun, W.A. 1997. Procedures for international shipments of sturgeon. U.S. Fish and Wildlife Service Region 5 Technical Information Leaflet 97-03.

Mohler, J.W., K. Fynn-Aikins, and R. Barrows. 1996. Feeding trials with juvenile Atlantic sturgeons propagated from wild broodstock. *The Progressive Fish Culturist* 58:173-177.

Mohler, J.W. 1997. Immersion of larval Atlantic salmon in calcein solutions to induce a non-lethally detectable mark. *North American Journal of Fisheries Management* 17:751-756.

STUDIES IN WHICH THE CENTER COOPERATED:

Development of immunological marking methods for tagging of Atlantic salmon fry - *Dr. William Krise, Research and Development Lab - Wellsboro, PA ; Dr. John Sternick, Mansfield University, PA*

Screening of microsatellite markers in genomic DNA of Atlantic sturgeon from the Hudson, Delaware, Chesapeake Bay, James and/or York Rivers to determine genetic population structure. - *Dr. Tim King, Leetown Science Center (USDA) - Leetown, WV.*

Study Number: L-97-01

Title: Effect of water temperature and hardness on uptake of calcein marks in larval Atlantic salmon caudal fin tissue

Principal Investigator: Jerre W. Mohler-NEFC

Background and Justification:

Fry stocking by the U.S. Fish and Wildlife Service has become an increasingly important part of the Atlantic salmon (ATS) restoration program in the Northeastern U.S.. Therefore, a need exists within Region 5 of the U.S. Fish and Wildlife Service for a technique of marking non-feeding Atlantic salmon fry (sac-fry) with a readily recognizable mark capable of being detected in returning adult fish. In 1995 (*Study L-95-04*) calcein immersion was tested at two concentrations for a duration of 48 hours. Fish from all calcein treatments received a mark detectable as brilliant green fluorescence in all fin ray structures when viewed under fluorescent microscopy. In 1996 (*Study L-96-08*), it was found that 48-hour calcein green treatments gave better mark readability than lesser treatments (36, 24, or 12-hour). Since the treatment must be static or recirculatory in nature due to chemical costs and wastewater handling concerns, it is important to discover conditions which will yield efficient mark induction. Calcein is not an FDA-approved chemical for use on fish, therefore experimentation is necessary to contribute to existing knowledge of the compound when used in this manner.

Study Objectives

(1) compare effects of two temperatures and two water hardness levels on calcein mark readability in larval ATS immersed in calcein (green) solution for 24 and 48 hours. (2) compare 30-day mortality and growth on one set of treatments and controls.

Materials and Methods:

Immersion trials consisted of calcein static baths. Each treatment had 3 replicates in the form of 6½-liter acrylic jars containing 200 non-feeding ATS fry of Connecticut River domestic parental origin. Calcein immersions were prepared at concentrations of 125 and 250 mg/L. Immersions were performed in both NEFC spring water and water from a local aquifer which has low hardness. In addition to immersion replicates, three control replicates received the same treatment as immersed fish but without an added chemical. Appropriate temperature (13E or 5E C) of replicates was maintained by a constant supply of fresh water surrounding the hatching jars during the trials. At the end of 24 or 48-hour immersion, 50 fish from each calcein replicate were scored for mark readability.

Results

1. Mark readability was effected by:
 - a. interaction of calcein concentration and immersion time
 - b. interaction of calcein concentration and temperature
 - c. interaction of hardness, temperature, and immersion time

In general, more readable marks were obtained using 250mg/L calcein in soft water at 13° C for 48 hours.

2. There was no significant difference in 30-day growth between calcein and control fish ($P > 0.05$).
3. Thirty-day mortality was significantly greater in fish immersed in 250 mg/L calcein (13.5%) vs. controls (3.5%). There was no difference in mortality between controls and fish immersed at 125 mg/L calcein ($P \# 0.05$).

Study Number: L-97-02

Title: Effect of two Atlantic salmon (*Salmo salar*) broodstock diets upon reproductive success

Investigators: Bill Fletcher - (NEFC) and Dale Honeyfield - U.S.G.S. Biological Resources Division (BRD),Wellsboro,(PA)

Co-investigators: Mike Hendrix/Jerre Mohler - NEFC; Bill Krise -BRD- Wellsboro; Vic Segarich, Bob Groton - Nashua NFH (New Hampshire); Larry Lofton - North Attleboro NFH (Mass.)

Background and Justification

The Atlantic Salmon Restoration Program relies heavily upon fish cultural facilities to produce fry, parr, and smolts for restoration stocking which in turn leads to an increased demand for quality eggs. Unfortunately reproductive performance of captive broodstocks have proven inconsistent, with resultant inefficiency in culture activities. Average eye-ups between lots and years vary as much as 60%. The NEFC, other Service facilities, and Wellsboro-BRD have conducted a number of studies which have resulted in limited success in improving reproductive performance of Atlantic salmon. Broodstock nutritional requirements are poorly documented but are important to reproductive success therefore, to expand our efforts to improve Atlantic salmon production efficiency, a study to determine the effect of diet on gamete quality and reproductive performance was proposed.

Study Objectives

The objective is to determine the effect of diet on reproductive performance of Atlantic salmon broodstock fed the current standard pelleted diet (ASD2-30) or a nutritionally updated extruded diet (ATS-5).

Methods

Diet.- Both diets were manufactured by Perdue Feed Inc., Catawissa, PA. The experimental ATS-5 diet was prepared using modern extrusion technology which has been shown to improve nutrient availability (Honeyfield, unpublished data). The percentage of the each ingredient in the ATS-5 was adjusted at the time of manufacturing using least cost formulation. The ATS-5 diet will improve feed digestibility, have ingredients which may effect reproductive performance, and utilize a change in the form of some nutrients from those presently used in the standard ASD2-30 diet.

Culture.- Feeding experimental diets was conducted at Nashua NFH and egg incubation at North Attleboro NFH. Experimental diets were fed for 6 months (April - September 1997). Nashua NFH set up two raceways each with 150 randomly selected 4 year old Atlantic salmon. Individual fish lengths and weights were recorded at start of trial and at the time of spawning. Initial biomass was adjusted to $\pm 5\%$ between raceways. The feed rate and adjustments in feed amounts were established and recorded by Nashua NFH.

Spawn.- Reproductive success will be measured by evaluating 15 spawns for each diet on three spawning days. Percent eye-up will be determined from the first take of eggs from each female and total number of second take eggs will be recorded. Each spawn will be conducted as 1:1 mating. Eggs will be transported to North Attleboro NFH and no initial pick of green eggs will be conducted. The following measurements will be taken: Fin erosion indices, milt motility/viability via flow cytometry at Penn State Univ., egg shock sensitivity, and quantification of egg color differences. Egg samples from will be collected prior to fertilization for laboratory analysis of selected nutrients. Eggs will remain frozen until analysis.

Results

The study is ongoing and scheduled for completion in Spring 1998.

Study Number: L-97-03

Title: Procedures for the International Shipments of Sturgeon

Principal Investigator: Wade Jodun - NEFC

Background and Justification

Globally, virtually all sturgeon species are exhibiting a marked reduction in number or are in severe decline. As culture and research efforts with sturgeon intensify, the worldwide need to acquire sturgeon species for scientific purposes has also increased. The importation / exportation of sturgeon is a lengthy, difficult process that entails several permits and requires a myriad of regulations from multiple countries, government regulatory agencies and airlines be adhered to. For example, each nation has different import criteria; the United States fish and Wildlife Service requires completion of Convention on International Trade of Endangered Species (CITES) import / export permits; each airline requires slightly different protocols for live animal packaging and container requirements; and only specific ports in each nation are designated for live animal entry. A condensed guidelines and informational source pertaining to how to effectively meet these criteria is needed in order to facilitate the international exchange of sturgeon species for scientific study.

Objectives

1) Develop a condensed informational source prepared as an aide to fishery biologists and sturgeon researchers with the intention of facilitating the international exchange of sturgeon species for research efforts and (2) Provide an easy to follow, step-by-step format that would ensure full compliance with all existing import / export regulations.

Materials & Methods

The abridged import / export procedures were devised through consultation with the U.S. Fish and Wildlife Service's Office of International Affairs (703-358-1754), Office of Scientific Authority (703-358-1861), Division of Law Enforcement (703-358-1949), Office of Management Authority (703-358-2093), Newark Port Office (201-645-5910) and the International Air Cargo Division of US Air.

Results

The effort resulted in a six step process outline in the abbreviated document. These steps include:

1. Drafting a letter of intent which also cites responsible parties.
2. Meeting the import regulations of the destination country (a list of sources is included in Appendix A).
3. Completion of a CITES import / export permit (a permit application and a full description of the application process is included in Appendices B and C, respectively).
4. Following the protocol for live animal packaging and container requirements (Appendix D of the document).
5. Contacting a Fish and Wildlife office at a port designated for live animal entry (a complete list of designated ports is found in Appendix E).
6. Completion of United States Fish and Wildlife Service (USFWS) Form 3-177 Declaration for Importation of exportation of Fish and Wildlife (form included in Appendix F).

The guidelines were also published as Lamar Informational Leaflet 97-03 titled: Procedures for International Shipments of Sturgeon.

Study Number: L-97-04

Title: Effect of density on mortality of green and eyed Atlantic salmon eggs in vertical Heath-style incubator trays

Principal Investigator: Jerre W. Mohler-NEFC

Co-investigators: John W. Fletcher-NEFC; Ken Gillette-WRNHFH

Background and Justification:

The Atlantic salmon program in Region 5 of the US Fish and Wildlife Service relies heavily upon fish cultural facilities to produce fry, parr, and smolts for restoration stocking. A large proportion of eggs produced in Region 5 salmon hatcheries are fertilized then shipped to White River National Fish Hatchery (WRNHFH) for incubation due to favorable water temperatures and facilities. In 1996/97 WRNHFH incubated over 9 million eggs and incubation space became scarce. Therefore it is necessary to optimize existing space by determining the maximum egg densities per Heath tray while maintaining mortality acceptable to Region 5 managers. Normally, egg densities are maintained at 6000-8000 eggs per tray at WRNHFH but no studies have been performed to compare densities. We propose to test the effect of density on mortality of both green and eyed eggs at WRNHFH. Green egg densities to be tested are: 8,000, 10,000, and 12,000 per tray and eyed egg densities will be 6,500, 8,500, and 10,500 per tray.

Study Objectives

- (1) We will compare effects of three egg densities on mortality of 150,000 green and 127,500 eyed Atlantic salmon eggs at White River NFH during the 1997/98 incubation period.
- (2) Through analysis of egg mortality data, we will recommend a maximum egg density for future incubation of green and eyed ATS eggs in Heath trays at White River NFH.

Materials and Methods:

The study will take place at White River NFH during the 1997/98 incubation year. After disinfection, at least 150,000 fertilized eggs will be composited and gently mixed. Eggs will be withdrawn for enumeration by displacement and resulting average number of eggs/ml will guide egg enumeration for placement into Heath trays at densities of 8000, 10,000, and 12,000 ($\pm 5\%$) per tray. There will be five replicates of each egg density. Throughout the incubation period, formalin will be administered to experimental eggs using the same treatments given production eggs. Experimental egg trays will be subject to similar treatment concerning periodic examination, shocking, and removal of dead eggs. Numbers of dead eggs in experimental trays will be recorded and once production eggs have reached the eyed stage, percent mortality will be compared between treatments. Once eggs have eyed, at least 127,500 will be composited, mixed, enumerated and placed into Heath trays as before but with densities of 6,500, 8,500, and 10,500 per tray ($\pm 5\%$). The study will conclude after performing final larval counts/tray. This will be performed by displacement in a graduated container using the average of three burette tube sample counts per density treatment. Larvae can then be transferred from trays to tanks with other production fry prior to stock-out. Hypotheses to be tested are as follows: H_0^1 : There is no difference in percent mean mortality between density treatments. H_0^2 : There is no correlation between mortality and vertical position of heath tray for each density tested.

Results

The study is ongoing with results expected in Spring 1998.

Study Number: L-97-05

Title: Atlantic Salmon Fertility Studies, 1996, Effect of Billard's Diluent Upon Fertilization Success

Principal Investigators: Bill Fletcher

Co-Invest/Cooperators: Mike Hendrix and Jerre Mohler (NEFC); Bill Krise, U.S.G.S.-BRD-Wellsboro; Larry Lofton, North Attleboro NFH; Micky Novack, R.S. Cronin NSS

Background and Justification

The Atlantic Salmon Program relies heavily upon fish cultural facilities to produce fry, parr, and smolts for restoration stocking; and, starting in the mid 1980's, has placed an increasing emphasis upon fry stocking as a restoration tool which has led to an increased demand for quality eggs. Since 1989, the Northeast Fishery Center, other Service facilities and Wellsboro-BRD have conducted a number of studies concerning water quality, fertilization procedures, and Atlantic salmon physiology with the aim of improving egg quality.

North Attleboro NFH and R.S.Cronin NSS both maintain Connecticut River kelt salmon for egg production. Typically milt from Connecticut River sea-run salmon collected at Cronin NSS is transported to North Attleboro NFH in chilled oxygenated zip-lock bags or in chilled loosely capped test tubes. Time from milt collection to use may vary from 4 to 24 hours.

Billard's diluent, a physiological saline, was employed in 1995 at Tunison Lab., USGS-BRD, to significantly extend ATS milt viability over a six hour period (Bill Krise).

Study Objectives

The objective of the study was to test the null hypothesis that use a physiological saline such as Billard's diluent, along with appropriate sperm activators, would not effect sperm viability when compared to traditional milt transport methods.

Methods

Milt (3 to 5 ml) was collected from five RS Cronin NSS sea-run Atlantic salmon held in Tank 2 on the afternoon of November 5, 1996. The milt from each male was split into 2 aliquots. One half of the milt was held in an oxygenated ziplock bag. The second half was suspended 1: 100 in a solution of Billard's diluent and then oxygenated. Milt was held 24 hours in an iced cooler for use at North Attleboro NFH. Eggs (45,000) were collected from Connecticut River kelts at North Attleboro NFH. Approximately 11,250 eggs from each of four females were used in the study. The take from each female was distributed 1,875 eggs to each of six bowls to create equal pools of eggs (four \times 1875 = 7500 eggs per bowl). Fertilization was conducted 24 hours following collection of milt. Three bowls of eggs were fertilized with 3 ml each of milt pooled just prior to fertilization from aliquots stored in zip-lock bags. The other three bowls of eggs were fertilized with the equivalent quantity of milt suspended in Billard's diluent - pooled just prior to fertilization. All procedures regarding egg water hardening and disinfection in iodophor were conducted in compliance with Service fish health guidelines. Incubation was conducted at North Attleboro NFH. The study concluded when eyed eggs were enumerated (North Attleboro staff). Success of egg eye-up between treatments was evaluated with 2 sample t-tests.

Results

Use of Billard's diluent showed a negative impact on egg eye-up. No eye-up was obtained for eggs fertilized with milt stored in Billard's diluent. Average eye-up for three Heath trays of eggs fertilized with milt stored in chilled oxygenated plastic bags was 84 %.

Study Number: L-97-06

Title: Atlantic Salmon Fertilization Trials, 1996 Merrimack Domestic Eggs, Evaluation of Billard's Diluent, Pooling of Milt and Effects of Time Upon Fertilization Success

Principal Investigator: Bill Fletcher

Co-Invest / Cooperators: Mike Hendrix and Jerre Mohler (NEFC); Bill Krise, USGS-BRD-Wellsboro (PA); Larry Lofton, North Attleboro NFH (Mass.); and Vic Segarich, Bob Groton; Nashua NFH (New Hampshire)

Background and Justification

The Atlantic Salmon Program relies heavily upon fish cultural facilities to produce fry, parr, and smolts for restoration stocking. In practice, most production eggs are spawned at one station and transported in gallon jugs for incubation at another hatchery. Eye-ups for eggs transported in this manner, have reached levels exceeding 90 percent but have declined in recent years at times to below 60 percent. Emphasis upon fry stocking as a restoration tool has led to an increased demand for quality eggs, therefore NEFC in cooperation with other Service facilities and BRD-Wellsboro have conducted a number of studies aimed at improving egg survival. In 1993 a pilot scale study showed:

- 1) significantly better domestic egg eye-up by delaying fertilization until the eggs had arrived at the incubating facility (87% vs 41% shipping fertilized egg in insulated jugs; 2) improved eye-up for eggs shipped moist in egg transport boxes vs. insulated jugs; 3) a significantly better eye-up percentage for eggs transported with ice in jugs vs. no ice; 4) a correlation between percent eye-up and shipping periods, and 5) water hardening eggs in iodophor solution does not impact egg survival.

Based on these observations, trials were conducted to evaluate delayed fertilization shipping protocol on a production scale basis in the fall of 1994 (Study L-95-02). Although study egg lots showed improved eye-up with delayed fertilization, results of statistical evaluations were not strongly conclusive. In the study L-95-02 pooled milt was employed; however, the unfertilized eggs were not pooled. A large degree of variability in egg quality within treatment groups was observed. It is also believed that milt handling techniques can effect egg survival. Billard's diluent, a saline solution, was employed in 1995 at Tunison Lab., USGS-BRD, to extend ATS milt viability over a 6-hours (B. Krise).

Study Objectives

The objective of the study was to test the following null hypotheses: 1) no differences in milt viability exists between individual male salmon; 2) the effect of pooling milt prior to fertilization will not impact overall eyeup for a series of replicates when compared to utilizing milt from individual males; 3) there are no differences in eye-up between eggs fertilized prior to transport vs. delayed fert. at the receiving station and 4) Billard's diluent along with sperm activating solutions does not effect milt viability vs. milt stored in oxygenated bags.

Methods

Ten male and 6 female Atlantic salmon (45,000 eggs) from Nashua NFH were employed in the study to conduct nine fertility trials designed to test the above hypotheses. Eggs were divided into nine groups of 5,000 eggs. Incubation was conducted at North Attleboro NFH. The study was concluded when eyed eggs were enumerated by NEFC staff. Immediately upon collection of milt from each male, motility was be determined via light microscopy at raceway. Milt from each male was divided into aliquots or pooled, and placed into labeled tubes as follows so it could be tracked from individual males as well as groups of pooled milt.

Results

- 1) Viability of individual males varied more than pooled milt fertilizations. 2) trials which employed Billard's diluent showed poor eye-up and a positive correlation between length of time suspended in diluent and reduced viability.
- 3) No difference was found between eggs fertilized immediately At Nashua NFH vs. those fertilized at North Attleboro NFH employing chilled oxygenated transport of gametes. 4) Eye-up was better for eggs fertilized with milt used 2 hrs. after collection vs. eggs fertilized with milt collected immediately.

OTHER BIOLOGICAL INVESTIGATIONS PERFORMED

- L97A Exploration of methods for batch marking American eel elvers.** - Increased harvest pressure is being placed upon populations of larval American eels (elvers) along the eastern coast of the U.S. due to their high value as an export to commercial foreign grow-out facilities. NEFC began to explore techniques for mass marking the nearly translucent 3-inch long organisms to help facilitate future wild population management needs. Techniques attempted included both mechanical and chemical means. Some success for short-term marking was obtained with the compound calcein, which glows green under long-wave ultraviolet light.
- L97B Investigation of blue heron depredation at the Big Brown fee-fishing facility.** - This facility located in Effort, PA, is experiencing daily fish loss to predators (blue heron). To help come up with solutions to an "age old" aquaculture industry-wide problem, NEFC attempted trapping and relocation of heron in 1995 with limited results. This year we documented frequencies of bird visits and behavior using time-lapse video equipment. The efficacy of distress calls and visual deterrent was documented with the same equipment. Preliminary results indicate that distress calls and the selected visual deterrents are not effective in preventing blue heron depredation of fish at this facility.
- L97C Capture and transport of Atlantic sturgeon broodstock from the Hudson River.** - NEFC along with assistance from a commercial fisherman netted and transported Atlantic sturgeon broodstock from the Hudson River during the 1997 spawning season (June-July) on well-known spawning areas near Hyde Park, NY. Unfortunately, no female sturgeon were captured but a total of 43 males were captured. The gender ration is normally skewed in favor of males but the observed capture ratio was somewhat disturbing to biologists given the number of nets set over the four-week capture period (164 nets set over a period of 22 different tides). Four males were transported back to Lamar for conversion to formulated diets and for use as a future source of milt for egg fertilization.
- L97D Induction of spermiation in Atlantic sturgeon captured in 1991 as juveniles from the Delaware River.** - Juvenile sturgeon were captured in gill nets near Artificial Island in the lower Delaware River in 1991 and taken into captivity at NEFC. The five survivors eventually began feeding regularly on formulated feed pellets. By 1996, it was judged that condition factors were favorable for experimental injection of gonadatropins to determine whether any individuals were sexually mature males. Common carp pituitary (CCP) was injected into all five of the captives at a rate of 1 mg/Kg of body weight in July, 1996 and 24 hours later no milt was produced. The following year (June, 1997), the same fish underwent similar CCP injections. Attempts to extract milt after 24 hours were successful with two of the five expressing milt.
- L97E Initiation of feeding in captive Atlantic sturgeon broodstock.** - It has been difficult to induce wild sturgeon to feed in captivity. A variety of techniques were explored with some success obtained when frozen blood worms and semi-moist soft feed pellets were offered. NEFC is now developing a feed using these two ingredients as a starter for wild fish brought into captivity.
- L97F Evaluation of attachment of pseudo-sonic tags in domestic 3-yr old Atlantic sturgeon.** - In cooperation with the USFWS - Maryland Fisheries Resource Office, nine sturgeon were outfitted with pseudo transmitter tags using stainless steel and teflon wire in a variety of attachment techniques to test retention and affect on sturgeon skin abrasion. After six months of carrying the tags, it was found that severe skin erosion was present near the ends of the tags on all fish due to constant abrasion from normal fish movements. Best retention was seen with tags installed with plastic backing and wire inserted between scutes rather than drilling through scutes

- L97G Fish Health Inspection Services provided to National Fish Hatcheries in Region 5.** - In compliance with the Service Fish Health Policy and Implementation Guidelines (and the Great Lakes Fish Disease Control Policy and Model Program and the New England Salmonid Health Guidelines, where applicable), annual or semiannual fish health inspections have been conducted at Service fish rearing facilities. These inspections are necessary to enable facilities to legally release or transport fish. Those facilities working with valuable and imperiled stocks, such as Atlantic salmon, are able to modify the annual inspection requirements through mortality monitoring, where hatchery staff are trained by fish health biologists to sample the recent mortalities and send the samples to the Fish Health Unit. This procedure, though more intensive at the lab provides a better, year-round surveillance of the status as well as reduces the number of valuable fish needed to be sacrificed.
- L97H Initiation of the National Wild Fish Health Survey.** - Under the leadership of Service Regional Fish Health Centers, and in cooperation with stakeholders such as states, tribes, and the aquaculture industry, this project was launched in 1997 in order to determine the distribution of certain pathogens in fish in the wild. The Survey is incorporating standardized diagnostic and data management methods to ensure national comparability; identifying target pathogens, fish species, and habitats; and developing a systematic watershed approach that will be followed for the next 3 to 5 years. The Fish Health Unit has obtained Enzyme Linked Immunosorbant Assay (ELISA) and Polymerase Chain Reaction (PCR) equipment and training for conducting analysis on wild fish health samples. To date, fourteen species have been examined from thirteen locations in Region 5.
- L97I Implementation of a Pro-Active Fish Health Management Program at Various Atlantic Salmon Facilities.** - In cooperation with several facilities in Region 5, the Fish Health Unit administers several pro-active fish pathogen surveillance and prevention techniques. Non-lethal monitoring of mucus and testing of water for bacteria are methods of surveillance for earliest possible detection and for water treatment efficacy. The Atlantic Salmon Sea-Run Protocol, where a combined antibiotic/vaccine injection is administered to the fish upon arrival at the facility, has been a very successful preventative of bacterial epizootics during spawning season. This protocol has involved partnerships between several Service salmon facilities, The Fish Health Unit, USGS-BRD, US FDA, and the Service INAD program, of which FHU staff serve as regional coordinator and field monitors.