

U.S. Fish & Wildlife Service

**Northeast Fishery Center
Lamar, Pennsylvania**

Annual Report of Biological Activities 2003



Juvenile Atlantic sturgeon captured in the Hudson River 2003

2003 was a year of significant accomplishments for the staff of Northeast Fishery Center - Lamar, PA (NEFC) and the first full year under the leadership of Center Director, Mike Millard. Biological activities were again geared towards restoration efforts on federal trust species such as Atlantic salmon and Atlantic sturgeon. For example, 6 weeks of field work was performed on the Hudson River as part of a cooperative agreement with the State of New York to develop a scientifically-sound juvenile Atlantic sturgeon sampling strategy as a predictor of population trends. Applied research also continued in areas of fish culture technology with inter-jurisdictional species, exemplified by recent experiments on the cryo-preservation of Atlantic salmon milt. 2003 was also the year which marked the completion of the Culture Manual for Atlantic Sturgeon, a long-term project which began in 1991. The newly-established genetics lab underwent construction for additional laboratory and office space and will be fully functional as an aquatic species DNA lab in 2004. This continued expansion of NEFC's Population and Ecology Section came with the welcome addition of geneticist, Meredith Bartron, Ph.D. and population ecologist, John Sweka, Ph.D. NEFC's versatility was also brought to light by: being a pilot station for testing of the Service Asset Maintenance Management System (SAMMS) program, performing efficiency tests on an aquaculture heat-recovery system, being instrumental in a U.S. Food and Drug Investigative New Animal Drug approval for a fish-marking compound (calcein), and for assisting in the discovery of 2 federally-listed freshwater mussel species within the Erie National Wildlife Refuge. We proudly report the following Biological Activities for 2003:

STUDIES PERFORMED

Study Number and Title:

- LM-02-01 Relative abundance sampling of juvenile Atlantic sturgeon in the Hudson River
- LM-03-02 Comparison of mortality between calcein-marked and unmarked Atlantic salmon fry stocked in Woods Race tributary at the Northeast Fishery Center
- LM-03-03 Mussel survey of Muddy Creek within the Erie National Wildlife Refuge
- LM-03-04 Evaluation of unique scale marking of Atlantic salmon parr with calcein
- LM-03-05 Cryopreservation of Atlantic salmon semen using 5 extender and cryo-protectant combinations
- LM-03-06 Thermal performance of a countercurrent flow spiral heat exchanger with possible applications for aquaculture
- LM-03-07 The use of oxytetracycline for validating annulus formation in pectoral spines of hatchery-reared Atlantic sturgeon *Acipenser oxyrinchus*
- LM-03-08 Genetic structure of the horseshoe crab (*Limulus polyphemus*) populations in Delaware Bay
- LM-03-09 Growth and Survival of First-Feeding Atlantic Salmon Fry in response to various starter diet regimens
- LM-03-10 Mortality associated with catch-and-release angling of striped bass and American shad in the Hudson River

OTHER BIOLOGICAL AND RELATED INVESTIGATIONS PERFORMED:

- LM03A Fish Health Inspection/Monitoring/Diagnostic Services
- LM03B Aquatic Resources Management Plan for the Erie National Wildlife Refuge-Seneca Division
- LM03C Participation in the National Wild Fish Health Survey
- LM03D Incidence and Prevalence of Infectious Salmon Anemia virus (ISAv) in Sea Run Penobscot River Atlantic Salmon held at Craig Brook NFH for Broodstock
- LM03E Participation in Maine Fish Health Advisory Board concerning Infectious Salmon Anemia (ISAv) Issues
- LM03F U.S. Fish and Wildlife Service Fish Health Procedures Handbook
- LM03G Quality Assurance/Quality Control for Infectious Salmon Anemia virus (ISAv) Samples and Diagnostic Techniques
- LM03H Fish Health Extension Services
- LM03I U.S. Fish and Wildlife Service Fish Health Policy
- LM03J Incidence and Prevalence of Spring Viremia of Carp (SVC) Virus in a watershed of Virginia/North Carolina
- LM03K Development of a computer program to identify genetically optimal matings for broodstock management
- LM03L Partnership with the Pennsylvania Fish and Boat Commission for pond culture of juvenile walleye and striped bass
- LM03M Maintenance of the U.S. Atlantic Salmon Assessment Committee (USASAC) database

STUDIES / PUBLICATIONS IN WHICH THE CENTER COOPERATED:

Bay-wide tagging study to assess spawning migration and population size of horseshoe crabs in Delaware Bay. David R. Smith, U.S. Geological Survey - Biological Resources Division, Leetown Science Center, WV (M. Millard, USFWS Project officer)

The efficacy of marking fish with calcein via feed. Dale Honeyfield, U.S. Geological Survey - Biological Resources Division, Wellsboro, PA

The ecology of *Tubifex tubifex* in selected Pennsylvania streams. Adam Kaeser, Pennsylvania State University

Infectious salmon anemia virus: Injection challenge and waterborne transmission monitored by hematology and Polymerase chain reaction assay. Philip E. McAllister, USGS National Fish Health Research Laboratory

Quality Assurance Testing for Infectious Salmon Anemia. Sharon MacLean, National Marine Fisheries Service

STUDIES / PUBLICATIONS IN WHICH THE CENTER COOPERATED (Continued)

Relative Sensitivity of the ASK cell line for detection of infectious salmon anemia virus. Jill Rolland, USDA/APHIS; James Winton, USGS , Western Fisheries Research Center; Deborah Bouchard, MicroTechnologies, Inc.

Relative Resistance of Pacific Salmon to Infectious Salmon Anemia Virus. Jill Roland, James Winton, USGS , Western Fisheries Research Center

Evaluation of rainbow trout strain variation in response to challenge with *Flavobacterium branchiophilum*. Phil McAlister and Pete Bullock, Leetown Science Center (USGS-BRD) and The Conservation Fund, Freshwater Institute.

Engineering services for water treatment feasibility study and conceptual documents, phase II feasibility study 2003, Northeast Fishery Center, Lamar, Pennsylvania. The Conservation Fund, Freshwater Institute - Shepherdstown, WV.89 pp.

Evaluation of negative bias in multiple-pass removal population estimators and its influence on large scale population estimates for stream fish. – Chris Legault, NOAA-Fisheries, Northeast Fisheries Science Center, Woods Hole, MA. Ken Beland, Maine Atlantic Salmon Commission, Bangor, ME.

Restoration of hatchery-impacted streams by removal of phosphorous. Science Support Program - Study 05008. Philip L. Sibrell- USGS Leetown Science Center (John W. Fletcher, Service Project Officer)

Identification of best management practices in extensive rearing units - Richard W. Soderberg, Mansfield University, Mansfield, PA.

Coloso, R.M., K. King, J.W. Fletcher, A.Werner and R.P. Ferraris. (In press). Effects of dietary phosphorus and vitamin D3 on sodium phosphate cotransporter expression, plasma vitamin D levels, phosphatase activity, and effluent partitioning in RBT culture. *Journal of Comparative Physiology*.

Coloso, R. M., K. King, J. W. Fletcher, P. Weis, A. Werner, and R. P. Ferraris. 2003. Dietary P regulates phosphate transporter expression, phosphate activity, and effluent P partitioning in trout culture. *Journal of Comparative Physiology–Part B* 173:519-30

Coloso, R.M., K. King, J.W. Fletcher, M.A. Hendrix, M. Subramanyam, P. Weis and R.P. Ferraris. 2003. Phosphorous utilization in rainbow trout (*Oncorhynchus mykiss*) fed practical diets and its consequences on effluent phosphorous levels. *Aquaculture* 220: 801- 820

Coloso, R.M., S.P. Basantes, K.King, M.A. Hendrix, J.W. Fletcher, P.Weis., and R.P. Ferraris. 2001. Effect of dietary phosphorus and vitamin D3 on phosphorus levels in effluent from experimental culture of rainbow trout. *Aquaculture* 202:145-161.

Smith, D., P. Pooler, B. Swan, S. Michels, W. Hall, P. Himchak, and M. Millard. 2002. Spatial and temporal distribution of horseshoe crab (*Limulus polyphemus*) spawning in Delaware Bay: Implications for monitoring. *Estuaries* 25(1)115-125.

STAFF PUBLICATIONS:

- Bartron, M.L. and K. T. Scribner. In press. Temporal comparisons of genetic diversity in Lake Michigan steelhead, *Oncorhynchus mykiss*, populations: effects of hatchery supplementation. *Environmental Biology of Fishes*.
- Bartron, M.L., D.R. Swank, E. Rutherford, and K.T. Scribner. In review. Methodological bias in estimates of strain composition and straying of hatchery-produced steelhead in Lake Michigan tributaries. *North American Journal of Fisheries Management*.
- Bartron, M.L. and K. T. Scribner. In review. Spatial genetic structure among Lake Michigan steelhead (*Oncorhynchus mykiss*) populations. *Transactions of the American Fisheries Society*.
- Jodun, W.A. In press. Growth and feed conversion of sub-yearling Atlantic sturgeon at three feeding rates. *Journal of Applied Aquaculture*. Volume 15.
- Millard, M., S. Welsh, J. Fletcher, J. Mohler, A. Kahnle, and K. Hattala. 2003. Mortality associated with catch and release of striped bass in the Hudson River. *Fisheries Management and Ecology* 10:295-300.
- Mohler, J.W. 2003. Producing fluorescent marks on Atlantic salmon fin rays and scales with calcein via osmotic induction. *North American Journal of Fisheries Management*. 23:1108-1113.
- Mohler, J.W. 2003. Culture Manual for the Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*. U.S. Fish & Wildlife Service, Hadley, Massachusetts. 73 pp.

TECHNICAL INFORMATION LEAFLETS:

None produced in 2003

TECHNICAL REPORTS:

- Fletcher, John W. 2003. Effects of hormone implant use in males, stocking density, and male to female ratio upon tank spawning performance of American shad. In Susquehanna River Anadromous Fish Restoration Committee. Restoration of American Shad to the Susquehanna River, Annual Progress Report. U.S. Fish and Wildlife Service, 2002. Harrisburg, PA.
- Fletcher, John W. and John A. Sweka. 2003. Northeast Region fishery management plan module. The software module enables users to program and query links between Service activities, Northeast Region Fisheries Strategic Plan, and principle recovery and restoration management plans.
- Jodun, Wade A. and Anthony F. Carta. 2003. Northeast Fishery Center SAMMS business rules, manual for implementation of Service Asset and Maintenance Management System.
- Millard, M. J., J. Mohler, A. Kahnle, K. Hattalla, W. Keller, and A. Cosman. 2003 Mortality associated with catch-and-release angling of striped bass and American shad in the Hudson River. Final Report to the N.Y. Department of Environmental Conservation.

TECHNICAL REPORTS (continued)

Mohler, J.W. 2003. Aquatic Resources Management Plan for the Erie National Wildlife Refuge-Seneca Division. Special Detail for USFWS Region 5 "Pathways to Leadership" training.

FORMAL PRESENTATIONS:

Bartron, Meredith - Lake Michigan steelhead population genetics. April 30, 2003. Penn State University, University Park, PA.

Fletcher, John - Effects of hormone implant use in males, stocking density, and male to female ratio upon tank spawning performance of American shad. Oxytetracycline Task Force Meeting. February 13, 2003, Harrisburg, PA.

Fletcher, John - Effects of water salinity upon American shad tank spawning. 59th Northeast Fish and Wildlife Conference. April 14-16, 2003. Newport, RI

King, Kim - Cryopreservation of Atlantic salmon semen using five extender and cryoprotectant combinations. Connecticut River Migratory Fish Restoration Workshop. Feb. 11, 2003. Hadley, MA

Mohler, Jerre - Aquatic biology at the Northeast Fishery Center. Biology Majors Lecture at Lycoming College. September 25, 2003, Williamsport, PA.

Mohler, Jerre - What I did on my Pathways to Leadership Special Detail. Presentation to the Regional Directorate and classmates during Region 5's "Pathways to Leadership" closeout session. December 11, 2003. Hancock, MA.

Sweka, John - U.S. Atlantic Salmon Assessment Committee database status and future developments. USASAC annual meeting. Feb. 25, 2003. East Orland, ME.

NATIONAL COMMITTEE PARTICIPATION:

Coll, John and Patricia Barbash - Served on the National Fish Health Policy Revision Committee to re-write the National Fish Health Policy and Procedures handbook.

OTHER SIGNIFICANT COMMITTEE PARTICIPATION:

Barbash, Patricia.- Served on the Maine Fish Health Advisory Board to make recommendations to the Maine commissioners relative to fish health issues impacting wild Atlantic salmon populations and commercial aquaculture.

Barbash, Patricia.- Served on the New England Salmonid Health Committee to make recommendations to the New England Atlantic Salmon Commission relative to fish health issues impacting the New England states.

Bartron, Meredith.- Served on the Atlantic Salmon Biological Review Team (BRT). The BRT is conducting a second status review regarding the listing of the Gulf of Maine Distinct Population Segment listing under the Endangered Species Act.

OTHER SIGNIFICANT COMMITTEE PARTICIPATION (continued)

Bartron, Meredith.- Served as committee chair for the Captive Broodstock Management Plan Committee (CBMPC). As part of the Atlantic salmon recovery plan, the CBMPC is drafting a formal broodstock management plan, as well as developing guidelines for maintaining captive-reared populations throughout their life cycle.

Anthony F. Carta. Served as Region 5 Fisheries representative to the Northeast Region's Wage Grade Committee.

Jodun, Wade.- Selected as a trainer for the Service and Maintenance Management System (SAMMS) and worked in conjunction with Gary Melvin of the National Conservation Training Center-Shepherdstown, WV to develop a training manual and set up the initial training seminar

Selmer-Larsen, Kim.- Served on the Great Lakes Disease Committee to represent Region 5 relative to disease issues affecting the Great Lakes.

Sweka, John. – Participated in the U.S. Atlantic Salmon Assessment Committee (USASAC).

Sweka, John. - Consulted on development of NASCO salmon habitat database, US Atlantic Salmon Assessment Committee, NASCO

Study Number: LM-02-01

Title: Relative abundance sampling of juvenile Atlantic sturgeon of the Hudson River

Principal Investigator: John Sweka, Northeast Fishery Center (NEFC)

Co-Invest/Cooperators: Mike Millard and Jerre Mohler (NEFC); Andy Kahnle and Kathy Hattalla (NY Dept. of Environmental Conservation)

Background and Justification

The early juvenile stage offers the best opportunity for monitoring Atlantic sturgeon (ASN) populations over time and for evaluating the population response to the current fishery moratorium. At the early juvenile stage, ASN spend the entire year in the river and have attained a size that can be effectively sampled by gill nets. A practical approach for long term monitoring of ASN population trends would be via annual estimates of relative abundance, such as mean catch per unit effort (CPUE), from a standardized sampling design.

Study Objectives

This 2-year study was aimed at developing the sampling methodology that will make assessment of trends in annual CPUE of juvenile Atlantic sturgeon possible at a practical level of field effort.

Materials and Methods

Juvenile ASN were sampled by USFWS personnel in Newburgh and Haverstraw Bays of the Hudson River from October – November 2003 with additional sampling conducted by NYDEC personnel until December 5, 2003. Sampling in both bays was stratified according to relative depth and substrate type and effort was allocated proportionately among substrate/depth strata. At each pre-determined site, 3 anchored gill nets consisting of 3, 4, and 5 inch stretch mesh were set perpendicular to shore and fished for about 2 hours. The sampling unit used in statistical analysis was the combination of all three nets (one net set) deployed at a site. Captured Atlantic and shortnose sturgeon were measured, weighed, and had a USFWS carlin tag and PIT tagged applied. A sample of the left pectoral spine was also removed from each captured ASN for aging purposes. Sturgeon were then released at the site of capture. Other species captured in gill nets were simply enumerated. A chi-square test was used to determine if the distribution of net sets resulting in a catch of at least one sturgeon was different from the distribution of sampling effort among strata. Catch data was also mapped in a GIS format to examine spatial relationships between net sets which captured sturgeon. Differences in juvenile Atlantic sturgeon size between bays was determined with a nonparametric median test.

Results (Fall 2003)

- A total of 121 juvenile Atlantic sturgeon were captured in 109 net sets between both bays but were captured more frequently in Haverstraw Bay sets (36% vs. 13% in Newburgh Bay).
- Presence of juvenile Atlantic sturgeon was not dependent upon habitat in either bay but overall, juvenile sturgeon tended to be present most frequently in the Soft/Deep stratum in both bays.
- Lower catches in Newburgh Bay may be due to lower capture efficiency of sturgeon in this region due to strong tidal currents
- Length frequency histograms showed the presence of two to three year classes of juvenile Atlantic sturgeon with more large individuals in Haverstraw Bay.
- Sampling will begin again in March 2004 and continue through April 2004

Study Number: LM-03-02

Title: Comparison of mortality between calcein-marked and unmarked Atlantic salmon fry stocked in Woods Race tributary at the Northeast Fishery Center

Principal Investigators: Jerre Mohler - Northeast Fishery Center (NEFC)

Co-investigators: John Sweka; Patrick Farrell - Northeast Fishery Center (NEFC)

Background and Justification

Millions of Atlantic salmon fry are stocked each year throughout river basins in the Maine, Connecticut, and Merimack River salmon restoration programs. A major obstacle to evaluating the performance of these fry has been the inadequacy of existing technologies for marking fry. NEFC began experimentation with calcein in 1995 and found that mass-immersion techniques could be used to apply a non-lethally-detectable fluorescent calcein mark to early life stage Atlantic salmon. The technique was field-tested in the Sheepscot River in Maine using Atlantic salmon fry from Craig Brook National Fish Hatchery. Field recovery of fry and data assessment showed that marked and non-marked fry were not recovered at the expected 1:1 ratio, in that significantly greater numbers of marked fish were recovered. The current study continues field-testing of the efficacy of using calcein for fishery evaluations by utilizing a controlled, natural stream channel at NEFC which will facilitate replicated trials. Results from the study will help biologists determine whether calcein-marked fry have survival equivalent to unmarked fry once released into the wild. These data will provide assessment of the utility and practicality of using calcein to mark fry as part of the monitoring and evaluation program of Atlantic salmon recovery in Maine as well as other salmon restoration programs.

Study Objectives

In 2003, a total of about 1,800 calcein-marked and non-marked Atlantic salmon fry were reared at NEFC and field-evaluated to test the hypotheses that marked and non-marked fry will survive from stocking date to capture date at a 1:1 ratio and that growth is comparable between marked and non-marked survivors after being stocked as non-feeding fry in the Woods Race stream at NEFC .

Materials and Methods

The study was conducted in the Woods Race tributary at NEFC in 2003. Connecticut River domestic Atlantic salmon stock were used to produce fry which were calcein-marked and stocked at the non-feeding life stage. Equal numbers of calcein-marked and non-marked fry were stocked in each of three sections of Woods Race which are separated from each other by concrete control structures. The control structures were outfitted with dam boards and a top screen designed to prevent fry escapement. Once stocked, fry relied on natural feed and received no care except that screens were cleared of debris on a daily basis. No fish predators were introduced into the study area and each stream section was supplied with equivalent amounts and types of woody debris and cobbles for cover. At about 4 months post-stocking, each section of Woods Race was electro-fished for recovery of all salmon and each recovered individual was examined with a SE-MARK™ detector for mark classification. Study-wide, numbers of marked and non-marked fry captured from each stream section were compared using a Replicated Goodness of Fit test (G-statistic) to test the hypothesis that marked and non-marked fry survived from stocking date to capture date at a 1:1 ratio.

Results

-Growth and survival of marked vs non-marked fry was not compared due to the following reasons:

- 1) Positive evidence was found that an unknown number of fry escaped the immediate study area and probably emigrated from their assigned stream section due to high water events.
- 2) A large number of calcein marks were highly degraded and could not be identified without use of fluorescence microscopy. Therefore, some marks may have been totally degraded making comparisons of survival and growth uncertain between marked and non-marked fish
- 3) Reasons for degraded marks will be explored in 2004 with controlled experimentation.

Study Number: LM-03-03

Title: Mussel survey of Muddy Creek within the Erie National Wildlife Refuge

Principal Investigators: Jerre Mohler - Northeast Fishery Center (NEFC)

Co-investigators: Jeff Haas - Erie Nat'l Wildlife Refuge; Patricia Morrison - Ohio River Is. Nat'l Wildlife Refuge

Background and Justification

It is widely recognized that freshwater mussels in North America are an important component of many aquatic ecosystems. Mussels are sessile filter-feeders which make them useful indicators of the health of aquatic environments and they also have regional commercial importance as seed pearl material for the cultured pearl industry. Biologically, they are of interest due to their species diversity which is characterized by nearly 300 species in the U.S. and Canada. Being organisms which are mostly sessile to stream bottom habitats, mussels have developed unique reproductive strategies which require larval metamorphosis on a host fish with some species employing a "lure" to attract potential hosts. Mussels are also important food supplies for many animals including muskrats, mink, otters, fishes, and some birds. Unfortunately, about 72% of the North American mussel taxa are considered endangered, threatened, or of special concern due primarily to habitat destruction and degradation associated with anthropogenic activities. In consideration of this, it is important to perform baseline surveys in areas capable of supporting freshwater mussel populations to document species richness and reproductive success. We performed a qualitative mussel survey on Muddy Creek which flows through the Seneca Division of the Erie National Wildlife Refuge in Crawford County, Pennsylvania.

Study Objectives

In the summer of 2003, we surveyed Muddy Creek within the boundaries of the Erie National Wildlife Refuge to obtain baseline data on species diversity, relative abundance, and documented recruitment in the mussel populations of Muddy Creek.

Methods

A preliminary survey of the study area was performed in June 2003 via canoe to determine stream navigability and identify areas which showed evidence of mussel habitation through presence of muskrat middens and visual observation of mussel beds. Subsequently, a survey design was formulated with the objectives of determining species richness and documenting reproduction of mussels in the study area. Field sampling consisted of timed searches in areas capable of being examined via snorkeling with each sampling location consisting of a riffle-run-pool sequences in areas identified in the preliminary survey. Searches commenced using 2-3 individuals equipped with wet suits and snorkels spaced evenly across the stream width. One additional individual searched stream edges using a viewing bucket and collected mussels using superficial visual technique. Searchers equipped with snorkels, used both visual and tactile methods with search time limited to a maximum of 60 min at each station. Stream length as well as beginning and end of all sampling locations was documented using a hand-held global positioning system unit. One site which showed relatively high diversity was sampled via excavation and screening of the substrate using ten randomly selected 0.25-m² quadrats to determine the percentage of juveniles approximately < 3 years of age present. Cooperators on the survey were: Ohio River Islands NWR, the Western PA Conservancy, and the State College, PA Ecological Services Office.

Results

- A total of 22 species of mussels were found over the 20 stations sampled.
- Two federally-endangered species were found: Clubshell Pleuobema clava and Northern riffleshell Epioblasma torulosa rangiana along with a number of PA state-listed species
- The total number of mussels collected and returned to the stream was 2966, representing an overall collection rate of 0.91 animals per diver minute
- Excavated quadrats at one station revealed that about half of the animals recovered were juveniles demonstrating successful recruitment

Study Number: LM-03-04

Title: Evaluation of unique scale marking of Atlantic salmon parr with calcein

Principal Investigator: John Sweka - Northeast Fishery Center (NEFC)

Co-investigator: Jerre Mohler, Patrick Farrell- NEFC

Background and Justification

Federal and state resource agencies meet current stocking demands with Atlantic salmon (ATS) at a tremendous cost in hatchery operations. Despite stocking efforts, returns of sea-run adults continue to decline and are at an all-time low throughout New England waters. Evaluation of stocking practices is needed to identify areas where smolt production is highest, thereby allowing managers to concentrate efforts in productive areas. Application of a unique mark, retained through the smolt stage and corresponding to release site, would allow correlation of rearing location to subsequent capture in downstream smolt traps. Traditional marking techniques are not practical due to numbers of fry stocked and related handling problems. However, chemically marking ATS with calcein allows for mass marking with a high degree of mark retention through the smolt stage. Once juvenile ATS reach 24–30 mm, scale development occurs and immersion in calcein places a mark on the scales. Additional immersions can then be applied for additional marks to creating unique banding patterns on scales which would enable differentiation of different groups of fish.

Objectives

The objectives of this study were to determine if sequential immersions of ATS parr in calcein will produce unique banding patterns on the scales and to determine the effect of the process on short term (one month) and long term (one year) survival and growth via controlled experimentation.

Methods

Connecticut River-origin ATS were hatched, reared, and periodically observed under magnification to determine scale development. Once scales developed, marking proceeded via methods developed at NEFC using a 1.5% NaCl bath followed by immersion in a calcein solution. Parr were then placed in their respective rearing tanks. Seven marking treatments were used with 3 marking sessions. An experimental unit consisted of a tank of 100 parr replicated 3 times for a total of 300 parr per treatment. Treatments were denoted with 1's and 0's according to whether or not fish were marked during a session (ex: a mark during the 1st and 3rd marking session was denoted "101"). A separate sample of fish were marked during the 1st marking session for periodic sampling to determine if sufficient scale growth occurred for the next marking to proceed. Thirty days after the 3rd marking session, 25 parr in each tank were sampled for mark retention and growth. Scale samples were read by 2 observers and matched to known treatments to determine reliability of mark assignments. After initial evaluation, all parr within a treatment were pooled and re-randomized into 3 tanks of 25 parr each to eliminate tank effect. One year later, another evaluation will be performed.

Results

Mean mortality ranged from 3.3 – 7.6%, with no difference between treatment groups ($p = 0.70$). Instantaneous specific growth rates ranged from 1.77 – 2.00 $\text{g}\cdot\text{g}^{-1}\text{d}^{-1}$, but did not differ between treatments ($p = 0.38$). Percent agreement between readers on scale assignments was 91.80%. There were differences in the percentage of correct assignments among treatments ($p < 0.01$). Scales from treatments 1-0-0 and 1-0-1 were correctly identified 64% and 88% of the time, respectively, while scales from other treatments were correctly identified >97% of the time. The most likely reason for this difference is that some of the fish may not have developed scales by the time of the first marking and the initial band on the scale was missing. This study demonstrates that calcein may be used to create a unique banding pattern on salmon scales to differentiate large groups of marked fish. Additional experiments will be conducted in 2004 to refine marking procedures and ensure that all fish have developed scales by the time of the first marking episode.

Study Number: LM-03-05

Title: Cryopreservation of Atlantic salmon semen using 5 extender and cryoprotectant combinations

Principal Investigator(s): Kim King, Wade Jodun and John Fletcher - NEFC

Co-Investigator(s): William Wayman and Greg Looney USFWS, Warm Springs Technology Center,

Background and Justification

Atlantic Salmon (ATS) Restoration relies heavily upon fish culture facilities to produce fry, parr, and smolts for stocking. However, despite decades of stocking, sea-run returns of ATS remain at low levels. To address this issue, the U. S. Fish and Wildlife Service has taken strong interest in the potential of cryopreservation techniques to maximize the conservation of available genetic material.

Cryopreservation has been identified as a viable means to establish germ plasm repositories for fish production facilities when a shortage of males exist and to provide sperm from males with a known disease history for selective breeding programs. Several cryopreservation methods have been used with varying results to cryopreserve ATS spermatozoa. Early attempts to cryopreserve sperm in straws were unsuccessful. In contrast, Mounib (1978) reported high fertility success (80%) with a pellet technique in which ampoules were frozen. However, these results could not be duplicated. In later studies, variable results were obtained using both the pellet and straw techniques. In general, the non-repeatable results obtained on different fish of the same species indicate no satisfactory technique has yet been developed for cryopreserving ATS sperm.

Objectives

The purpose of this study was to evaluate 5 fish sperm extenders previously untested on ATS that have been used primarily for salmonid cryopreservation.

Materials and Methods

Source of Milt and Eggs.-- Milt was collected from 5 Connecticut River F1 ATS held at White River National Fish Hatchery, Bethel, Vermont. Only samples with motility of at least 90% were used. Eggs were collected from 5 Connecticut River F1 Atlantic salmon held at NEFC.

Freezing of semen.-- (1) Cloud - 5% dimethyl sulfoxide (DMSO), 13.3% egg yolk, (2) Cloud - 5% DMSO, without egg yolk, (3) Gallant - 10% dimethylacetamide (DMA), (4) Hank's Balanced Salt Solution modified with 10X Sigma Concentrate- 10% DMSO (HBSS-S), and (5) Stoss and Holtz - 10% DMSO (S&H) were tested as possible extenders. Semen and extenders were stored on ice. Semen from individual males was mixed with extenders at a dilution ratio of 1:4 (semen:extender). Diluted semen was immediately drawn into 0.5 ml French straws and placed directly into Dewars containing liquid nitrogen for storage.

Thawing of semen and fertilization.-- Frozen semen was transported to the NEFC in liquid nitrogen. On the day of spawning, individual straws were thawed at 40EC in a water bath for 7 seconds and immediately used to fertilize approximately 200 eggs. After fertilization, eggs were water-hardened in 50 ppm iodophore for 30 minutes and then placed in randomly assigned Heath tray compartments.

Incubation. — Fresh water was introduced at the rate of 15 L/min. All eggs received a 15-min flow-through treatment of 1500 mg/L Paracide F every other day beginning on the second day of incubation and continuing until eggs were eyed. After eggs developed to the eyed stage, they were physically shocked, and survival was determined by percent eye-up.

Results:

Fertilization rates, expressed as the percentage of eyed embryos, ranged from 5.0- 26.0% for ATS sperm preserved with five extender combinations. Semen cryopreservation with the Cloud with 5% DMSO without egg yolk yielded significantly higher ($P < 0.003$) fertilization rates (26.0%) than did sperm cryopreserved with the other four extenders.

Study Number: LM-03-06

Title: Thermal performance of a countercurrent flow spiral heat exchanger with possible applications for aquaculture

Principal Investigator: Wade A. Jodun - NEFC

Co-Investigator: Anthony F. Carta - NEFC

Background and Justification

Many aspects of fish husbandry and experimentation with aquatic species require heating water for use in flow-through culture systems. By manipulating water temperatures, hatcheries are capable of producing larger fish at stocking, controlling the onset of sexual maturation and influencing egg incubation. Unfortunately, the cost of heating water in hatcheries with flow-through systems can be cost prohibitive. Heat exchangers have been marketed for years for a variety of industrial purposes and have already been successfully employed in marine aquaculture. However, published information documenting the performance and describing the possible applications of spiral heat exchangers (SHE) in aquaculture and fisheries research is limited.

A countercurrent-flow SHE was installed in the dissolved gases lab at the Northeast Fishery Center (NEFC) in Lamar, Pennsylvania. The purpose of the device is to reduce energy expenditures and heating costs by using already heated water discharged from the freshwater culture tanks to preheat incoming ambient water prior to its entering the boiler. The design specifications call for the SHE to be capable of heating as much as 378 L/min (100 gpm) of 4.3 °C incoming water to a temperature of 10 °C by using 378 L/min (100 gpm) of 18.3 °C discharge water (approximately 40% heat recovery).

Study Objectives

The objectives of the study were to field test the newly installed heat exchanger in order to evaluate the thermal performance of the unit under continuous use and at various flow rates and temperature differentials (ΔT 's).

Materials and Methods

A series of performance trials were conducted to analytically validate the heat recovery efficiency (RE) of the SHE under various conditions. Initially, the SHE was evaluated over a 30-d period to quantify its RE, maintenance requirements, and to assess any losses in performance due to bio-fouling during an extended period of continuous operation. During this phase of the trials the SHE utilized 378 L/min (100 gpm) of heated water (11.0 °C) discharged from 16 culture tanks to preheat 378 L/min (100 gpm) of 4.3 °C incoming ambient water. In the second phase of the performance evaluations, the efficiency of the SHE to heat incoming ambient (3.4 °C) water using discharge water heated to either 11.1°C ($\Delta T = 5.6$) or 15.4 °C ($\Delta T = 11.1$) was tested for the following flow rates: 151 L /min (40 gpm); 227 L /min (60 gpm); 302 L /min (80 gpm); 378 L /min (100 gpm).

Results:

Mean efficiency over the 30-d period of continuous operation was 35.07 % \pm 1.4 SD and no evidence of fouling of the heat transfer surfaces was observed. The results of the second series of performance tests indicate the RE of the SHE was significantly affected by flow rate ($F_{3,3} = 38.5$, $p = 0.01$) but not by level of ΔT ($F_{1,3} = 4.61$, $p = 0.12$). A significant interaction ($F_{3,16} = 26.23$, $p = 0.01$) between the main effects was also noted. For all ΔT / flow rate combinations, RE ranged from 33% to 43%. For both levels of ΔT , the highest RE was observed at the lowest flow (151 L/min) while the lowest RE occurred at the highest flow rate (378 L/min). The results of these trials indicate spiral heat exchangers have the potential to be successfully employed as heat loss recovery tools at fish hatcheries and private aquaculture facilities.

Study Number: LM-03-07

Title: The use oxytetracycline for validating annulus formation in pectoral spines of hatchery-reared Atlantic sturgeon *Acipenser oxyrinchus*

Principal Investigator: Wade A. Jodun - NEFC

Co-investigators: Thomas Kehler - Penn State University; Pat Farrell - NEFC; Dave Dropkin - USGS-BRD, Wellsboro, PA

Background and Justification

Aging of fish is routinely estimated through examination of calcified structures for growth patterns. Although a variety of skeletal parts with visible calcium depositions have been used to age acipenserids, age estimates for this group are largely based upon counts of apparent annuli visible in thin transverse sections of the pectoral fin rays. However, despite its widespread use in aging acipenserids, this pectoral-fin spine technique has only recently been validated for white sturgeon *Acipenser transmontanus* and for lake sturgeon *Acipenser fulvescens*. The ASFMC listed verifying the current methodology for estimating the age of Atlantic sturgeon (ASN) using fin rays as a highly prioritized research need for the species. Stevenson and Secor (1999) provided a partial validation of the periodicity of ring deposition in ASN when they used a solution of 25 mg oxytetracycline (OTC)/ kg of fish injected into the dorsal musculature to produce distinct marks on a small (n=5) number of known-age (4 year old), laboratory-reared ASN and observed a distinct OTC mark followed by an opaque zone three months after injection. However, for a complete validation of the technique it is first essential to track fish for at least a year to identify an annulus. They also noted a clearly visible OTC mark 15 months after injection. However, that sample size was limited to a single fish. Validating fish aging techniques is extremely important in fisheries biology. Without accurate aging techniques, growth rates, age at maturity, longevity predictions and estimates of age-specific data such as catch rates, fecundity, mortality, and growth rates, may be inaccurate.

Study Objectives

The objective of this study is to more completely validate, through the application of OTC marks, whether or not the zone preliminarily identified as an annulus (one pair of opaque and translucent rings) on ASN pectoral-fin spines is, in fact, an annual increment. This information will provide further confirmation of the pectoral-spine aging technique for fish of a range of ages as well as providing a key for use with the pectoral spine aging methodology for the species.

Materials and Methods

Ten Atlantic sturgeon from five year classes (FY 98, 96, 95, 94, 93) currently being cultured at NEFC were injected using OTC to produce a mark of known date in skeletal structures. All fish were anesthetized with 200 ppm MS-222, measured for fork length to the nearest millimeter, weighed to the nearest gram and administered a solution of 50 mg OTC/ kg of fish injected into the dorsal musculature to produce distinct marks. Twelve months after injection, a small segment of the left pectoral will be removed with a jeweler's saw. Fin spine segments will be dried and a minimum of three transverse sections (thickness = 0.2 mm) will be taken from each fin spine mounted on glass microscope slides, polished, viewed with epifluorescent microscopy and photographed to verify the existence of OTC marks and record the position of OTC marks with respect to opaque and translucent zones and to identify annual banding patterns within and among the various age groups.

Results:

The study is on-going.

Study Number: LM-03-08

Title: Genetic structure of the horseshoe crab (*Limulus polyphemus*) populations in Delaware Bay

Principal Investigators: Meredith Bartron, Mike Millard USFWS-Northeast Fishery Center

Co-Investigators/Cooperators: Dave Smith, USGS-BRD; Sheila Eyer, USFWS; Stewart Michaels, Delaware Division of Fish and Wildlife

Background and Justification

Horseshoe crabs (*Limulus polyphemus*) abundance in Delaware Bay has declined over recent years. Horseshoe crabs represent an integral component to the Delaware Bay ecosystem. For example, horseshoe crab eggs provide a major food source for migrating shorebirds. However, declining numbers of horseshoe crabs have reduced the amount of eggs available to shorebirds. Tagging studies have been initiated to examine adult horseshoe crab movement with Delaware Bay and fidelity of adult crabs to spawning beaches. Observations of movement are helpful to understand habitat utilization and spawning site fidelity, but observational studies are unable to provide information regarding successful reproduction and population structure of crabs in the bay. Additionally, because harvest of horseshoe crabs in Delaware Bay is regulated by multiple agencies, it is important to know if management efforts are focused on a single panmictic population (if crabs randomly choose spawning sites), or if multiple populations of horseshoe crabs exist in Delaware Bay. Understanding the population genetic structure of horseshoe crabs will aid in management of the crabs, provide critical information regarding life history traits, and aid in restoration efforts.

Objectives

Our goal for this project is to determine the spatial genetic relationships among horseshoe crab spawning beaches in Delaware Bay. Multiple sampling times throughout the spawning season will help determine the population structure of spawning beaches, and help determine if distinct populations exist temporally throughout the spawning period. This study represents the first year of a multi-year project to determine the temporal and spatial relationships of horseshoe crabs in Delaware Bay.

Methods and Materials

Adult horseshoe crabs will be non-lethally sampled from spawning beaches located around Delaware Bay. Approximately 60 individuals (equal sex ratios of male and female crabs) will be sampled from three beaches in Delaware: Kittshummock, Big Stone, and Fowler, and from three beaches in New Jersey: Fortescue, Reeds, and Highs beaches. Small tissue samples will be clipped from the pinchers of the adult crabs, and stored in 95% Ethanol. Microsatellite markers will be used to quantify allele frequencies and estimate genetic variation among horseshoe crab spawning beaches.

Results

The study is on-going. Samples were collected in May of 2003, and genetic analysis will begin following additional sampling in May of 2004.

Study Number: LM-03-09

Title: Growth and Survival of First-Feeding Atlantic Salmon Fry in response to various starter diet regimens

Principal Investigator(s): Wade A. Jodun and John Fletcher - Northeast Fishery Center (NEFC)

Background and Justification

Federal and state fish hatcheries raise millions of Atlantic salmon (ATS) for restoration projects in the northeastern U.S. Such hatchery production is essential for maintaining ATS stocks. Failure of ATS to begin feeding by the time yolk-sac absorption is complete may result in high mortalities during the first weeks of feeding. Therefore, successful propagation is contingent upon a feeding regime which gives good early growth and survival. Conventional dry diets perform well when used as ATS grower diets but have proven unsuccessful as starter diets. Currently, a semi-moist diet (BioDiet, BioOregon, Warrenton, Oregon) is routinely provided to first-feeding fry by many federal hatcheries in the northeast and has given acceptable results for a number of years. However, BioDiet is not completely acceptable as a production starter feed for at least 3 reasons: (1) It is manufactured only in the northwestern U.S. and shipping costs to hatcheries in the eastern U.S. are high (2) the small particle sizes of BioDiet are difficult to dispense uniformly with most automatic feeders due to its high moisture content, and (3) the high moisture content reduces the shelf-life of the diet. Also, in the past several years, low survival, apparently due to a low initial acceptance of BioDiet by first-feeding fry has been observed at (NEFC). Some hatcheries supplement BioDiet with live *Artemia* nauplii which is labor intensive and costly.

Objectives

The objective was to examine effects of diet regimen on growth and survival of first-feeding ATS fry.

Materials and Methods

4,900 ATS sac-fry spawned and incubated at NEFC were used in the study. One-hundred were weighed to obtain mean weight/ fish and starting mean weight for the study. The additional 4,800 fish were equally divided and randomly distributed among 24 cylindrical 90-L tanks at a density of 200 fish/ tank. Prior to the onset of feeding, each tank was randomly assigned one of the following 8 diet regimens. (1) BioDiet (2) Corey Starter (3) Larva Z Plus (4) live *Artemia* fed for 2 weeks followed by a one week weaning to Biodiet which was then fed for balance of the study (5) decapsulated *Artemia* fed for 2 weeks followed by a 1-week weaning to Biodiet which was then fed for balance of the study (6) Cyclop--eeze fed for 2 weeks followed by a 1-week weaning to Biodiet which was then fed for balance of the study (7) live *Artemia* fed for 2 weeks followed by a 1-week weaning to Corey Starter which was then fed for balance of the study (8) Cyclop--eeze fed for 2 weeks followed by a 1-week weaning to Corey Starter which was then fed for balance of the study. Treatments were performed in triplicate. Feed was offered at 4.5% body weight/d via automatic feeders. Rearing continued for 42 days.

Results

Final mean weight (g/fish) for all diet treatments ranged from 0.548 (Corey) to 0.320 (Larval Z). With the exception of Larval Z, final mean weights for all diet regimens which used only commercial starter diets (Corey, Larval Z, Biodiet) or commercial starter diets supplemented with Cyclop--eeze were greater ($P < 0.001$) than any diet regime which included live or decapsulated *Artemia*. Final Survival for all diet treatments ranged from 83.2% (decapsulated *Artemia* / Biodiet) to 96.2% (Cyclop--eeze / Corey). Regimens which included live or decapsulated *Artemia* for the first 2 weeks before gradually weaning fish to a commercial diet, exhibited lower ($P = 0.003$) overall survival than regimens which included only commercial starter diets (Corey, Larval Z, Biodiet) or commercial starter diets supplemented with Cyclop--eeze. Pre-switch survival was similar at 98.3% or higher for all diet regimens. Significant differences in mean weight and survival only appeared after the transition from live or decapsulated *Artemia* to commercially diets. This indicates development of a strong preference for *Artemia* with concomitant high mortality and suppression of growth when attempting to wean onto a prepared diet. Similar finds have been noted for other species.

OTHER BIOLOGICAL AND RELATED INVESTIGATIONS PERFORMED:

LM03A Fish Health Inspection/Monitoring/Diagnostic Services.- The Lamar Fish Health Center processed 265 laboratory cases in fiscal year 2003. Region 5 has a very extensive fish health monitoring program to enhance the fish health inspections, allowing continual surveillance of the health status of the stocks, some of which have been identified as very limited distinct population segments which the Service has listed under the Endangered Species Act. The Fish Health Center had 33 inspection cases, which included 14 that were conducted, as outlined in the Service Fish Health Policy, as virology lab services only for non-Service entities. These statistically based fish health examinations are essential to prevent the spread of fish diseases through fish and/or egg transfers and are necessary to enable facilities to comply with regulations on transporting and releasing fish. In addition to the 126 monitoring cases involving examination of fish, 2 Service facilities provided 33 water monitoring cases, where water from rearing units was examined by the water filtration method, a very effective pro-active protocol for diagnosing furunculosis before an epizootic occurs and for evaluating efficacy of ozone disinfection. In fiscal year 2003, fifteen laboratory cases were diagnostic examinations where moribund fish were examined and tested to determine the cause(s) of mortalities and other problems; recommendations for resolution were provided. As a cooperator in various fisheries projects within the region, the Fish Health Center also examined aquatic invertebrates (2 cases) which involved fisheries management activities with sandworms and bloodworms. In addition to the above, 17 cases were involved in cooperative research projects on infectious salmon anemia virus with the USGS National Fish Health Research Lab and the National Marine Fisheries Service. Contact: John Coll

LM03B Aquatic Resources Management Plan for the Erie National Wildlife Refuge-Seneca Division.- A special detail was completed by Jerre Mohler for the Seneca Division of the Erie National Wildlife Refuge in Guys Mills, PA. as part of the Region 5 "Pathways to Leadership" program. The work consisted of formulating an Aquatic Resources Management Plan for the refuge. No formal plan previously existed but the refuge was home to unique water resources including important fish and freshwater mussel communities. Background information was gathered from a variety of sources concerning what was known about water quality, stream surveys, public use patterns, and adjacent land use activities. A portion of the detail involved organizing and performing a mussel survey (See Study LM-03-02). The Management Plan was completed and contained 28 pro-active recommendations for protection of habitat for rare fish and mussels. Contact: Jerre Mohler

LMO3C Participation in the National Wild Fish Health Survey (NWFHS).- This project, launched in 1997, continues to involve all nine Service Fish Health Centers nationwide, incorporating standardized diagnostic techniques and data management methods to ensure comparability. In fiscal year 2003, the Fish Health Center initiated 37 cases for the Survey, in which 1,275 fish (12 different species) from a total of 31 sites were examined and efforts continued to enter completed cases into the NWFHS database. This database which is capable of single and double queries based on either fish species or fish pathogens, is now accessible via the internet on the Service website. The NWFHS is partnership driven and fiscal year 2003 enabled the Lamar Fish Health Center to conduct cooperative work with: (1) Penn State University on whirling disease in feral trout populations in Pennsylvania, (2) West Virginia DNR on assessing the prevalence of largemouth bass virus in bass residents of several bodies of water, (3) Virginia Department of Game and Inland Fisheries on assessing the prevalence of spring viremia of carp virus in resident cyprinids, and (4) several state and federal natural resource agencies (CT,ME,NY,NJ,VT) on developing brood stocks from feral populations. Outreach activities to increase awareness of the National Wild Fish Health Survey and involve other Service and partnering programs continue. Contact: John Coll

OTHER BIOLOGICAL AND RELATED INVESTIGATIONS PERFORMED (continued)

LM03D Incidence and Prevalence of Infectious Salmon Anemia virus (ISAv) in Sea Run Penobscot River Atlantic Salmon held at Craig Brook NFH for Broodstock. –The non-lethal ISAv surveillance protocol for screening sea-run Penobscot River Atlantic salmon as they are captured and brought to Craig Brook National Fish Hatchery was continued to determine incidence in this population. A sub-sample (60) of fish were sampled non-lethally (blood) and tested by reverse transcriptase-polymerase chain reaction and cell culture on SHK-1 and ASK cells. All fish tested negative by both polymerase chain reaction and cell culture techniques. As a tool for managing this virus at the facility, the entire population (n=602) was similarly screened, following cohabitation and prior to spawning. All tested negative and no isolation / quarantine of eggs was deemed necessary. Contact: John Coll

LM03E Ongoing Participation in Maine Fish Health Advisory Board concerning Infectious Salmon Anemia virus (ISAv) Issues. - The Maine Fish Health Technical Committee (MFHTC) serves as a scientific advisory board to the state Commissioners. The group, containing a representative from the Lamar Fish Health Center, is very involved with Infectious Salmon Anemia virus (ISAv), as well as other fish health issues related to private aquaculture and wild resources. The Center has established a monitoring program for all sea-run Atlantic salmon mortalities as has the Maine salmon industry which began participation in a US Dept. of Agriculture, Animal Plant Health Inspection Service Indemnification Program for eradication of ISAv in Maine. Part of the program involves depopulation and fallowing of all salmon net pens in Cobscook Bay, where ISA has been a problem for the private aquaculture industry for over a year. Due to the low numbers of the distinct population segments of Atlantic salmon listed under the Endangered Species Act, it is vital that the impacts of this and other diseases are held to a minimum. The unresolved issue which remains is the inconsistent management of ISAv across international borders in Canada, leaving the Maine sites along the border vulnerable to disease. The MFHTC continues to seek solutions to management of ISAv in Atlantic salmon wild and cultured stocks through communication with private industry and international regulators. Contact: John Coll

LM03F U.S. Fish and Wildlife Service Fish Health Procedures Handbook. -In cooperation with all nine USFWS Fish Health Centers, and in collaboration with the American Fisheries Society - Fish Health Section, a procedural manual for Fish Health Inspection Protocols has been further developed. A representative of the Lamar Fish Health Center chaired subcommittees to gather and edit procedures for the Sampling, Bacteriology and Quality Assurance Chapters of this Manual. The intent of the Handbook is to establish a nationally consistent set of protocols for use by all fish health inspectors and diagnostic laboratories when performing fish health inspections of fish culture and aquaculture facilities. The document is being considered by the Fish Health Task Force of the Congressional Joint Subcommittee on Aquaculture for incorporation into the National Aquatic Animal Health Plan as a national standard for fish health inspections. The document has also become a chapter in the updated version of the AFS/FHS Bluebook. It is available for viewing on the Internet at <http://fisheries.fws.gov/FWSFH/NFHSmian.htm> Contact: John Coll

LM03G Quality Assurance/Quality Control for Infectious Salmon Anemia virus (ISAv) Samples and Diagnostic Techniques. -The Lamar Fish Health Center participated in another round of QA/QC evaluating ISAv assays and procedures with National Marine Fisheries Service University of Maine at Orono (UMO), and MicroTechnologies, Inc. during fiscal year 2003. Receiving blind samples collected by UMO from clinical naturally infected, and clinical and sub-clinical experimentally infected, as well as negative fish, this exercise is examining the differences between sampling blood (non-lethal) and tissues (kidney/spleen) as well as the accuracies and sensitivities between the polymerase chain reaction and two cell culture assays, all conducted with duplicate samples in several laboratories. A total of 60 fish, producing 358 assays were completed at the Lamar Fish Health Center. The study identified problems with detection of the virus by cell culture. Contact: John Coll

OTHER BIOLOGICAL AND RELATED INVESTIGATIONS PERFORMED (continued)

LM03H Fish Health Extension Services. -The Lamar Fish Health Center continues to provide extension services to all federal, state, tribal and private inquiries in the area of fish health. Services provided include technical consultations, provision of supplies for fish necropsies, treatment recommendations and calculations, antibiotic injections, vaccinations, and provision of procedural protocols. Contact: John Coll

LM03I U.S. Fish and Wildlife Service Fish Health Policy. - The Lamar Fish Health Center actively continued in the Service-wide effort to revise the Service's national policy on fish health, 713 FW 1-5. One of the major changes is the removal of technical laboratory procedures from the policy, with reference to a Service Procedures Manual. This will allow procedures, which are subject to change due to advances in research, to be updated in the manual, without a formal (administrative) policy revision. Chapter 1 provides the general scope and responsibilities, with the most eminent change being the reinstatement of Whirling Disease as a pathogen of concern. Chapter 2 addresses operations, where special cases, i.e. endangered species, are considered in regard to different sample sizes and methodologies (non-lethal). Likewise, Chapter 3 covers exotic disease eradication, where destruction of any fish may be exempted from the provisions upon consent of the assembled task force that pathogen containment is achieved. Chapter 4 establishes a national consistency of how services to non-Service entities is handled, providing discretion based on available resources. Finally, an entirely new addition to the Policy, Chapter 5, addresses feral populations and the Service Controlled Propagation Program. A quantitative risk assessment grid has been developed to be used to evaluate disease risks in the development of the fish health management plan, as required by the Controlled Propagation Policy. For the first time, this document has received both internal and external review and comment, enabling Service partners to assist in addressing fish health concerns. At the end of fiscal year 2003, the policy revisions were finalized, awaiting signature and implementation in FY 2004. Contact: John Coll.

LM03J Incidence and Prevalence of Spring Viremia of Carp (SVC) Virus in a watershed of Virginia/North Carolina.- The Lamar Fish Health Center, in cooperation with the Warm Springs Fish Health Center and North Carolina WRC and Virginia DGIF, continued investigation of free-ranging cyprinids in the Dan River watershed from which the first isolation of SVCV in North America occurred at an aquaculture facility. Various techniques, including cell culture for isolation of the virus and antibody testing of serum for determining exposure were conducted. Several instances of fish with antibody titers were determined. To date, no free-ranging fish in this watershed have been found infected or carrying the virus. Additional work including formal investigations of susceptibility of native cyprinids to this recently introduced virus is planned. Contact: John Coll

LM03K Development of a computer program to identify genetically optimal matings for broodstock management.- Inappropriate hatchery mating designs can reduce effective population size, increase the likelihood of inbreeding and create population bottlenecks. New approaches, incorporating genetic data on potential breeders reduce chances of inbreeding, and have already been incorporated successfully in the Connecticut River and Maine Atlantic salmon restoration efforts. As part of the optimal mating software, we propose to develop an improved mating design optimization procedure. The improved design algorithm will incorporate factorial mating design and will use optimization procedures to determine the best set of mating pairs across all fish available for mating on a particular day. This will improve the efficiency of the program and facilitate its use in the hatchery environment. The new software will match already genotyped candidate parents for mating while (1) maximizing genetic distance (2) minimizing relatedness (based on relatedness measures and pedigree data) (3) following a user-defined mating strategy (4) allowing input flexibility for adults ripe that day (5) calculating both single-pair and factorial optimized sets of matings (6) tracking of "lifetime contribution" of individuals (7) tracking precocious parr and factoring in this information after some threshold contribution of parr has been surpassed (8) generating summary information on actual

OTHER BIOLOGICAL AND RELATED INVESTIGATIONS PERFORMED (CONTINUED)

matings, mean genetic distance of adults spawned, the reproductive contribution per individual, and any other desired data. We submitted and successfully received funding for this research through the Science Support Proposal program between USGS and USFWS. The project will begin January of 2004. Contact: Meredith Bartron

LM03L Partnership with the Pennsylvania Fish and Boat Commission for pond culture of juvenile walleye and striped bass.- A partnership in the form of a Memorandum of Understanding was established between the PA Fish and Boat Commission and the Northeast Fishery Center to provide use of five ponds for culture of approximately 150,000 walleye and striped bass juveniles for the Commonwealth. Contact: John Fletcher

LM03M Maintenance of the U.S. Atlantic salmon Assessment Committee database.- As part of evaluation and tracking of Atlantic salmon restoration efforts, data input by numerous fishery managers was standardized and sub-databases were developed for each salmon program in Region 5 of the U.S. Fish and Wildlife Service. Contact: John Sweka



U.S. Department of the Interior
U.S. Fish and Wildlife Service
N.E. Fishery Center - Lamar, PA
570.726.4247