First Maine Atlantic Salmon Technical Advisory Committee
Research Forum
16 January 2002
Murray Hall
University of Maine, Orono, Maine

Program

8:00 a.m.  Registration, coffee

8:30 a.m.  Welcome, announcements
Terry Haines
U.S. Geological Survey, Maine Field Station, University of Maine, Orono

Session 1

8:40 a.m.  Population dynamics of Atlantic salmon in the Narraguagus River
John F. Kocik and Kenneth F. Beland

9:00 a.m.  Origin and identification of Atlantic salmon postsmolts in Penobscot Bay
Russell W. Brown and Craig Tinus

9:20 a.m.  Phenotypic differences expressed during the marine phase for three remnant populations of Atlantic salmon
Timothy R. Sheehan, John F. Kocik and Ernie Atkinson

9:40 a.m.  Population structure of Maine Atlantic salmon and other Atlantic salmon in Maine
Tim King and Adrian Spidle

10:00 a.m.  Break

Session 2

10:30 a.m.  Acid rain: Still a problem for Maine’s Atlantic salmon?
John Magee

10:50 a.m.  Field evaluation of calcein marks on salmon fry stocked into the West Branch Sheepscot River, Maine
Jerre Mohler, Michael Millard and David Perkins
Physiological changes in wild and hatchery Atlantic salmon smolts in Maine: implications for marine survival
Stephen D. McCormick, Russell W. Brown, John F. Kocik, John A. Magee and Craig Tinus

Salar MAP: Opportunities for Canada-U.S. cooperation
Gilles Lacroix

Lunch

Session 3

Baseflow and stormwater chemistry of the Maine salmon rivers during the 2001 field season
Mark Whiting

Screening for salmonid pathogens in wild marine fishes
Sharon A. MacLean

Occurrence of small mouth bass (Micropterus dolomieu) in the Pleasant River watershed
Matthew Scott

An investigation of drift of Atlantic salmon fry, Salmo salar, immediately after stocking
Ernie Atkinson, Greg Mackey, Gregg Horton and Wayne Simmons

Break

Session 4

A measure of substrate embeddedness and its relationship to juvenile Atlantic salmon (Salmo salar) densities in the Narraguagus River
Ernie Atkinson, Joan Trial, Melissa Evers, Gregory Mackey and Kenneth Beland

The use of hormone implants to synchronize, advance, and improve the maturation of sea-run and kelt Atlantic salmon broodstock
Joseph Ravita and Stephen Gephard

Geomorphology and trends in hydrologic conditions of coastal Maine rivers
Robert W. Dudley, Joan Trial and Jed Wright
4:00 p.m.  

Closing  
Terry Haines  
*U.S. Geological Survey, University of Maine, Orono, ME*  
John Kocik  
*NOAA, Northeast Fisheries Science Center, Orono, ME*  
Joan Trial  
*Maine Atlantic Salmon Commission, Bangor, ME*
ABSTRACTS
ORAL PRESENTATIONS
Population dynamics of Atlantic salmon in the Narraguagus River

John F. Kocik¹ and Kenneth F. Beland²
¹NOAA, Northeast Fisheries Science Center, Orono, ME; ²Maine Atlantic Salmon Commission, Bangor, ME

Atlantic salmon populations in Maine have been at low levels of abundance for the last 75 years and have declined further in the past decade. As a result, the Gulf of Maine Distinct Population Segment of Atlantic salmon was listed as endangered in 2000. NOAA Fisheries (NMFS) and the Maine Atlantic Salmon Commission (ASC) have been quantitatively assessing populations in the Narraguagus River since 1991 to determine population trends and the causes of variable abundance. Trap catch of adults and red counts have confirmed that abundance has declined and remains low. To identify causes for this decline, we initiated a program to assess abundance at several life history stages to develop a stage-structured model of the dynamics of this population. We have generated a time series of pre-smolt abundance, smolt abundance, and adult returns. In addition, we age scale samples from each of these stages to facilitate assessment of cohort success. Pre-smolt production has ranged from 9,500 to over 27,000 from 1991-2000 and corresponding emigrating smolt estimates from 1996-2001 ranged from 1,800 to 3,600. Adult returns during this period have ranged from 23-87, indicating that adult Atlantic salmon are not replacing themselves despite supplemental fry stocking. Even in years with relatively large increases in large parr production (126%), smolt production has increased only modestly (3%). Total smolt production in these watersheds has averaged 44/ha (30-60/ha), well below the estimated production capacity of 300/ha. Additionally, marine survival continues to be below 1% and contributes to the declining abundance. We will extend this time series of data to facilitate further analysis to determine the ecological mechanisms responsible for production variability at each stage.
Origin and distribution of Atlantic salmon postsmolts in Penobscot Bay, Maine

Russell W. Brown and Craig Tinus

NOAA, Northeast Fisheries Science Center, Woods Hole, MA

The fate of out migrating Atlantic salmon postsmolts is poorly understood because monitoring is extremely difficult once smolts have left the rivers and entered the marine environment. Over a two year period, NOAA Fisheries has developed a coordinated research program focused on hatchery and naturally reared Atlantic salmon smolts in the Penobscot River watershed. This coordinated program involves the marking and release of 170,000 – 180,000 hatchery smolts marked with site and release date specific visual elastomer marks, a rotary screw trap monitoring program at the head of tide, and an estuary and nearshore marine trawling program. In May 2001, NOAA Fisheries initiated a pair trawl sampling program utilizing a modified midwater trawl with an aluminum catch box at the cod end throughout Penobscot Bay and nearshore waters of the Gulf of Maine. A total of 1,458 Atlantic salmon postsmolts were sampled with a short term handling mortality of 7.9%. Of those fish, 608 scale samples were taken and preliminary analysis suggests that a very low proportion of postsmolts were naturally reared. Ninety-nine stomachs were removed and analyzed, and these data suggest that postsmolts shift from feeding on riverine drift to being opportunistic piscivores soon after entering the marine system. Recovery of 355 elastomer marked fish will allow for evaluation of the relative contribution of different hatchery release groups to the post-smolt population. A rough understanding of migration routes was gained from catch data. A follow-up cruise in spring 2002 will expand the spatial and temporal scale of sampling to further explore trends in nearshore marine distribution at this critical life history stage.
Phenotypic differences expressed during the marine phase for three remnant populations of Atlantic salmon 

Timothy F. Sheehan¹, John F. Kocik² and Ernie Atkinson³

¹NOAA, Northeast Fisheries Science Center, Woods Hole, MA; ²NOAA, Northeast Fisheries Science Center, Orono, Maine; ³Maine Atlantic Salmon Commission, Jonesboro, ME

During 1998-2000, stock-specific marine growth rates were monitored for three endangered Atlantic salmon (Salmo salar) populations from eastern Maine. Atlantic salmon from the Dennys, East Machias, and Machias Rivers were spawned at a federal hatchery and their offspring were reared to the smolt stage at commercial facilities. Approximately 2,000 smolts from each stock were tagged with an elastomer injection, and then transferred to two marine sites (approximately 1,000 per site) for grow-out to the adult stage. At each site, smolts from each stock were placed together into a single sea cage for 29 months and reared under similar environmental and growing conditions. Biological sampling (length and weight measurements) was conducted bimonthly. Standardized photographs were taken from a random sample of individuals from one site at the conclusion of the study, and Truss Analysis (multivariate morphometrics) was conducted on these photographs. Significant differences in growth rates were detected at each site. Significant differences in body morphometrics were also detected among the three stocks, indicating a genetic basis for these phenotypic differences. Several hypotheses are offered as to the ecological meaning of these differences.
Session 1  
9:40 a.m. 

Population structure of Maine Atlantic salmon and other Atlantic salmon in Maine

Tim L. King¹ and Adrian P. Spidle²  
¹U.S. Geological Survey, Leetown Science Center, Kearneysville, WV; ²Johnson Controls, Cape Canaveral, FL

Salmon in the drainages of Maine’s Kennebec and Penobscot rivers were found to be genetically similar to those sampled from the eight rivers recently listed as an endangered Distinct Population Segment (DPS) under the United States Endangered Species Act. Genetic distance estimates confirm that Maine’s Atlantic salmon, both landlocked and anadromous, represent a discrete population unit, with a gene pool as discrete from any Canadian population as each Canadian population is from any other Canadian population, or any North American population from any European population. Within Maine, the anadromous and landlocked populations of Atlantic salmon were statistically distinct from each other. Extensive analysis of neutral genetic variation in Atlantic salmon also provides clear discrimination between Atlantic salmon of European vs. North American origin. An 11-locus suite of microsatellite markers is being used to determine the continent of origin of fish caught in the mixed-stock fishery off the coast of Greenland, and to detect aquaculture escapees in broodstock of Maine origin. Aquaculture escapees can thus be culled from river-specific broodstocks maintained for federally endangered Maine Atlantic salmon. An additional 18 polymorphic loci have been developed, for application to broodstock management both in Maine and in the Connecticut River, and for fine scale resolution of individual reproductive success within and between redds in Maine’s rivers.
Acid rain: Still a problem for Maine’s Atlantic salmon?

John A. Magee  
Gomez and Sullivan Engineers, P.C., Weare, NH

Acidic precipitation has been responsible for the decline and extirpation of many Atlantic salmon populations, with well-documented cases in Nova Scotia and Norway. Although emissions of nitrogen oxides and especially sulphur oxides have been reduced in recent years, decades of acid rain have led to lower buffering capacity of soils and associated rivers. This may make surface water more susceptible to short pulses of low pH. The biological effects of acid rain are well documented, and recent data suggest that short pulses of acidity can cause delayed mortality and slow growth in Atlantic salmon smolts. The extent to which acid rain may have impacted Atlantic salmon in Maine is not known, but a wealth of biological and chemical data has been generated on the Atlantic salmon populations and rivers in Downeast Maine. I will discuss the effects of acid rain on surface waters and Atlantic salmon, and synthesize these into the framework of Atlantic salmon restoration in Maine.
Field evaluation of calcein marks on Atlantic salmon fry stocked into the West Branch Sheepscot River, Maine

Jerre Mohler¹, Michael Millard¹ and David Perkins²
¹U.S. Fish and Wildlife Service, Northeast Fishery Center, Lamar, PA; ²U.S. Fish and Wildlife Service, Region 5 Office, Hadley, MA

The first field test of a new technique for mass-marking early life stage fish was initiated in April 2001 at Craig Brook National Fish Hatchery, Maine, where seven incubation trays containing a total of about 30,000 Atlantic salmon fry of Sheepscot River lineage were immersed into a solution of the fluorochrome dye known as calcein. In early May, equal numbers of marked and unmarked fry were stocked into the West Branch Sheepscot River at nine locations. Subsequent field recovery of marked and unmarked young-of-year salmon was undertaken using electrofishing techniques at fry release sites. Captured young-of-year were anesthetized, measured, and classified as marked or unmarked using battery-powered field detection wands. Additionally, an anal fin tissue sample was taken from all unmarked fish for subsequent genetic analysis to determine if unmarked fish were of hatchery origin. A total of 111 calcein-marked and 155 unmarked fry (42% marked vs. 58% unmarked) were recovered with a total of 558 minutes of electrofishing effort. Of the 13 stations sampled, seven had sufficient data for analysis with five of those seven stations showing marked and unmarked fish captured at the expected 1:1 ration. Replicated goodness-of-fit tests (G-statistic) applied to overall capture data showed that unmarked fry were recovered at a higher proportion than marked fry (P<0.05) (pending genetic analysis). Some calcein marks were weak and several marked fish could have been misclassified in the field. Field detection equipment performed well and resulted in instantaneous mark classification most of the time. The calcein mark technique has potential as a relatively inexpensive and practical way to perform hatchery product evaluations where a batch mark is adequate. Refinement of the batch-marking technique is needed to produce consistently visible calcein marks in nonfeeding Atlantic salmon fry.
Physiological changes in wild and hatchery Atlantic salmon smolts in Maine: Implications for marine survival

Stephen D. McCormick¹, Russell W. Brown², John F. Kocik³, John A. Magee⁴ and Craig Tinus²
¹U.S. Geological Survey, Silvio O. Conte Anadromous Fish Research Center, Turners Falls, MA; ²NOAA, Northeast Fisheries Science Center, Woods Hole, MA; ³NOAA, Northeast Fisheries Science Center, Orono, ME; ⁴Gomez and Sullivan Engineers, P.C., Weare, NH

Downstream migration and early seawater entry of smolts has been identified as a critical period for determining adult return rates in Atlantic salmon. Normal smolt development includes large increases in salinity tolerance and gill Na⁺, K⁺-ATPase activity. The capacity to develop salinity tolerance and other aspects of smolt physiology has been shown to be very sensitive to several classes of contaminants, including acid deposition, heavy metals and endocrine disrupting compounds. From 1998 to 2001, nonlethal gill biopsies have been taken from wild migrating smolts on the Narraguagus River, with additional sampling of other Downeast rivers in 1999 and 2001. Peak levels of gill Na⁺, K⁺-ATPase activity did not increase above 7 μmoles adenosine diphosphate (ADP) mg protein⁻¹ h⁻¹, substantially lower than values seen in southern New England, and moderately lower than the limited numbers of rivers sampled in New Brunswick and Newfoundland. Fish of Penobscot and Dennys rivers origin reared at Green Lake National Fish Hatchery were sampled from February until release in May. Gill Na⁺, K⁺-ATPase activity increased two-fold during hatchery rearing, and reached peak values of five to seven μmoles ADP mg protein⁻¹ h⁻¹ at the time of late release (May 9-13). Additional data on changes in circulating levels of hormones involved in smolt development, and gill Na⁺,K⁺-ATPase activity of fish captured in ocean trawls will also be presented. The results indicate that either Maine fish have inherently low gill Na⁺,K⁺-ATPase activity compared to other river systems, or that the development of fish in both the hatchery and the wild has been compromised by one or more environmental factors. Further work is needed to determine whether the observed low levels of gill Na⁺,K⁺-ATPase are related to short term performance (early survival and growth in seawater) and long term performance (adult returns) of hatchery and wild Atlantic salmon smolts.
Salmon stocks from inner Bay of Fundy rivers have crashed in the past decade and they were declared “endangered” under the new Canadian Species at Risk Act in 2001. Abnormally low survival of salmon during the oceanic phase has been targeted for the decline. In response, Salar MAP, the Atlantic salmon acoustic-tracking project, launched a major marine research effort in the Bay of Fundy in 2001. This project demonstrated the feasibility to track salmon postsmolts through coastal areas and developed the capability to capture live postsmolts during their marine migration. A large-scale acoustic telemetry project was conducted to track and compare the migration and distribution of tagged postsmolts from inner and outer Bay of Fundy rivers as they moved through the Bay of Fundy and into the Gulf of Maine. The aim was to find where they go after leaving the rivers and determine areas of potential loss. Simultaneously, a research cruise aboard the Canada Coast Guard fishing trawler, Alfred Needler, used new methods to capture live postsmolts on their way through and out of the Bay of Fundy. These were examined to determine origin and assess health and condition before release. Salar MAP is spearheaded by the Department of Fisheries and Oceans and the Atlantic Salmon Federation, and it involves the participation of many supporting partners. The goal is to ultimately determine the location and timing of salmon disappearance at sea for the endangered stocks and to try and uncover the causes. The focus of Salar MAP activities in the Bay of Fundy, and the expansion of the proposed project to the Gulf of Maine, present opportunities for Canada – USA cooperation.
Overall, the baseflow water chemistry of the Maine salmon rivers is fairly good, having moderate pH (pH 6-7) and positive alkalinity (ANC 37-1300 µeq/L). During the 2001 field season, water quality monitoring was extended to storm runoff events. Even though 2001 was a historic drought year, strong runoff events were observed in the spring and fall. In the Sheepscot River, many summer baseflow sample sites are very warm (above the 22.5 °C thermal stress threshold at which Atlantic salmon begin to lose weight and body condition). Many of these very warm sites also have high bacterial counts. The E coli counts throughout much of the central part of the river exceed the EPA recommended threshold for swimming and other water contact sports (126 colonies/100 ml). The bacteria evidently are primarily from dairy farms. Stormwater samples from this spring show that the Sheepscot has moderate turbidity (2.4-4.9 NTU) and suspended solids (10-47 mg/L). Cove Brook has the highest pH and alkalinity of the official salmon rivers (pH range 7.2-8.2 and ANC range 712-2350 µeq/L). These high values are unusual for Maine and suggest that there is a significant source of carbonates in this watershed. Only about 0.05% of Maine's surface waters have a pH greater than eight [Maine Volunteer Lake Monitoring Program website, Water Resources Institute (now the George J. Mitchell Center)]. During strong storms or snowmelt events, Cove Brook experiences high turbidity (range 1-40 NTU) and high suspended solids (2.9-100 mg/L). The high turbidity is apparently caused by some river bank failures. The Downeast rivers have the best overall water quality. Although these rivers have the lowest pH and ANC, the main stems of the rivers have not been observed to experience low pH (pH less than 5.5) and high exchangeable aluminum events. High E coli counts appear to be limited to the lower, mostly in-town, sections of the rivers. The herbicide Velpar (hexazinone), used extensively on blueberry farms in these watersheds, occurs in trace amounts (1-3 ppb) in the Narraguagus River, Pleasant River, and Mopang Stream. We plan to continue to monitor both baseflow and stormwater events in the salmon rivers, and to focus more effort on the water quality of tributaries and expand our bacterial monitoring.
Screening for salmonid pathogens in wild marine fishes

Sharon A. MacLean  
NOAA, Northeast Fisheries Science Center, Narragansett, RI

In an effort to identify potential carriers of salmonid pathogens, various species of wild marine fishes were collected and assayed for several salmonid viruses and *Renibacterium salmoninarum*, the agent of bacterial kidney disease (BKD). Fish tested were taken from the vicinity of salmon culture net pen sites, as well as from locations hundreds of miles away from salmon culture activities. Over 1,400 fish, including alewife, American eel, herring, mackerel, pollock, and winter flounder, have been assayed by cell culture for viruses, direct fluorescent antibody test for BKD, and/or RT-PCR and indirect fluorescent antibody test for infectious salmon anemia virus. BKD was not detected in any of the fish sampled. Viruses were not isolated in cell culture nor detected by IFAT from any fish sampled. RT-PCR positive results were obtained from two pollock taken from an ISA-diseased salmon net pen, whereas pollock collected outside a diseased pen were not positive by RT-PCR. Because the corresponding cell cultures were negative, the significance of the RT-PCR positive results is unclear. The most immediate use of this information is in industry attention to biosecurity practices concerning nonsalmonids retained in and harvested from salmon net pens.
Occurrence of smallmouth bass (*Micropterus dolomieu*) in the Pleasant River watershed

Matthew Scott  
*Project SHARE (Salmon Habitat and River Enhancement), Belgrade, ME*

Smallmouth bass is an exotic species to Maine and was introduced shortly after the Civil War. Since that time, the species has become one of the most popular and valuable warmwater sport fisheries in Maine. However, the intentional introduction of exotics is biological pollution of the worst kind. Understanding the implications of such illegal introductions is never fully understood by the perpetrators. Smallmouth bass were not found in the Pleasant River watershed based on fishery and angler surveys dating back to the 1950s, although drainage basins to the east and west have had smallmouth bass for many decades. During the mid-1970s, an illegal introduction of smallmouth bass was made into Pleasant River Lake, the largest headwater lake in the drainage. Based on Atlantic Salmon Commission data for 1995, this species has spread down the Pleasant River to Columbia Falls. This predator now directly feeds upon and competes with young Atlantic salmon life stages. The first fishery survey of Pleasant River Lake, Southwest Pond and other waters did not report collecting smallmouth bass. The water quality of the lake is marginal for coldwater species, but a large and healthy smelt population exists there. Extensive water quality data from the early 1970s conclude that the lake has very low productivity and there is a very small basin of cold water for salmonids. These studies collected chlorophyll *a*, total phosphorus, secci disk, total alkalinity and dissolved oxygen data. With this recent introduction, the recovery of wild Atlantic salmon for the Pleasant River is even more questionable and puts the recovery program into greater jeopardy with this predator expanding its range into the critical habitat of Atlantic salmon.
An investigation of drift of Atlantic salmon fry, *Salmo salar*, immediately after stocking

Ernie Atkinson¹, Greg Mackey¹, Gregg Horton² and Wayne Simmons³

¹Maine Atlantic Salmon Commission, Jonesboro, ME; ²U.S. Geological Survey, Silvio O. Conte Anadromous Fish Research Center, Turners Falls, MA; ³Lunaform, Franklin, ME

Atlantic salmon restoration efforts in Maine employ fry stocking as one of the primary population enhancement strategies. However, the initial fate of stocked fry is unknown. Fry quickly disappear upon release, but the distance they drift is unknown. The behavior of fry after stocking could affect their survival and the quality of habitat they ultimately inhabit. We released 10,000 unfed fry in late morning into the Dennys River, Maine, May 1999. We trapped these fry using fry drift traps at three downstream transects spaced at 50-meter intervals from May 19 to June 14. Eighty-one percent of fry remained in the first 50 meters of release, with the remainder distributed throughout the next 100 meters and beyond. No fry were captured during daylight, with 75% caught after nightfall. Fry movement stopped after seven days. Taken together these data suggest that fry are not swept along with the current when stocked, but find refuge and then move volitionally during low light periods. Management implications of this study are to stock fry at rates that prevent over-saturation, but take advantage of fry drift to distribute fry effectively. Further study should focus on effects of current velocity on drift, and difference between fry emerging from gravel and stocked fry.
A measure of substrate embeddedness and its relationship to juvenile Atlantic salmon (*Salmo salar*) densities in the Narraguagus River

Ernie Atkinson¹, Joan Trial², Melissa Evers³, Greg Mackey¹ and Kenneth Beland²

¹Maine Atlantic Salmon Commission, Jonesboro, ME; ²Maine Atlantic Salmon Commission, Bangor ME; ³Maine Department of Environmental Protection, Augusta, ME

We estimated cobble embeddedness to evaluate the habitat quality for juvenile salmonids. Atlantic salmon (*Salmo salar*) parr use interstitial spaces for shelter from fast moving currents and to find thermal refuge, particularly during winter months. During the summer of 1993, we estimated cobble embeddedness and the interstitial space index (ISI) at 28 sites along the Narraguagus River and its tributaries. We found no significant difference between cobble embeddedness and ISI between riffles (means 22% and 3.10m/m²) and runs (means 27% and 1.97m/m²). Both ISI and embeddedness were correlated to substrate size.
The use of hormone implants to synchronize, advance, and improve the maturation of sea-run and kelt salmon broodstock

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Captive Atlantic salmon broodstock often “ripen” at different rates, resulting in a prolonged spawning season. Nonrandom, genetically based mating schemes can be thwarted by nonsynchronous ripening of spawners. The aquaculture industry has used commercially available hormones to synchronize ripening of Atlantic salmon broodstock, but government-based restoration programs in the US have not. In October 2001, the Connecticut River Atlantic Salmon Restoration Program implanted 150 µg of salmon gonadotropin-releasing hormone (SGnRH) into 20 female and nine male sea-run salmon at the Whittemore Salmon Station (Barkhamsted, CT) and the Richard Cronin National Salmon Station (Sunderland, MA) in order to synchronize their ripening. Also implanted were 36 female and 7 male reconditioned kelt salmon broodstock at the Whittemore Salmon Station and the North Attleboro National Fish Hatchery (North Attleboro, MA). This was done to accelerate their spawning and to study the impacts on the quality and production of milt by male kelts. This paper reports the costs and methodology of implantation, the impact on the timing of ripening of spawners, and the impact on the quality of the gametes.
Geomorphology and trends in hydrologic conditions of coastal Maine rivers

Robert W. Dudley¹, Joan Trial² and Jed Wright³
¹U.S. Geological Survey, Augusta, ME; ²Maine Atlantic Salmon Commission, Bangor ME; ³U.S. Fish and Wildlife Service, Falmouth, ME

The Maine Atlantic Salmon Commission (ASC), U.S. Geological Survey (USGS), and U.S. Fish and Wildlife Service are collaborating on a study of geomorphology of unregulated salmon streams in Maine in an effort to assemble a knowledge base with which to assess degraded river reaches and design restoration projects. The average characteristics describing the geometry of a river channel within a hydrologically homogenous region are sufficiently consistent that the degree of deviation from normal stream geometry can be interpreted as the magnitude of the effect of disturbance. For this reason, regional models or curves that relate normal stream channel geometry to drainage area size and reference discharge can be valuable tools used in quantifying disturbance at river reaches and designing projects to restore them. Preliminary curves for Maine based on the 1.5-year recurrence interval flow compare similarly to regional curves based on bankfull flows for Vermont. The Maine ASC is also working with the USGS in examining trends in hydrologic conditions for coastal Maine’s rivers to aid in evaluation of climatological impacts on salmon. The trend analyses include looking at changes in monthly and annual flows, the timing of seasonal flows, and changes in snowpack and duration of river ice in the coastal river basins over time. Preliminary findings indicate a statistically significant trend in the timing of spring runoff for earlier dates over the past 86 years. Both the geomorphology and hydrologic trend studies are currently ongoing.