Penobscot Science Exchange
University of Maine, Orono
George Mitchell Center
107 Norman Smith Hal
March 4, 2011
Meeting Notes

Agenda:

10:00-10:05 Introductions

10:05-11:05 Research Presentations (10min presentations w/ 2min discussion)

1. Brandon Kulick – Modeling Penobscot and Kennebec IBI results
2. Theo Willis - Alewife Population Structure in the Gulf of Maine
3. Mark Whiting – The Effect of Katahdin Iron Works on the Water Quality of Blood Brook and the West Branch of the Pleasant
4. Dan Skall – Using Fish Scales as a Biomonitoring Tool for Contaminants Monitoring
5. Steve Knapp – NOAA Dam and Owner Survey: An Overview of Planned Survey Efforts

11:05-11:10 Break

11:10-11:45 Research Updates (3min updates w/ 1min discussion)

1. Hannah Webber – Engaging teachers and students in landscape-scale research while supporting improved science education: Investigating eels – an expansion of the Acadia Learning Project
2. Gayle Zydlewski – Not just sturgeon: Sturgeon habitat and population dynamics, monitoring diadromous fish movements using hydroacoustics and data fusion
3. Dave Courtemanch – Wastewater Relicensing for the Penobscot
4. Barbara Arter – Sturgeon/Salmon Endocrine Disrupter Study
5. Karen Wilson – Alewife Stock Structure
6. Katie Norris – Tracking the influence of diadromous alewives on Maine lake and stream systems using nutrient limitation assays
7. Steve Coghlan – Sea Lamprey Ecology

11:45-12:00 Research Coordination (5min each)

1. Penobscot Indian Nation – Dan McCaw
2. Penobscot River Restoration Trust – Charlie Baeder
3. DSRRN Update – Karen Wilson

12:00-1:00 Lunch

1:00-2:30 Field Coordination Meeting

Meeting Participants:

PSE Spring 2011 Participants		
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10:00-10:05 Introductions

10:05-11:05 – Research Presentations

1. **Brandon Kulick – Ecosystem Response Model for use on Maine Diadromous Rivers**

Bio Condition Models

Tiered model with axes of biotic community condition and human disturbance gradient – results in different combinations of native and non-native species

350 Sampling Stations make up the Maine-wide IBI Program (2002-2007). Penobscot was sampled in 2004 and 2007 under the program, 2008-2009 study with focus on restoration. Subset of 30-40 Penobscot sites selected to monitor stocks.

Development of Model

Unique Character of Maine Riverine Fish Assemblages

- Ecosystem only exists since last ice age, relatively young
- Little connection to major river systems
- Coolwater species not indigenous

Electrofishing Distribution Model – Smallmouth Bass

- Native minnow species inverse distribution (trophic exclusion on native fish community)
- Frequency analysis to develop slope of curve (positive or negative metric)

Applied scores to rivers in Maine (Biotic Integrity) – W. Br. Penobscot scores ~ 80-40, E and N. Br. Penobscot scores 60-40

ME Index of Biotic Integrity declines from headwaters towards coast.

2010-2011 Additional pre-project data collected

Refining IBI Metrics for Diadromy

2011- Dam removal and restoration process starts

2. **Theo Willis – Genetic relationship between alewife and blueback herring in midcoast Maine**

Is local adaptive pressure in individual watersheds sufficient to overcome outbreeding and inbreeding depression?

In 2009, sampled constrained area in Kennebec watershed and Penobscot with several donor populations in between. Also sampled eastern sites without any known stocking program

Microsatellite markers on fish from these sites

Found several sites with genetically distinct runs.

-Veazie Dam (alewife) were genetically similar to Lockwood, White Pond, Leonard, Wight Pond, Nequassett (never stocked?).

- Lockwood related to Leonard, Wight, Sennebec, Nequassett, Brunswick sites.

- Brunswick related to Lockwood, Veazie, Wight, Neqassett.

4 Major "Donor Sites" identified. A lot of crossing between watersheds but also sites within watersheds that appears genetically distinct from every other site.

Genetically Distinct Populations:

- Sewell, Dresden and Webber are recently managed/stocked sits for ~ 5 years
- Nequasset has never been stocked
- Damariscotta Lake – Stocked in 1807, similar genetics to St. George, Bagaduce, Sebasticook and Nequasset.

Alewife population genetics in Maine may have been bottlenecked over time by overfishing, dam placement.

Future: 2011 Repeat analysis of 2010 data except Sewall Pond. Develop additional markers.

2010: Year 3 – repeat sampling of all 14 sites to complete 3 years of sampling.

3. Mark Whiting – The Effect of Katahdin Iron Works On the Water Quality of Blood Brook and the West Branch of the Pleasant River

Pleasant River stocked with Atlantic Salmon (west branch). Population of returns is good.

Part of Piscataquis R Watershed, Howland Dam controls access, soon to be bypassed.

From 1840-1890, large iron smelting operation at KIW (east bank on west branch) and source of Ore on west bank. Legacy of pollution?

KIW Pyrrhotite is one of the world's largest sulfide deposits at 200million tons

Some pits are self-draining, others are not. In non-draining sites, there is exposed bedrock that has runoff pH of 2.2, heads towards Blood Brook. Acidity comes from oxidation of sulfur (sulfides into sulfate) and oxidation of iron (ferric into ferrous). North side of mountain has large iron deposit.

DEP has biomonitoring sites on Blood Brook and several other sites around Iron Mountain. Blood brook supports almost no biota. Blood Brook barely achieved class A quality.

Project Goals: Document problems at blood brook, effect on West Branch? How far downstream does problem occur?

Blood Brook water quality measured in 2007, 2009 along with many other sites nearby in West Branch, East Branch, control brook (Houston Brook).

Found a lot of Aluminum and Nickel. pH was ~ 6.5-6.7 at sites downstream along West Branch. Blood Brook had pH of 5.26.

Aluminum along West Branch high in Spring with heavy snowpack, shallow subsurface flow in contaminated soils. At Blood Brook, chemistry is fine at high flows, poor at base flows.

Blood Brook – Ground water connections with strong iron signature, not surface water. 5 Springs that bring iron and sulfur into Brook.

Problems most evident at Blood Brook, only special conditions at Katahdin – with no downstream issues on West Branch of Pleasant. Blood Brook chemistry may be completely natural.

4. **Dan Skall – Using Fish Scales as a Biomonitoring Tool for Contaminants Monitoring**

Are field fish exposed to contaminants – using biomarkers to answer this question. Fish scales offer a non-lethal, non-invasive approach compared to gill sampling. Scales are also regularly collected by DMR, IFW. Scale sample storage is also long-term.

Example of biomarker: cholesterol as a marker of heart health.

Prozac, PCB126, a toxic metal (unsure which yet), synthetic estrogen endocrine disrupter will be examined.

To date, only examined CYP1A from PCB126 contaminated fish. Metals may inhibit ER expression, strogens may inhibit CYP1A.

Test Species: Atlantic Salmon

Hypotheses:

Can measure biochemical response of fish to surface water contamination

Methods:

Stored scales from skin tissue samples. Exampled enzyme activity, protein location, gene expression (mRNA) using qPCR.

Used multiple treatments of organic contaminates to induce CYP1A.

For qPCR. Stored scales in RNALater to store for indefinite amount of time. Extracted RNA, reverse transcribed to cDNA. Designed and tested primers to optimize qPCR protocol. Amplified cDNA through qPCR to quantify expression.

Expected to see increased fold induction based on increased dose. To this point, only run full does trial. 2,000 fold induction in high dose fish.

Future: IHC Staining needs to be repeated, qPCR on fish dosed with prozac, EE2, a toxic metal.

Scale sampling: easy collection, storage, non-lethal. Easy to handle, storage is long lasting. Can repeatedly sample same individual over time.

5. **Steve Knapp – NOAA Dam and Owner Survey: An Overview of Planned Survey Effects.**

Survey of 396 Dams in 3 SHRUs. Survey of dam owners – identify current owner, phone survey/questionnaire.

Physical survey – measurement of dam, documentation of features, collect spatial data.

Database – combine results of physical and owner surveys.

Survey of Dam Owners – Needs to be updated, complete.

- Identify current owner, survey and questionnaire to gauge interest in passage improvements.

Physical Survey

- Spatial data collection, using tablet PC (2-5m accurate with integrated GPS camera).

- Physical measurements to update current database, spillway/dam dimensions, important dam features.

Database

- Combine results of physical and owner surveys. Locate dam with certain height, certain watershed, owner interest through database search query.
- Protect private information (unique ID for each dam)
- Help to prioritize restoration projects.

Overall Goal

- Update existing data
- Group Data (owner and physical information) into one location
- Create a query friendly database
- Allow for prioritization of structures based on variety of characteristics
- Identify potential connectivity improvement projects
- Provide public education and outreach
- Tie in with Current General Conservation Plan (GCP) Effort.

To Date, surveyed 48 dams (20 from Penobscot SHRU), 91 more from Penobscot needed to be surveyed. Most of the 48 surveyed do not have any form of fish passage. Many in disrepair, many small mill dams.

Future Work: Begin survey in Spring, 2011 on physical survey. Owner survey beings in Spring of 2011. Outreach and public information soon to follow. Contact Dan Kircheis or Steve Knapp.

Question: How to conduct owner survey – Survey researcher designed the wording at Kleinschmidt. Survey also put on federal register for public input. More of a goal to collect information on the dam, not opinions of dam owners.

11:10-11:45 Research Updates – (3min updates w/1min discussion)

1. **Hannah Webber - Engaging teachers and students in landscape-scale research while supporting improved science education: Investigating eels – an expansion of the Acadia Learning Project**

Put tools into teachers hands to help engage students about park interests. Students answer their own questions but that can also be used by scientists.

Example of a student project – effect of mercury on eel populations and stonefly. Data that students collect will help researchers in their own projects.

Spring 2011 – Find sampling locations, talk to Maine patrol and fishermen

- Sampling locations near schools, near us, recommendations for eel locations, information

- Small systems for safety
- Dams, perched culverts, other impediments
- No salmon research in the area

2. **Gayle Zydlewski - Not just sturgeon: Sturgeon habitat and population dynamics, monitoring diadromous fish movements using hydroacoustics and data fusion**
   - Sturgeon Habitat and Spawning
   - Population dynamics during winter and GoM-wide
   - Diadromous fish movement using hydroacoustics and data fusion on the Penobscot.

Sturgeon project – Tagged many late-stage female shortnose sturgeon. Double the number tagged of a typical year

Track fish to Kennebec River – partnering with DMR to set egg mats

Habitat modeling to find possible spawning locations (suitability map of Bangor dam reach).

Winter Population Estimates – Dropped camera to find sturgeon density map at wintering site.

Non-invasive way to find this estimate without gill-nets

Gulf of Maine-wide population estimates – size, age, sex ratio, diet, juvenile ecology, abundance measurements

Regional dynamics – catch and tag fish in multiple river systems in GoM – Also trying to identify river of origin

Goal to find population viability of shortnose sturgeon

Hydroacoustic Collection – Eonfusion program (4-dimmensional). Using didson data, tracking data with acoustic tags. At early stages, looking to compile more Penobscot river data that is being collected.

3. **Dave Courtemanch – Wastewater Relicensing for the Penobscot**

Modeling outcome – new licenses issued, stakeholder meeting in late February, 2011. Municipal wastewater licenses will not change, phosphorous limits based on current performance.

Pulp and paper mills licenses – Graph – red line is proposed phosphorous criteria (target for river), left line is class C water quality, green line is current – 2005 data without phosphorous control in place.

Goal is to achieve blue line based on model. Blue line based on Katahdin (0.1ug/L) and Old Town (0.5ug/L). This represents a reduction from previous limits. Katahdin had no limit – they consented to 0.5ug/L, imposed 0.1 ug/L.

BOD open in licenses. Model shows phosphorous is critical for oxygen levels. May change in future licensing.

4. **Barbara Arter – Sturgeon/Salmon Endocrine Disrupter Study**

Project commissioned by NOAA. Federally endangered Shortnose sturgeon and Atl. Salmon using rivers with major wastewater facility or minor facility.

Agencies less concerned about salmon (little time in contaminants), more concerned with sturgeon – see Dwyer et al., 2005 (two articles).

Require water quality monitoring, WET Testing (Whole Effluent Toxicity)

NFMS Water Quality Concerns: doesn't account for bioaccumulation and long-term effects, doesn't know best test species.

Project Purpose – focus on endocrine disrupters. Focus on life stages to identify vulnerabilities. Identify what the best species to test may be. Testing estordiol, EE2, oxylates. 15 total treatments (5 levels per chemical).

Project began in February, 2011. 96hr exposure. Long-term results in late 2012-2013. Early results in late 2011. Just focusing on estrogens in 2011.

5. **Karen Wilson – Alewife Stock Structure: Identifying Population Structure across Multiple Scales**

Looking at microsatellite genetics, morphometrics, otolith shape analysis – the hope is to use these techniques to show stock structure of alewives in GoM

Assess distribution of stocks by applying classification models to marine samples using bycatch individuals.

Goal: recommendations for implementing stock composition analysis

Hypotheses: Alewife populations maintain a metapopulation structure at scale of large river systems

Sampling 20 river systems – represents 1200+ individuals. Project should wrap up in another year or so.

Ongoing collaboration to have good picture within the next two years for wide-range scale

6. **Katie Norris – Tracking the influence of diadromous alewives on Maine lake and stream systems using nutrient limitation assays**

Hypotheses: if alewives are bringing nutrient subsidy to freshwater systems, nutrient limitation will be relaxed in oligotrophic freshwater systems. Higher density of alewives will cause greater relaxation of nutrient limitation

Nutrient limitation assays (+N, +P, +N and P), measure chorophyll a and ash-free dry mass. Lakes, using 1l bags. Streams, using nutrient diffusing substrates.

Measurements before, during and after alewife runs.

10 Freshwater systems (5 lakes, 5 streams with alewife runs, 5 lakes and 5 streams without runs). Looking for information on potential sites – run notification, run counts, fish access/stocking history of systems.

7. **Steve Coghlan – Localized effects of spawning sea lamprey on stream food webs**

Two projects beginning in 2011

- Carcass addition experiment – add lamprey carcases to 25m stream reaches to simulate a gradient in density
  - Sites: Pollard, Hemlock, Hardy, Scutaze, Roberts, Rocky, Little Schoodic
  - Range 0-1 carcases/m2
  - Sample upstream and downstream
- Metrics of interest

Snorkeling and videography behind active nests, electrofishing and slurp guns

Empirical data needed

- Fish length and weight
- Swimming velocity
- Feeding rates
- Prey capture success
- Drifting rate of inverts, eggs
- Energetic value of prey
- Temperature
- Fish density and abundance

Modeling framework – Current velocity vs. benefit or cost (J/h) – Emax is greatest difference between cost and benefit, crossover point where cost becomes greater as velocity increases

Quantify acceptable range of velocity, what energetic benefit minnows gain, population-level consequences of increased sea lamprey spawning, implications for juvenile Atl. Salmon

Data – Expected in 2012.

Dead lamprey from streams with excess lamprey, Veazie trap (<100). Population wont be depressed because of this, not taken from outside range.

11:45-12:00 Research Coordination (5min each)

1. **Penobscot Indian Nation – Dan McCaw**

Fisheries biologist from Penobscot Indian Nation

Contact: Dan.mccaw@penobscotindiannation.org

2. **Penobscot River Restoration Trust – Charlie Baeder**

Project – baseline work ongoing, water quality studies wrapping up, field work in 2011 finished by end of summer, 2011. Data analysis in winter. Dam removal beginning in 2012 and begin post-dam removal studies in 2013.

Penobscotriver.org – research interviews placed soon, information on current projects

Funding stable, not growing. Stimulus funding taking care of initial baseline work, NOAA funds for long-term monitoring. Hope to build on these sources.

Follow-up monitoring probably from 2013-2015. If need exists to go further, additional funding will be needed. Current focus on fish passage, water quality.

3. **DSRRN Update – Karen Wilson**

Adria and Karen attended NSF Meeting for PI in December, 2010. Currently 2.5 years into grant. DSRRN grant is most diverse in terms of participants of all those that attended meeting in DC.

Participation of graduate students in DSRRN activities (May workshop, Fall workshop, summary meeting in Spring or Summer, 2013).

PIs looking for comments or suggestions for the upcoming 2 years, how DSRRN's legacy should be, goals for upcoming workshop.

Symposium in Spring or Summer, 2013 should be large, emphasize published works. Call for planning committee in next couple months.

May 2011 Workshop – Focus on Natural Variability – gain information on habitat, management of systems. Reminder call going out soon. Looking for participants to bring data, skills. Focus on alewives, how it may apply to other species. Submit abstracts to apply for slots.

- DSRRN is not the same organization as PSE. PSE runs out of funding at the end of April, 2011.

12:00-1:00 Lunch

1:00-2:30 Field Coordination Meeting