A Herring Impaired Ecosystem
Is it worth the risk?

Dr. Evelyn Brown

Currently - Flying Fish Ltd

Background: over 10 yrs at ADFG with much of that as a herring biologist; EVOS PI for herring damage assessment; over 10yrs as UAF researcher; served 2 yrs as fisheries biologist for Metlakatla on Annette Island in early 80s)

PhD (UAF) – Dissertation Title:

Stock Structure and Environmental Effects on Year Class Formation and Population Trends of Pacific Herring in Prince William Sound, Alaska

flyingfishltd@embarqmail.com 509-493-8900

Evolution of Herring Fisheries and Management

- Early 1900s – the SE Alaska herring complex was huge with massive harvests over 100K tons; spawning occurred in a host of locations and large juvenile herring schools were observed in the inlets and bays
- Marine mammal and seabird predators were reduced via whaling and bounty programs (sea lions, seals, & eagles); massive salmon harvests reduced predation by salmon on herring. Later in the century, offshore harvests by Japanese and Koreans removed thousands of predatory species like sharks.
- The removal of these species simplified the dynamics controlling herring and placing man as the main predator/removal source for juveniles and adults
- The population was probably reduced by WWII when the industry and markets began to collapse (see Andy's timeline)
- When roe markets were developed in the 70s, the population was at low levels and an order of magnitude smaller than the one earlier in the century
- Stock assessment and monitoring began in earnest in the late 70s ; the frame of reference used today in management does not include the early years; i.e. our measuring stick began with a depleted stock.

Present Day Complexity

- The current population is a fraction of the size from a century earlier and many localized spawning areas have disappeared (i.e. stock contraction)
- Marine mammal, seabird, and shark populations have recovered and along with the enhanced salmon production, have increased the predation pressure on herring substantially, especially since the 80s. Man must now share the " harvest" with a host of other species. Humpbacks have been observed eating juvenile herring in PWS and SS.
- Climate change is introducing a new twist that will affect herring from bottom up (change in ocean conditions/plankton) and top down (new predators like tuna and whiting) and from within (new diseases accompanying food stress and changing temperatures)
- Meanwhile, the grassroots management in the form of ADFG has been systematically gutted with less money for assessments and research; ADFG has been forced to rely more and more on model outputs (i.e. ASA) often based on a single population level index
- ADFG is not equipped to adapt to the complex system dynamics; they are forced to modify basic herring biology (e.g. maturation rates) to make the data fit the expected shape of the model
- The forecasted population can be easily manipulated by using a different observed index (e.g. spawn deposition versus miles of spawn), using different maturity schedules, changing the fecundity rates (nos. eggs per gram) and changing the mortality schedule for each age.
- Vince's analysis shows that using alternative rates, the population could be significantly smaller than ADFG is forecasting; our analysis shows the existence of two stable population states – high and low since the 70s; PWS shows the exact same stock dynamics and probably operates under similar forcing mechanisms (i.e. PWS and SS analogous populations). We can use the two for contrasting.
- We feel that using the "high" number is extremely dangerous; we can demonstrate that given observed stock dynamics, the SE population is at a high risk for collapse. Given the current predation pressure (which includes a commercial harvest), once collapsed the stock will remain "trapped" at a low density state just like PWS is today. We believe that the fishery and whales can change herring distribution and affect spawning behavior (effects mainly felt by subsistence users)

SE Alaska Sans Herring

The impacts of a collapsed stock extend beyond the direct effect on herring harvest stakeholders (commercial and subsistence). Indirect impacts include:

- Lower average salmon sizes (already happened) and ultimately decreased marine survival; smaller halibut and reduction of other herring fish predators
- Create at risk marine mammal populations culminating in lawsuits (i.e. Pollock – Alaska Peninsula)
- Impacts on the sport charter industry, whale and sea bird watching tourism
- Jeopardy for marine mammals and subsistence harvest will likely result in a federal take-over of fisheries and research (some in Alaska are banking on this)
- Open niches once occupied by herring to non-commercial species like sand lance and juvenile pollock (i.e change the community structure)
- Low herring populations due to "trap" dynamics for years to come
- Huge expenditure by the state for herring recovery (how expensive was salmon enhancement?), required environmental impact studies, response to lawsuits, a new bureaucracy to deal with the joint state-federal oversight
- Increased economic hardships on local communities and zero income to state

Key Questions and Data Needs

- Stock Structure
  - define the SE herring complex structure, interactions among local stocks including interdependencies (i.e larvae from one region feed recruits to another); this has been done in PWS
  - Establish relationship between diversity , number and distribution of spawning sites and SE complex stock size
- Effects of scale of fishery and predation on herring distribution and spawning behavior
  - do fleets and whales alter spawning and overwintering areas? Are herring "on the run"?
  - Population large; scale of fishery & predation << scale of herring distribution/spawning vs
  - Population small; scale of fishery and predation => scale of herring distribution/spawning
  - Estimate and monitor whale predation rates
- Recruitment
  - Where are the larval & juvenile herring and how can they be protected or enhanced?
  - Where are the survival "bottlenecks"?
  - What dictates year class strength?
- Modeling
  - Include more than one stock index to weight the ASA; reinstate winter surveys and beef up spring indices
  - Track and measure vital rates affecting the model (i.e. fecundity/reproduction, maturity rates, and mortality rates)
  - Incorporate ecosystem effects (predation, disease, competition, climate via size at age) into forecast modeling
  - Develop a habitat correction model for egg deposition, miles and mile-days of spawn (BC has done this with their spawning data).

Short Term Action Plan

- Push impending BOF proposals to immediately adopt conservative (lower) estimate of stock in recognition of "at risk" status
- Result is a decrease of the quota and a restriction of fishing near spawning localities in danger of extinction; preserves traditional harvest localities
- Convene a workshop to discuss a new research, assessment and management plan for SE herring; invite PWS stakeholders, managers, and researchers to discuss shared goals and resources (i.e improve cost-effectiveness of efforts via scale of activities)
  - At the workshop discuss standardization of herring data collection methods, assessments and modeling across the state (currently, each region can adopt its own methods and tools; comparison a among regions is extremely difficult and data is hard to obtain
  - Discuss "herring clearing house" data site; PWS has a data portal under construction which could be expanded statewide
- Increase ADFG budget for regions with stocks at risk (SE, PWS, Cook Inlet, Kodiak)
- Consider ADFG reorganization to enable modernization

Long Term Action Plan

- Remove ADFG from adversarial position and encourage co-operative efforts with local resources (STA, KHAC, other local groups and agencies)
  - Improve transparency/data sharing; see http://www.pac.dfo-mpo.gc.ca/sci/herring/herspawn/pages/default5_e.htm
  - Return mission of ADFG and BOF back to conservation and away from harvest maximization
  - Add conservation of local spawning areas and diversity in distribution as a management goal (common practice in Canada and with Atlantic herring)
- Model co-management structure using Canadian models (site above and http://hcrs.bc.ca/hcrs_science.php); a diverse oversight committee is responsible for management with ADFG advisory and operating with state law frameworks
  - Schedule a workshop with Canadian specialists involved in fishery co-management (i.e. Rob Stevenson, George Rose, Jake Schweigert)
  - The cost of co-management is much lower than 100% government because local resources are incorporated (fishing boats, subsistence harvesters, school kids, the list is endless)
  - One advantage is that socioeconomic issues can be considered within the guidelines for conservation (i.e. opt out of harvest when price is low or fish are small – cannot do this under current structure)
  - Main advantage is empowerment of all stakeholders and a change in the human dynamics; energy toward cooperation rather than toward conflict
  - Economic impact on local communities will be significant; i.e. money flows to local ADFG and research org and local resources instead of regional or out-of-state federal government labs
- Using co-management structure, establish a herring research and assessment plan using co-funded sources (i.e. State of Alaska should not have to pay for all of this)
- Once stocks have recovered and there is a healthy fishery, make use of research quotas to pay for research and assessment programs.
  - Excise tax on charters/tourism, etc. can contribute to conservation plans just as commercial fisherman pay an aquaculture tax for salmon enhancement (whether they agree with enhancement or not)
  - Fisherman and other stakeholders "take turns" performing assessment and data collection; their involvement in turn increases their ability to co-manage with a common conservation goal

Note: Others will speak about socioeconomic actions (permit buybacks, restructuring loans for processors, etc.)