Northwest Power and Conservation Council

August 30, 2012

MEMORANDUM

TO: Council members

FROM: Peter Paquet – Manager, Wildlife and Resident Fish
Patty O'Toole – Program Implementation Manager
Jim Ruff – Manager, Mainstem Passage and River Operations

SUBJECT: Summary Report from August 9, 2012, Predation Workshop

Background

On August 9, 2012, the Northwest Power and Conservation Council hosted a science-policy exchange in Portland, Oregon. The objectives of the exchange were to increase our understanding of the role of predation and predator control actions in the Columbia River Basin (CRB) and its effects on the ecosystem, as well as discuss the scope of predation issues throughout the CRB, in both anadromous fish and resident fish (blocked) areas. The workshop included discussions of fish, bird and marine mammal predation management and ecosystem predation dynamics. The day concluded with a discussion of possible management alternatives to lessen the impact of predation, primarily on salmonids.

Approximately 70 people participated in the exchange. Participants heard from a dozen speakers and had the opportunity to query and comment on the information presented. Most members of the region's Independent Science Advisory Board (ISAB) attended, along with representatives from state and federal agencies, Indian Tribes, utilities, universities, and consulting firms. The presentations, meeting summary and participant list are available on the Council's website at http://www.nwcouncil.org/fw/program/2012spe/.

Food web implications of predation

ISAB member Robert Naiman provided a synopsis of the ISAB's 2011 report on *Columbia River Food Webs*. Critical issues include uncertainty about the carrying capacity of the river; the proliferation of chemicals and contaminants; and the consequences of non-native species, which lead to hybrid food webs. There is an ever-changing mix of species in the basin, and the presence of non-native species is increasing yearly. As a result, there are hybrid food webs established in most of the basin, which is opening a new chapter in fishery management. There is

evidence more smolts are migrating in the Columbia-Snake rivers than occurred before the dams due to releases of millions of hatchery fish. Controlling predators reverberates through the system in unpredictable ways. Ecosystems have a balance between prey and predator – can affect population performance. Predation is an important, natural process which can have a positive influence on populations by culling out the sick, or weaker animals. Dr. Naiman pointed out that people kill more large fish through harvest than any other predator in the basin. Harvest results in about 30 percent mortality for adult salmonids. In comparison, total predation mortality on anadromous salmonids by birds and mammals is unlikely to exceed 20 percent. Thus it is prudent to think about humans as predators in any management program. A model of predator-prey or food web interactions in the CRB is needed to better understand the process.

I. Fish predation and recent predation research

Bonnie Ellis of the University of Montana's Flathead Lake Biological Station described a "trophic cascade" which occurred with the introduction of a food source (*Mysis* shrimp) in the 1980s for the non-native kokanee population. The events in Flathead Lake illustrate that complex food web interactions have occurred since *Mysis* shrimp were introduced. These changes have favored non-native fish at the expense of native species and caused a disruption in the natural food web that has affected both fish and wildlife species in the lake.

Holly McLellan of the Colville Tribes spoke about the ecological impacts of non-native species in Lake Roosevelt reservoir behind Grand Coulee Dam. Walleye were illegally introduced into the lake in the 1950s. These fish spawn below Little Falls Dam, and the spawning run has been protected since the 1980s. The lake is also home to other non-native fish, including smallmouth and largemouth bass. The smallmouth bass population has expanded dramatically since the 1990s. Surveys show an increase in walleye and a decrease in native fish abundance, including kokanee, redband trout, and white sturgeon. Predation is one of the major reasons for the decline. The Colville Tribe implemented non-native predator reduction in the Sanpoil River in 2011. Reducing the non-natives, even to benefit native fish, is "a very complex political issue."

Attendees commented that this presentation is a good example of the human and social aspects of the predation issue, i.e., restoration or conservation of native fish versus a fishery for non-native fish. From a predation management standpoint, this is a thorny policy issue involving the public and revenue sources because the states get funding from selling fishing licenses.

Deane Osterman of the Kalispel Tribe presented information on the invasive northern pike population in the Pend Oreille River, focusing on the tribe's "rapid response" in recent years to address the emerging problem. Northern pike were introduced in the 1960s, and their numbers have increased significantly in recent years, growing from 400 in 2006 to over 5,500 in 2010. The pike pose a great threat to native fish species because they adversely impact all eight of the tribe's FERC-licensed hydro projects. In 2012, 5,808 northern pike or 88 percent of the 2010 estimated adult population were caught in the nets. Fishing derbies are another management approach. The pike accumulate toxins, however, so human consumption is discouraged. The key "take away" message is when northern pike are introduced to a water body, people should take immediate action. The public's reception to the Tribe's action has received has been rough. People like catching 40-pound fish. It was suggested that the Council could play a role in regional coordination efforts and developing solutions to regional predation issues.

John Skidmore of BPA described the northern pikeminnow management program, which primarily uses removal by sport fishers. The program is administered through the Pacific States Marine Fisheries Commission, and the fiscal year 2012 budget is $8.3 million. The goals of the angler program include removing 10 to 20 percent of the predatory sized pikeminnow per year.[1] After eight years, predation by pikeminnow had been reduced by an estimated 25 percent. Over 3 million pikeminnow have been removed to date, and the 10 to 20 percent removal rate has been achieved in 17 of 21 years. In the last five years, the rate has been 15 percent or greater. The program has saved an estimated three to six million smolts. Thirty journal articles have been published on the program and there is significant science underlying its claim to success.

Member Booth asked if there is an estimate of the percent of fish predation systemwide on juvenile salmon. A 1996 paper estimated the total juvenile salmon lost to pikeminnow at 16.4 million fish a year. It is probably on a par with avian predation. NOAA Fisheries has worked to come up with an estimate but found there was not a good way to do it. Crucial information is missing, including good data on the abundance of bass and walleye. However, most of the predation on juvenile salmon is by pikeminnow, with only about 20 percent by other species.

Participants discussed the difficulty in coming up with an overall predation estimate. In the early work, the estimate was based on numbers of fish and it was based on marked-group recapture. It was a complicated piece of work and the scientific studies since then haven't gone into that level of detail. It is extremely complicated to conduct such studies, so an overall estimate would involve revisiting the more intensive research methods of the past. Dan Schill of the Idaho Department of Fish and Game expressed the importance of putting science up-front in management programs.

Following the presentations and discussions on fish predation, Beth Sanderson from NOAA's Northwest Fisheries Science Center described a number of research papers NOAA scientists have written about non-native aquatic species in the Northwest and their impacts on threatened and endangered species. A brief review of recent research papers was provided on:

- non-indigenous species and the threat to endangered salmon
- smallmouth bass as a threat to native species and a value to anglers
- behavioral response of juvenile Chinook salmon to an invasive predator
- habitat associations between juvenile salmonids and smallmouth bass
- patterns in catch per unit effort of native prey fish and alien piscivorous predators
- juvenile Chinook salmon in an increasing warm and invaded world
- native invaders, including birds, mammals and fish
- management of predator-prey relationship of salmonids and piscivorous birds
- seasonal shifts in walleye diets related to juvenile salmon migrations
- stocking of non-native fish species from 1978-2008.

II. Piscivorous birds and salmonid predation

Caspian Terns and Double-Crested Cormorants

Dan Roby of Oregon State University (OSU) presented results of a collaborative research project being carried out by OSU, USGS, and Real Time Research. The research is on the predator-prey

[1] The NOAA Fisheries FCRPS Biological Opinion calls for removing 15 percent or more pikeminnows.

relationship between birds and salmonids in the Columbia River Basin, and Roby focused his presentation on misconceptions about piscivorous bird predation, as well as the actions to manage that predation. The presentation noted that fish consumed by Caspian terns has been fairly steady while consumption by double-crested cormorants has increased significantly. In 2011, consumption by terns and cormorants nesting on East Sand Island in the Columbia River estuary was estimated at 25 million juvenile salmonids. It is likely that avian predation in the estuary is an "order of magnitude" higher than avian predation on the Columbia Plateau. However, it was noted that even smaller avian colonies like the one at Potholes Reservoir can have a significant impact on particular ESUs, such as on upper Columbia steelhead. Research does not support the concept that managing avian predators can recover ESA-listed salmonids.

The presentation noted that the bird populations grew dramatically from 1977 to 2006, which has increased predation significantly. Managers favor a "push and pull solution" over other options, including lethal removal. The push involves installing fencing to limit the size of nesting grounds, pushing the birds into a smaller area. The pull involves "pulling" the birds to other locations, such as Crump Lake in the Warner Valley of southern Oregon, away from the Columbia River estuary.

Participants pointed out there are different paradigms with management of avian versus fish predators. When it comes to birds, why is there resistance to culling them when it is considered and implemented for other predators? One reason is due to the federal Migratory Bird Treaty Act[2] which protects these birds.

The participants in the workshop discussed how hatchery production has stabilized a food supply that was not reliable in the past and it comes in a concentrated pulse. When the steelhead and Chinook dissipate, birds have a hard time finding enough food to feed their young. The Corps' dredge islands and the hatchery fish food supply created an optimal situation for bird predators. The birds' nesting habitat has been reduced in other places, so birds are attracted to these locations.

American White Pelicans at Blackfoot Reservoir

Dan Schill, IDFG, provided an overview of the management of the predator-prey relationship between the American white pelican and the native Yellowstone cutthroat trout near the Blackfoot Reservoir, which was constructed in 1912. The white pelicans were not present in the reservoir before 1993, when they started nesting on Gull Island. Initially, the pelicans were nesting at the mouth of the Blackfoot River. The Yellowstone cutthroat trout in the reservoir was one of "the big three" fishery stocks for Idaho but the population collapsed in the late 1980s from overexploitation. The presentation described "a gauntlet" the native trout have to travel between pelican colonies in low water years and the research using radio tags to establish the total predation rate on the trout. In 2010 and 2011, the predation estimate was 36 to 71 percent on juveniles and 28 to 49 percent on adults. Management actions to address the predation were controversial and included putting pelican predators back on the nesting islands and fencing to

[2] The **Migratory Bird Treaty Act of 1918** (**MBTA**), codified at 16 U.S.C. §§ 703–712 , is a United States federal law, at first enacted in 1916 in order to implement the convention for the protection of migratory birds between the United States and Great Britain (acting on behalf of Canada). The statute makes it unlawful to pursue, hunt, take, capture, kill or sell birds listed therein ("migratory birds"). The statute does not discriminate between live or dead birds and also grants full protection to any bird parts including feathers, eggs and nests. Over 800 species are currently on the list.

ratchet down the nesting area, but both were unsuccessful, in part due to the fact it caused the pelicans to abandon their nests. IDFG has found that egg oiling is a "more surgical" approach to managing the white pelican population and it is showing some success.

NOAA Fisheries counts birds in its ocean surveys and can explain some variation in salmon returns in terms of the density of birds, such as common murres and sooty shearwaters. It also looks like there is a relationship between the behavior of the plume and predation. Research in the estuary has found that Caspian tern predation goes up and down with the density of prey species. At high flows, some marine species get pushed out of the estuary, and predation on other species goes up.

III. Pinniped Predation

Bill Wilson, retired from NOAA, reported on the role of sea lions as predators, competitors, and prey, and on the status of the species. The number of California and eastern Steller sea lions is increasing, while the number of western Steller sea lions, listed as endangered, is decreasing. The eastern Steller sea lion is listed under ESA as a threatened species, but a delisting review by NOAA is underway. However, only 40,000 to 50,000 of the western Steller sea lions remain, and the ongoing decline in that population is of great concern for NOAA. There are three ecotypes of killer whales -- transient, resident, and offshore – that prey on sea lions.

Robin Brown of the Oregon Department of Fish and Wildlife noted sea lions swim up and down the west coast and into the Columbia River to forage for food sources. They are known to go up and down the Washington and Oregon coast all the way to Alaska and then return to Bonneville Dam for the spring Chinook salmon run.

Robert Stansell of the Corps of Engineers presented 2002-2012 data on sea lion presence and predation in the tailrace below Bonneville Dam. For the first few years of the study, there was an increase in California sea lions every year and an earlier arrival time at the dam. However, as the California sea lion abundance has declined in recent years, the Steller sea lion presence has increased. The same trend is true in predation on salmon and sturgeon. There has been a dramatic drop in predation by California sea lions, but Steller sea lion predation is on the rise. Just over 50 California sea lions have been removed from the Bonneville tailrace area since 2008. Some animals have been sent to zoos or aquariums and some were euthanized. Since the states of Washington and Oregon received approval under section 120 of the Marine Mammal Protection Act[3] (MMPA) to lethally remove California sea lions, 38 individuals have been trapped and euthanized. Most of these were the worst offenders in terms of repeatedly showing up at the dam to prey on salmon. Removing the animals has led to a drop in the overall number of California sea lions and a drop in predation. It was also noted the Steller sea lions "bully" the California sea lions and steal their salmon, and that could be another reason for the drop in California sea lion numbers.

[3] The **Marine Mammal Protection Act of 1972** (**MMPA**) was the first act of Congress to call specifically for an ecosystem approach to natural resource management and conservation. The MMPA prohibits the taking of marine mammals, and enacts a moratorium on the import, export, and sale of any marine mammal, along with any marine mammal part or product within the United States. The Act defines "take" as "the act of hunting, killing, capture, and/or harassment of any marine mammal; or, the attempt at such."

Member Booth noted some newer research indicates that the pinniped take in the estuary and lower Columbia River may in fact be higher than previously thought. A NOAA Fisheries scientist described a recent study on adult spring Chinook salmon going above Bonneville Dam, for 2010 to 2011, there was an estimated 12 percent unaccounted loss of tagged fish, with most of the loss occurring in the lower estuary. The researcher's hypothesis is that much of the loss is due to pinniped predation.

IV. Predation Dynamics

Matt Mesa from USGS provided an overview of predation dynamics and the need for a food-web approach to predator management in the Columbia River Basin. Predation has direct and indirect effects, and the cascading effects are particularly important in pelagic communities. Most studies on the direct effects of predation are concerned with the killing and eating of a prey species. The interactions between species are also dependent on other species in the community; there are many indirect effects but that is not a topic typically seen in Columbia Basin research. Selective predation, in which predators have the ability to choose their prey by size, species, or prey condition, can alter the composition of the prey community. A predator can also select for sub-standard prey, e.g., individuals that are diseased, injured, or stressed.

The importance of the food web is missing in the Columbia River Basin research. Food web research gives insights into how energy flows through the system and into productivity and resilience that single-species studies do not. This type of research is challenging given the huge spatial scope, ephemeral prey sources like migrating salmonids, and other issues affecting conditions simultaneously, such as disease, contaminants, and climate change.

Workshop participants pointed out the constraints imposed by various statutes and the way they direct agency actions. For example, the protection of marine mammals and the Endangered Species Act pushes us into a single-species management mode. The statutes present barriers to implement food web-based management. The Northwest Power Act, however, presents an opportunity to be more creative because of its ecosystem approach.

It was also noted that the tribes, states, and the federal government are thinking hard about the future of the Columbia River Treaty. The treaty is for the purpose of flood control and power production, and it led to the development of large headwater storage projects, which have had profound effects on the ecosystem and hydrology of the Columbia River. There is now an opportunity to reframe the Columbia River Treaty, and the 15 tribes have rallied around bringing ecosystem functions into the Treaty negotiations.

V. Alternative Predation Management Strategies

Workshop participants discussed the dichotomy in the way various predators are treated. With fish and marine mammal predators, individuals are targeted and removed; with avian predators, it is a habitat-based approach. But the common theme is habitat. Is there a way to look at these other predator species from a habitat perspective? Is there a way for us to change the focus?

Participants discussed this idea, noting where tributaries come into the Columbia River, cormorants prey on lamprey that do not have a place to get away because these areas are too shallow. At these tributary confluences, there is a real opportunity to make habitat changes.

It was also suggested that when predators show up, we need to focus on dealing with them immediately. If not addressed right away, predation can become a chronic problem.

Research has shown it has only been in the last 10 to 12 years that individual sea lions have learned the behavior of going to places where there are bottlenecks in salmon passage, such as below Bonneville Dam. The states have tried to do what they can to manage pinnipeds within the limits of the MMPA. There are also attempts to change the MMPA, but it is difficult for legislators to push for these changes so it is unlikely to happen. It makes no sense to try to manage pinnipeds on a larger scale.

Only a small percentage of the animals in the west coast California sea lion population are at Bonneville Dam, and with states permitted to remove problem California sea lions, predation and the numbers of those mammals present have decreased. Council staff posed the question, if Steller sea lions were to become de-listed, would a similar removal approach work for them?

Participants stated, if Stellers were de-listed, they did not see a reason not to seek the same authorization for removal of Steller sea lions. However, many suggested there would be opposition, noting the states have been in court multiple times over the California sea lion removal request.

Representatives from Oregon and Washington agreed that removing over 50 California sea lions has made a difference. In 2011 and 2012, there were extreme high flows, which reduced the amount of time the Chinook salmon run was exposed to sea lions, which has also contributed to a reduction in losses. Acquiring MMPA Section 120 authority to remove the sea lions took good salmon take information to support the request. The MMPA requires proof there is a significant impact on endangered runs that would have a negative effect on recovery. The Corps' ongoing visual observations below Bonneville Dam were used in that instance. Lack of proof has been a vulnerable aspect in the court proceedings. There is a need for more information and a defensible scientific study that quantifies the sea lion impact on salmonids on the lower stretch of river. A bill to address Steller sea lions is working its way through Congress, and if it passes, it creates more management flexibility in dealing with Steller sea lions for predation on both listed salmonids and sturgeon.

Prompted by member Phil Rockefeller, participants described their most significant predator-prey problems affecting salmon, steelhead, lamprey, and sturgeon. Tom Rien of ODFW pointed out that the ongoing pikeminnow project is an important effort, yet it isn't at the forefront of what we are thinking needs to be done. For Oregon, sea lion predation that affects adult salmon and sturgeon is at the top of our list, as is avian predation. They estimate that 14,000 sturgeon are killed per year and feel they need to better understand the lower river predation numbers. Rien suggested developing a bioenergetics model for sea lion predation on salmon, sturgeon and lamprey.

Council staff asked if a model like Compass could be revised to include a predation component? NOAA Fisheries indicated the lifecycle component could incorporate predation, but it would require obtaining specific predation data. The predation estimates are too vague for some species. The models have survival components already for each mainstem reservoir which are

correlated with travel time and temperature. This would involve parsing the reservoir survival information we already have. There would be a large error margin around such small numbers.

Member Bill Booth noted that the Council currently has opportunities with the review of data management projects and a review of the way the Council communicates with its audiences. The Council could help highlight predation issues and communicate estimates about the magnitude of the problem to people in the region. But we would need good estimates of the percent of fish taken by the three different predator groups, and a common metric for predation, for public information purposes. Booth also noted the lethal take of pinnipeds has been successful in reducing salmon predation and stressed the importance of tribes, states and scientists working together to overcome legal, funding, and cultural obstacles.

Participants acknowledged that comparing the predation impacts of birds, mammals, and fish is difficult and complex, but it appears the impact may be on the same order of magnitude for all three groups. The problem with comparing them is that impacts are occurring at different life stages. NOAA Fisheries is treating it as additive mortality, but when we look at the effects of managing birds and other species, we need to determine if we get as much benefit overall as removing a few sea lions.

McLellan from the Colville Tribe reminded the participants that walleye and bass are the biggest challenge in the blocked area above Grand Coulee Dam. We do not yet have high-level policy support for predator management actions there, and it is needed.

The group discussion suggested that priorities vary depending on location up or down the river and some wondered with climate change and other factors, is an ecosystem approach possible? Managers may end up "triaging" species and writing off what cannot be addressed. Others thought yes, an ecosystem approach may be the only approach over time that works.

VI. Staff identifies the following to be **potential next steps:**

a. Prepare an inventory of predation problems and actions being taken in the basin to address them. This could be done by developing a map showing where predation is occurring in the CRB.
b. Develop a common metric of fish, bird and marine mammal predation and impacts on salmon, sturgeon and lamprey. The lower river tribes are interested in assisting in this effort.
c. Investigate the indirect, or food web, effects of predation; develop a model of predator-prey interactions for CRB salmonids in a lifecycle context – based on adult equivalents. Consider starting with mid-Columbia steelhead.
d. Convene follow-up workshops, if necessary, to further develop and discuss some of these next steps with regional partners.

Summary Report from Predation Workshop

Predation in the Columbia River Basin, What are the Management Alternatives?

Science-Policy Exchange Series

Thursday, August 9, 2012

Portland, Oregon

Ambridge Event Center

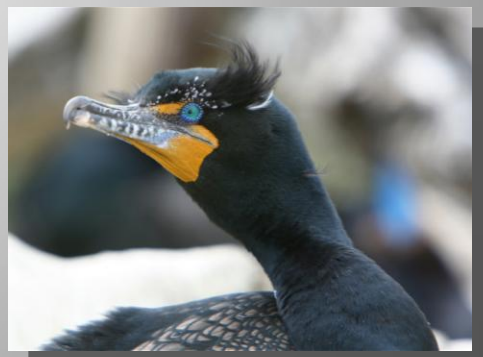
Northwest Power and Conservation Council

Overview of workshop

- Objectives:
  - increase our understanding of the role of predation and predator control actions in the CRB
  - its effects on the ecosystem
  - discuss the scope of predation issues throughout the CRB
- About 70 people participated
  - ISAB members, state and federal agencies, tribes, utilities, universities
- Presentations, meeting summary, participant list posted on Council's website

Overview of workshop II

- Opened with a review of ISAB Food Web report.
- Held sessions for fish, avian, pinniped predation
- Review the elements of predation dynamics
- Discussion of alternative management strategies



Opening remarks – Robert Naiman

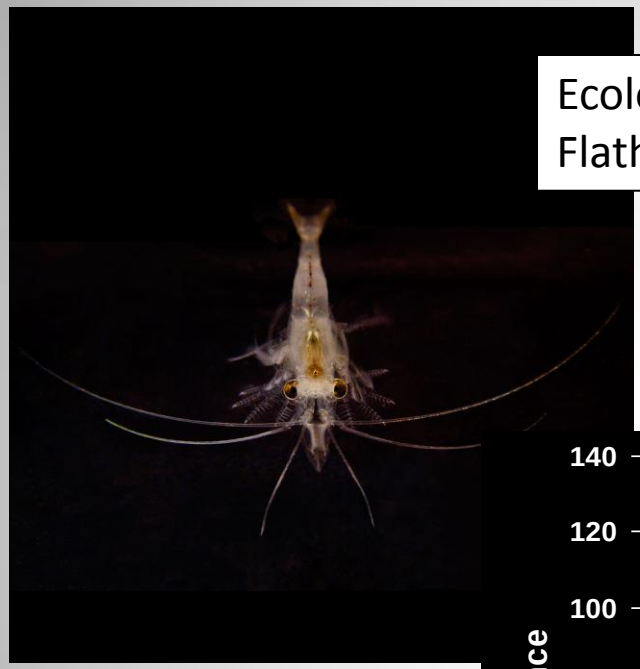
- carrying capacity of the river
- proliferation of chemicals & contaminants
- Consequences of non-native species = hybrid food webs

- Humans as predators
- Don’t ignore “indirect” predation relationships
* Model of predator-prey interactions is needed

The missing links: implementing food web research in the CRB

- Reveal insights into underlying energy flow, productivity & resilience that single species approaches cannot
- Key trophic pathways and foods vary over time and space—a broad view is rare
- Food web structure and processes determine how the ecosystem functions collectively

Fish Predation Session



Ecological impacts of Non-Native Species in Flathead Lake, Montana

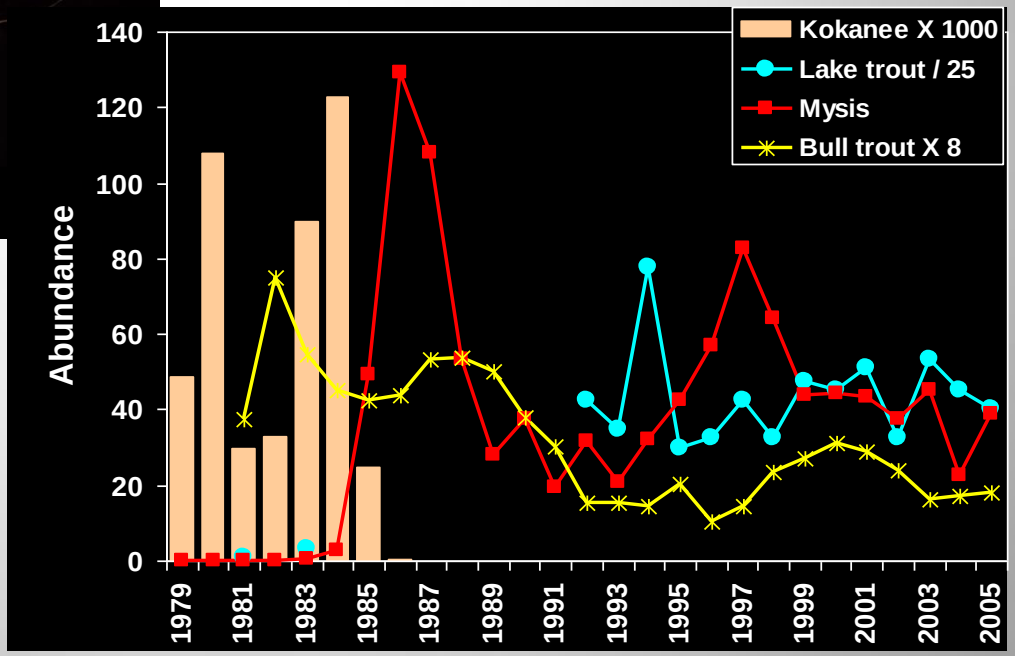
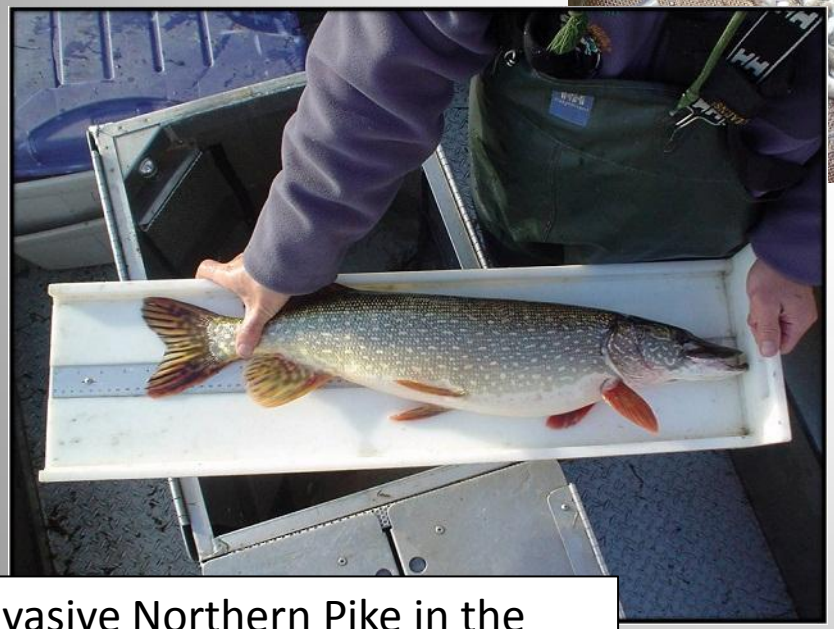


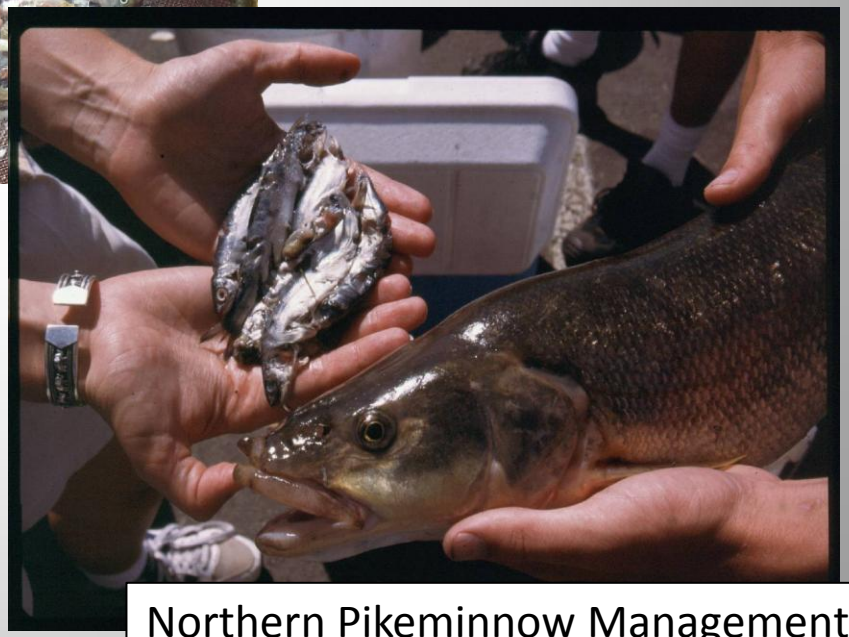
Photo by Joe Giersch

Fish Predation Session

Lake Roosevelt – Walleye and Bass Predation



Invasive Northern Pike in the Pend Oreille River, Washington



Northern Pikeminnow Management Program

Avian Predation Session

Caspian Tern Colony

Double –crested cormorant colony

Avian Predation Session

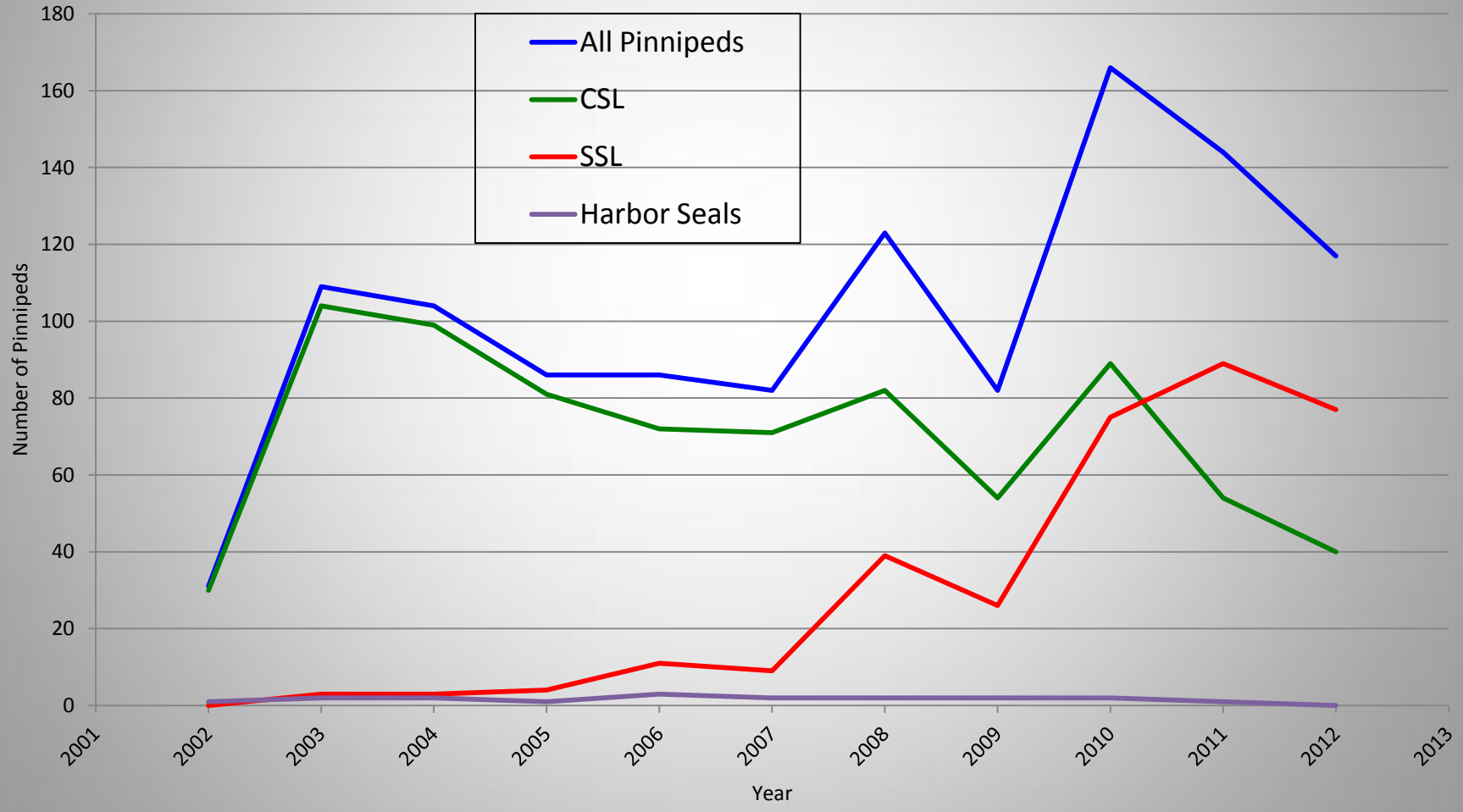
White Pelican Predation

Pinniped Predation Session

- Sea Lion Species:
  - California Sea Lions (not listed) - increasing
  - Steller Sea Lions eDPS (threatened) – increasing (delisting review under way)
  - Steller Sea Lions wDPS (endangered) - decreasing
- Predators – varied diet: fish, cephalopods, crustaceans
- Competitors – commercially-targeted longline and trawl species; ESA-listed salmon ESUs
- Prey – killer whales, some sharks, humans

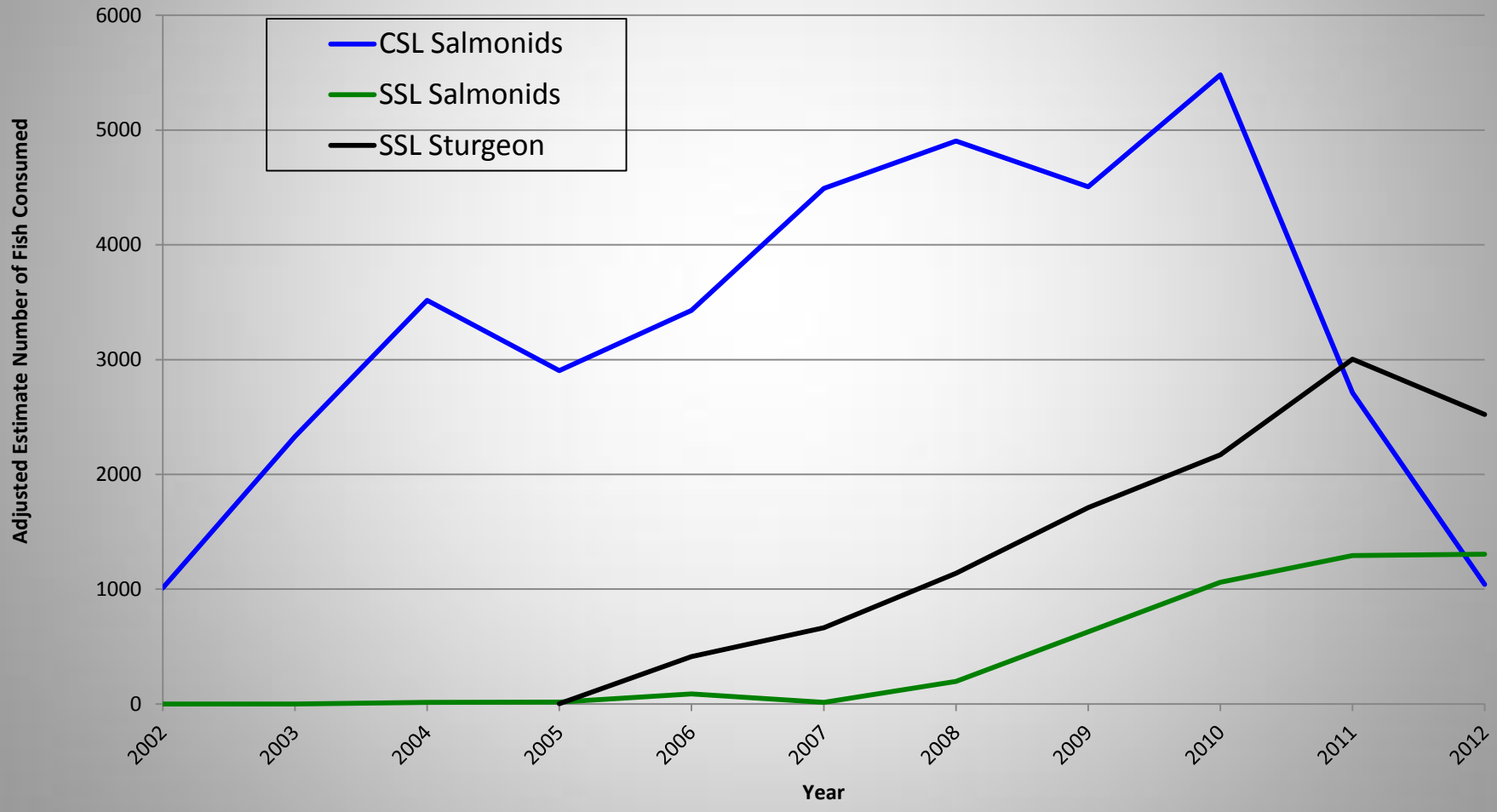
Pinniped Predation Session

Minimum Annual Pinniped Abundance



Pinniped Predation Session

Estimated Salmonid and Sturgeon Consumption by Pinnipeds



Key Points -- Pinniped Predation Session

- Physical barriers effectively block CSL access to fishways.
- Non-lethal deterrence efforts have failed to reduce predation on salmonids and sturgeon at the dam.
- Trapping/removal program seems to be working by reducing both CSL abundance and amount of predation on salmonids. Without 53 removals, salmonid predation would have been higher.
- Salmonid catch has decreased (2,382; 1.4% of run in 2012).
- SSLs are more of a problem with increasing abundance and more predation on both white sturgeon and salmon species.
- Sea lions are impacting early season spring Chinook stocks.
- SSLs are coming earlier each year and impacting white sturgeon below BON Dam.

Predation Workshop – Next Steps

- Prepare inventory of predation problems and actions throughout CRB
- Develop a common metric for fish, bird and pinniped predation
- Investigate indirect, food web effects of predation
- Convene follow-up workshops