



Independent Scientific Advisory Board
for the Northwest Power and Conservation Council,
Columbia River Basin Indian Tribes,
and National Marine Fisheries Service
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July 30, 2008

ISAB Report Presentation: Non-native Species Impacts on Native Salmonids in the Columbia River Basin

Tom Poe, ISAB review lead, will present findings from the ISAB's Report: Non-native Species Impacts on Native Salmonids in the Columbia River Basin (ISAB 2008-4, July 15, 2008). The report's executive summary is provided below. The full report is posted on the ISAB's webpage at www.nwcouncil.org/library/isab/isab2008-4.htm.

EXECUTIVE SUMMARY

Humans have intentionally and unintentionally accelerated the movement of animal and plant species into ecosystems where they are non-native. The major causes for these unprecedented species movements have been post-1900 increases in inter-continental trade, travel, and tourism, as well as import and export of exotic pets, ornamental plants, foreign foods, and crop plants. The negative impacts of non-native species invasions, along with habitat loss and degradation, are recognized as the two leading causes of native species imperilment in North American freshwater ecosystems.

While intentional and unintentional introductions of non-native species have accounted for initial establishment of non-native species, *habitat change* is currently the major factor causing the expanding distribution and increasing abundance of non-native species in the Columbia River Basin. Most of the free flowing river habitats in the Snake and Columbia rivers have been converted into reservoir habitats through dam building, intended for hydroelectric power generation and for flow regulation for irrigation diversion and flood control. The reservoirs have created hotspots of non-native species, which become source populations of non-natives, facilitating secondary spread of these species throughout the basin.

This review's results, presented in the body of this report, indicate that the potential impacts and risks to native salmonids and other native fishes from non-native species are significant, with most subbasins in the Columbia River Basin already dominated by non-native fish species. The *predatory effects of some of these non-native fish species on native salmonids* are the most well documented of all non-native impacts on salmonids in the Pacific Northwest, and in some habitats non-native fishes can consume significant numbers of emigrating juvenile salmon.

In addition to predation, non-native species pose a number of other significant impacts to natives species, including *competition for food and habitat* (e.g., larval/juvenile American shad have reduced zooplankton species food base favored by subyearling Chinook), *food web alterations* (e.g., native resident fish communities in littoral habitats of Columbia River reservoirs are being replaced by non-native species), *interbreeding* (e.g., genetic introgression between cutthroat trout and brook trout), and *disease transmission and parasites* (e.g., American shad is a carrier of a protozoan parasite of salmon). Native species are also significantly impacted by *non-native invertebrates* (e.g., the freshwater Asian clam which has replaced native mollusks in the Columbia River Basin), and *non-native plants* (e.g., Eurasian milfoil, which is widespread in Columbia River reservoirs and is altering littoral habitats).

ISAB Recommendations for Actions to Address Non-native Species Impacts

Because of these impacts, the ISAB recommends that the Northwest Power and Conservation Council (Council) and the Fish and Wildlife agencies in the Basin elevate the issue of non-native species effects to a priority equivalent to that of habitat loss and degradation, climate change, and human population growth and development.

The ISAB also provides the following specific recommendations:

- **Exploratory Surveillance and Monitoring** – Exploratory surveillance and monitoring of fish, plant, and invertebrate populations needs to be increased for early detection of invasive non-native species and tracking of their distribution and abundance in the future. In addition to informing immediate management actions, this monitoring will provide information to evaluate the effectiveness of prevention and control measures. Early detection of rare non-native species is challenging and may sometimes require use of sophisticated sampling designs and estimation techniques. However, the cost of control after spread of undesirable species thoroughly justifies the effort.
- **Enforcement** – Federal, Regional, and State Policies and regulations regarding non-native species exist, but enforcement seems to be weak or non-existent. Improved enforcement of current regulations should be a high priority.
- **Fisheries Management** – Smallmouth bass and channel catfish support significant sport fisheries in the lower Snake and Columbia rivers. Walleye are the subject of significant sport fisheries in the mid-Columbia, extending into the lower Columbia River. State fisheries agencies in Washington, Oregon, and Idaho have simultaneously adopted management policies that in some cases seem aimed at perpetuating or even enhancing populations of these introduced predators. The ISAB recommends that the Council urge the state agencies to relax (or eliminate) fishing regulations that may be enhancing populations of non-native species (both predators and competitors), especially those that directly or indirectly interact with juvenile and adult salmonids.
- **Prevention** – Direct removal by physical (e.g., netting or electrofishing) or chemical (e.g., rotenone or antimycin) means have had very little success in eliminating or controlling non-native species, once they are well established. Therefore, prevention is

the best hope for dealing with non-natives and certainly the most cost-effective.

- **Habitat Restoration** – One of the best strategies for protecting native species and minimizing the establishment and spread of non-native species is to maintain and restore habitats (including riparian habitats). When native species are provided with habitat for which they are best adapted, they have an improved chance of out-competing or persisting with non-native species. Restoring physical features (including natural flow and thermal regimes) may make native species more likely to persist in environments now occupied by non-natives.
- **Planning** – Planning for future actions to prevent, control, and minimize non-native species' impacts to native species and their ecosystems should be a high priority. The Council should encourage revisions in the Fish and Wildlife Program Subbasin Plans to include plans for addressing non-native species threats and impacts.
- **Education** – Public awareness of the threats that non-native invasive species pose to aquatic ecosystems and the native species therein is critical for curtailing the introduction and spread of new non-native species. A wide range of groups and educational actions can contribute to public awareness including public schools; watershed councils; television and radio public service announcements; billboards; sport fishing organizations; and other environmental organizations such as The Nature Conservancy.
- **Research** – Research needs are many, including (1) mapping the vulnerability of the landscape to non-native species introduction, establishment, and spread; (2) examining the impacts of non-native predators on native salmonids and other native species at regional scales and where many species co-occur; (3) determining the potential for transmission of diseases and parasites to native species, (4) improving understanding of the effects of competition between non-native and native species, and (5) exploring the potential synergistic interactions of climate change, land use, and non-native species spread.

ISAB Recommendations for Evaluating the Use of Non-native Fish in Resident Fish Substitution Projects

The Council's Fish and Wildlife Program recognizes that construction of Grand Coulee Dam on the Columbia River in 1941 and Brownlee Dam on the Snake River in 1959 completely blocked over 18,000 miles of streams that had been historically accessible to anadromous salmon, approximately 38% of the historic range. The Council's Program mandates that anadromous fish losses due to the blockage need to be partly mitigated by assuring that populations of resident fish species remain healthy. Part of this mitigation includes a resident fish substitution policy that, among other actions, allows for stocking of non-native species that are compatible with the continued persistence of native resident fish.

However, the Fish and Wildlife Program does not establish the specific limits (i.e., how much risk) or the methods (i.e., risk management protocols) to evaluate whether a proposed project is

reasonably benign and likely to provide benefits, without undesirable consequences. Moreover, the introduction or enhancement of non-native species is seldom a controlled research experiment, and it is difficult to reliably forecast the effects of such introductions or enhancements on native species. In the absence of clear knowledge of expected effects, which would most often require a lengthy research study, an alternative approach to evaluate a resident fish substitution project would be to complete an environmental risk assessment before initiation of the introduction or enhancement of a non-native species. Such an assessment should be included as part of the review material for evaluation of non-native species substitution proposals.

ISAB Recommendation

- **Environmental Risk Assessment** - A thorough Environmental Risk Assessment of potential negative impacts on native fish species should be completed and submitted, concurrently with project proposals, for all resident fish substitution projects in which a non-native species is to be selected for substitution. The ISAB understands that the Council, Independent Scientific Review Panel, and fish and wildlife managers would need to be involved in development of a final Environmental Risk Assessment template and that *this recommendation is a starting point and not an endpoint*.

The ISAB appreciates the efforts of the resident fish and wildlife managers to provide briefings on resident fish substitution, site visits to view affected habitats in the blocked areas of the Columbia River Basin, and constructive comments on a draft risk assessment approach.



Non-native Species Impacts on Native Salmonids in the Columbia River Basin

Including Recommendations for Evaluating the Use of Non-native Species in Resident Fish Substitution Projects

Independent Scientific Advisory Board

ISAB 2008-4

July 15, 2008

Review Objectives

- ▶ Describe history of non-native species introductions and current status in the Columbia River Basin
- ▶ Document the biological impacts and risks to native salmonids
- ▶ Describe the current status of mgt. actions taken to reduce impacts

Review Objectives (cont.)

- ▶ Describe the changing cultural values and current federal and state laws, policies, and plans regarding non-native species
- ▶ Recommend strategies for detecting, preventing, and controlling non-native species
- ▶ Recommend scientific criteria for evaluating resident fish substitution projects

History of Non-native Species in the Columbia River Basin

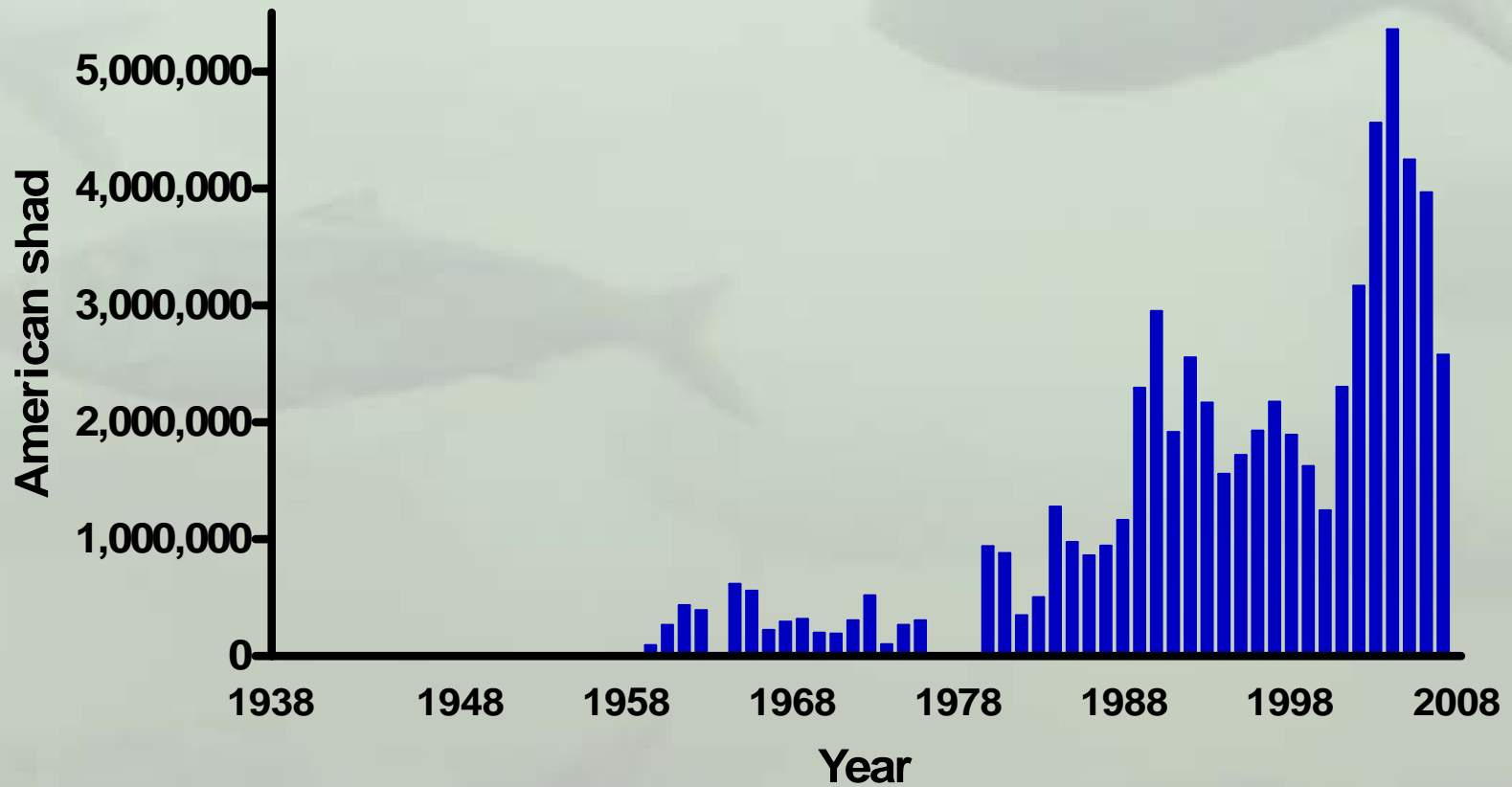
- ▶ General pattern of introductions
- ▶ Early economic and cultural reasons
- ▶ History of American shad in the Columbia



Smallmouth bass

American shad

Bonneville Dam passage



Role of Habitat Alteration in Facilitating Non-native Expansion

- ▶ Hydrosystem development
- ▶ Forestry practices
- ▶ Agricultural practices
- ▶ Urbanization

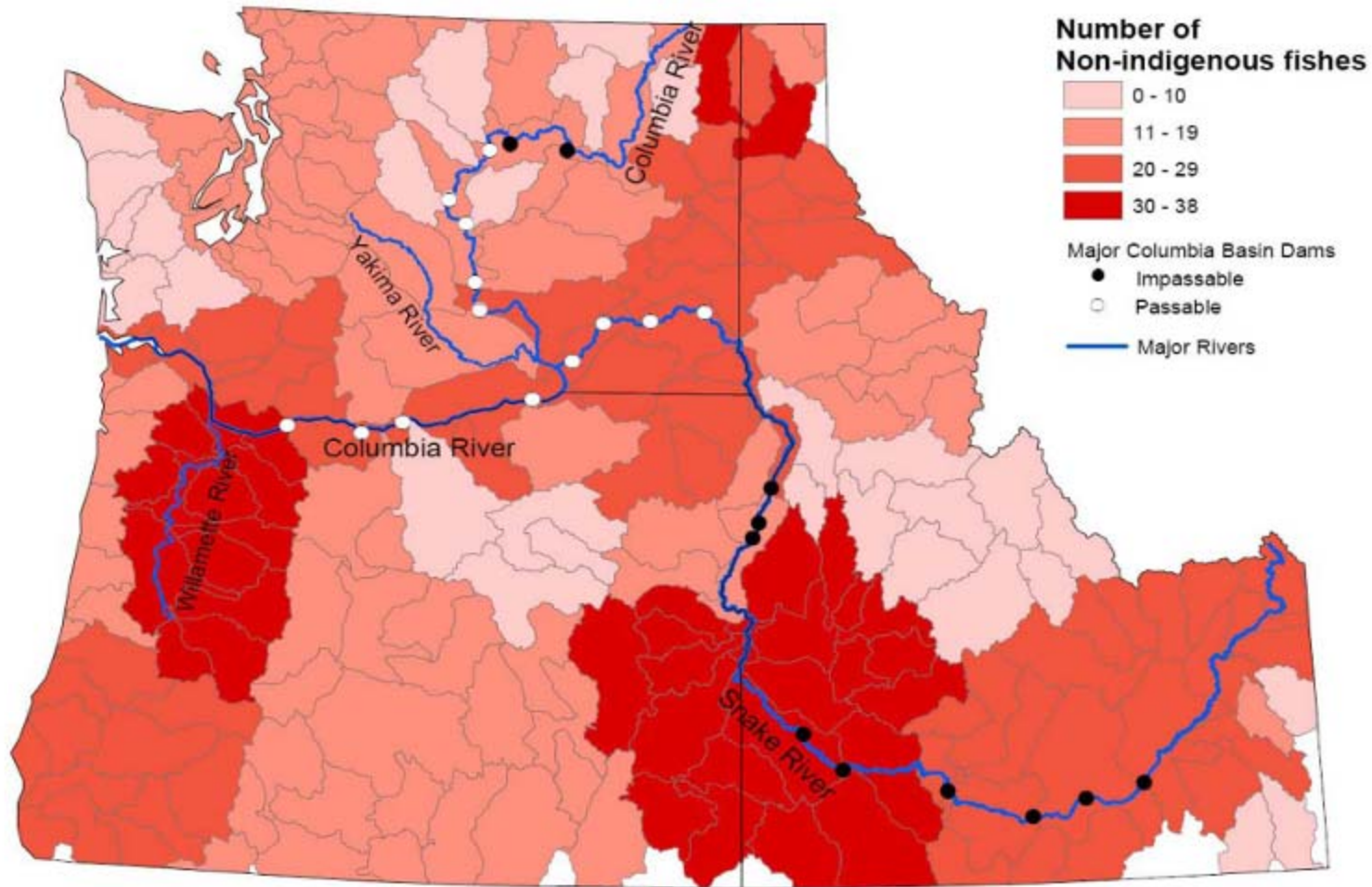


Eurasian milfoil

Current Non-native Fish Species Distribution in the PNW

- ▶ A recent survey of the occurrence of NNS in the PNW in 2007 (Sanderson et al) indicated that NNS made up 54%, 46%, and 60% of the resident fish species in WA, OR, and ID, respectively.
- ▶ The survey also indicated that many of the subbasins in the CRB have from 20 to 38 species of non-native fishes – Figure 2

Current Non-native Fish Species Distribution in the PNW



Biological Impacts and Risks to Native Salmonids

- ▶ Predation
- ▶ Competition for food and habitat
- ▶ Food web alterations
- ▶ Interbreeding
- ▶ Disease transmission and parasites
- ▶ Non-native invertebrates
- ▶ Non-native plants



Red swamp crayfish

Current Status of Management Actions to Reduce Non-native Species Impacts

- ▶ Eradication or reduction
 - Hand-pulling or mechanical harvest (weeds)
 - Toxicants
 - Netting
 - Electrofishing
- ▶ Barriers
- ▶ Targeted sport-angling



Walleye

Changing Cultural Values, Laws, and Management Plans

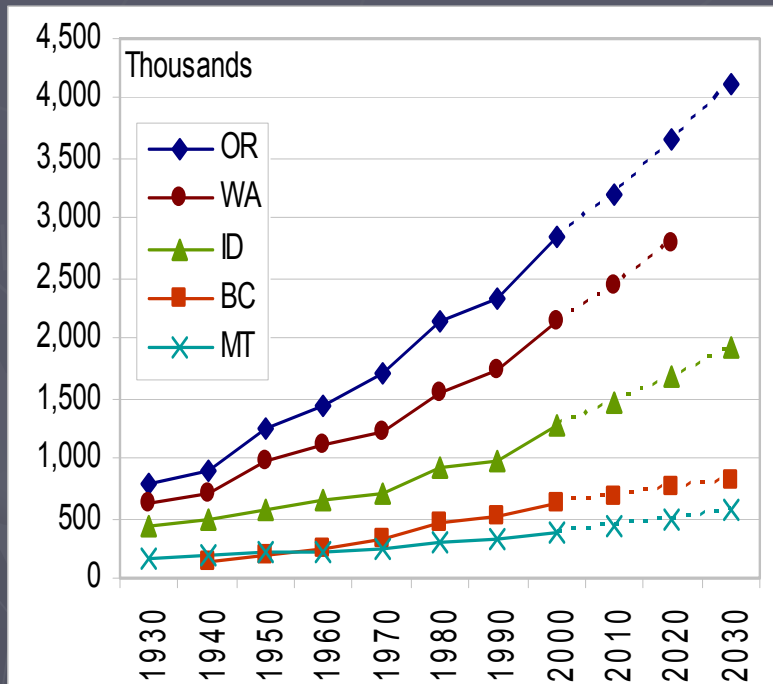
- ▶ Changing cultural values
- ▶ Laws, policies, and plans
 - Federal and state laws and regulations
 - Management/action plans
- ▶ National Scientific Societies



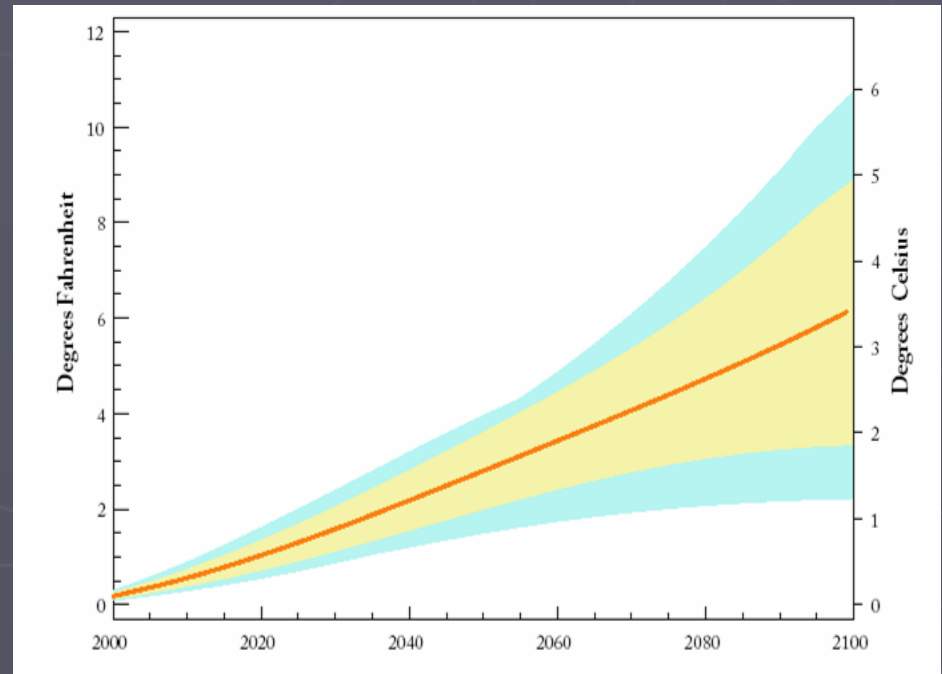
Channel catfish

Future Concerns

- ▶ Climate change
- ▶ Human population growth and development



US and Canada censuses. State and regional district projections for 2010 and 2020



The latest climate model simulations show a +1 to +6 °C warming for the PNW by 2100.

Recommendations

- ▶ Exploratory Surveillance and Monitoring
- ▶ Enforcement
- ▶ Prevention
- ▶ Fisheries Management

Recommendations (cont.)

- ▶ Habitat Restoration
- ▶ Planning
- ▶ Education
- ▶ Research



Northwest Power and Conservation Council
Dayton Creek

Evaluating the Use of Non-native Fish in Resident Fish Substitution Projects

► Background

- FWP mitigation for anadromous fish losses in blocked areas includes resident fish substitution which can be introduced species and artificial production can be used to sustain those species.
- The Program further states that those substitution species must be “compatible with the continued persistence of native resident fish species”; and “appropriate risk management needs to be maintained in using the tool of artificial propagation”.

Environmental Risk Assessment

- ▶ During proposal reviews the ISRP found that the FWP statements regarding risk to native species did not provide clear risk management criteria or methods to evaluate whether a proposed project may be able to provide benefits without undesirable consequences.
- ▶ As an alternative to conducting one or more lengthy research studies to determine level of risk to native species, an environmental risk assessment can be effective for determining risk prior to introducing a non-native species.

Risk Assessment Format

- ▶ A list of 15 topics with associated questions asks for the documentation on rationale and risks needed to produce a thorough risk assessment.
- ▶ Several of the more important topics include:
 - interactions with other species in system
 - genetic effects
 - escape/dispersal
 - carrier of disease/parasites
 - monitoring for success or negative consequences.

ISAB Recommendation

- ▶ A thorough Environmental Risk Assessment of potential negative impacts on native fish species should be completed and submitted, concurrently with project proposals, for all resident fish substitution projects in which a non-native species is selected for substitution.
- ▶ The ISAB understands that the Council, ISRP, and fish and wildlife managers would need to be involved in development of a final ERA template and *this recommendation is a starting point and not an endpoint.*