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## Response to RSRP recommendations

### Harvest

#### I. Summary of RSRP recommendations

The Panel (report of August 2001 meeting) noted that government agencies have a generally poor track record preventing overexploitation of marine fish and that harvest has been identified as a factor for decline for many listed salmon ESUs. The Panel found that the models used to set allowable harvest for salmon, including listed ESUs, are "notoriously inaccessible and impenetrable," and they felt that the day-long session with scientists and managers familiar with salmon harvest did not provide much additional insight. Their primary criticism is that the biological rationale for allowing significant harvest on listed ESUs has not been adequately documented by the agency.

The Panel suggested that

- A) The agency make better (and more transparent) use of stochastic population dynamic models in their assessments of harvest impacts;
- B) The agency make a better link between the results of such models, which evaluate population behavior into the future, and the yearly process of shaping fisheries to meet allocation and stock-specific conservation constraints;
- C) The agency make stronger efforts to move toward terminal fisheries; and
- D) The process of setting allowable harvests should be integrated with consideration of other natural and human induced sources of mortality throughout the life cycle, and with other management actions designed to alleviate these sources of mortality.

#### II. NWFSC assessment

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Three pages

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## Response to RSRP Recommendations

### Barging

#### 1) RSRP recommendation (from 4-6 December 2000 meeting)

B. "Resolving some of the suspected differences between hatchery and wild fish should be an early and essential target. The same *might* [emphasis added] hold for the relative fates of barged and unbarged smolts in a river system without dams."

F. "A major issue for research to resolve is the question of how much 'deferred mortality' results from dams. Our suggested barging experiment would help to resolve this issue."

The above recommendations are in addition to language that states: "One pivotal source of model disagreement concerns the magnitude of "indirect" or "deferred" mortality that smolts may experience from the hydroelectric system, either from dam passage or from barging around dams. Controlled experiments with natural passage vs. barging of hatchery fish down certain rivers without dams could help to resolve these differences by allowing direct measurement of delayed mortality from barging, which could then be used to calibrate extra mortality from dam passage, by comparison to barging down rivers with dams."

#### 2) Assessment of merits of the recommendations.

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Four pages

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## **Response to RSRP recommendations**

**Beyond the four H's: interspecific interactions, exotic species, climate change, estuarine and ocean conditions.**

### **1) RSRP Recommendations**

The RSRP has identified important issues to salmon beyond habitat, harvest, hatcheries and hydro. Issues identified in their reports include:

(a) Decadal scale climate oscillations (e.g., PDO), climate regime shifts generally, and at-sea conditions

(b) Role of estuaries...in one sense they are part of habitat; however, in another we restrict the use of the term habitat to freshwater spawning and rearing areas

(c) The impact of exotic species on salmon population dynamics...e.g., cord grass in estuaries, Atlantic salmon, shad, walleye, smallmouth bass, etc.

(d) Interspecific interactions...e.g., predation by Caspian terns, marine mammals

### **2) Assessment of the scientific merits of the recommendations**

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Three pages

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## Response to RSRP recommendations

### Hatchery Issues

#### Summary of RSRP recommendations

- Marking of hatchery fish
- Monitor fitness of hatchery fish in the wild
- Estimate straying rates for wild salmon
- Estimate the fitness effects of hatchery release by conducting phenotypic selection analysis and breeding experiments on hatchery and wild fish
- Conduct a multi-regional analysis to evaluate the contribution of hatchery releases compared to other potential negative effects
- Conduct large scale experiments involving controlled closures of hatcheries in order to empirically estimate the magnitude of deleterious hatchery effects and determine the potential for, and time scale of, wild stock recovery after hatchery releases cease
- Expand the NATURES program for production of fish with wild-like morphology, physiology, behavior, and post release survival

The RSRP has identified these seven recommendations that we discuss in detail in the following text. Included for each recommendation are:

#### *Summary of RSRP recommendations*

##### *Assessment of scientific merit*

Is it important?

Are there places where it is being done?

Is it feasible from a technical standpoint?

Economic/legal/political considerations

*How to implement recommendations (and potential obstacles)*

*Consequences not implementing*



## Marking

*Summary of RSRP recommendations* – The RSRP suggested that all hatcheries “be encouraged” to mark 100% of their releases such that all hatchery fish could be traced to a particular release time and location.

*Assessment of scientific merit*

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**Monitor fitness of hatchery fish in the wild**

*Summary of RSRP recommendations -*

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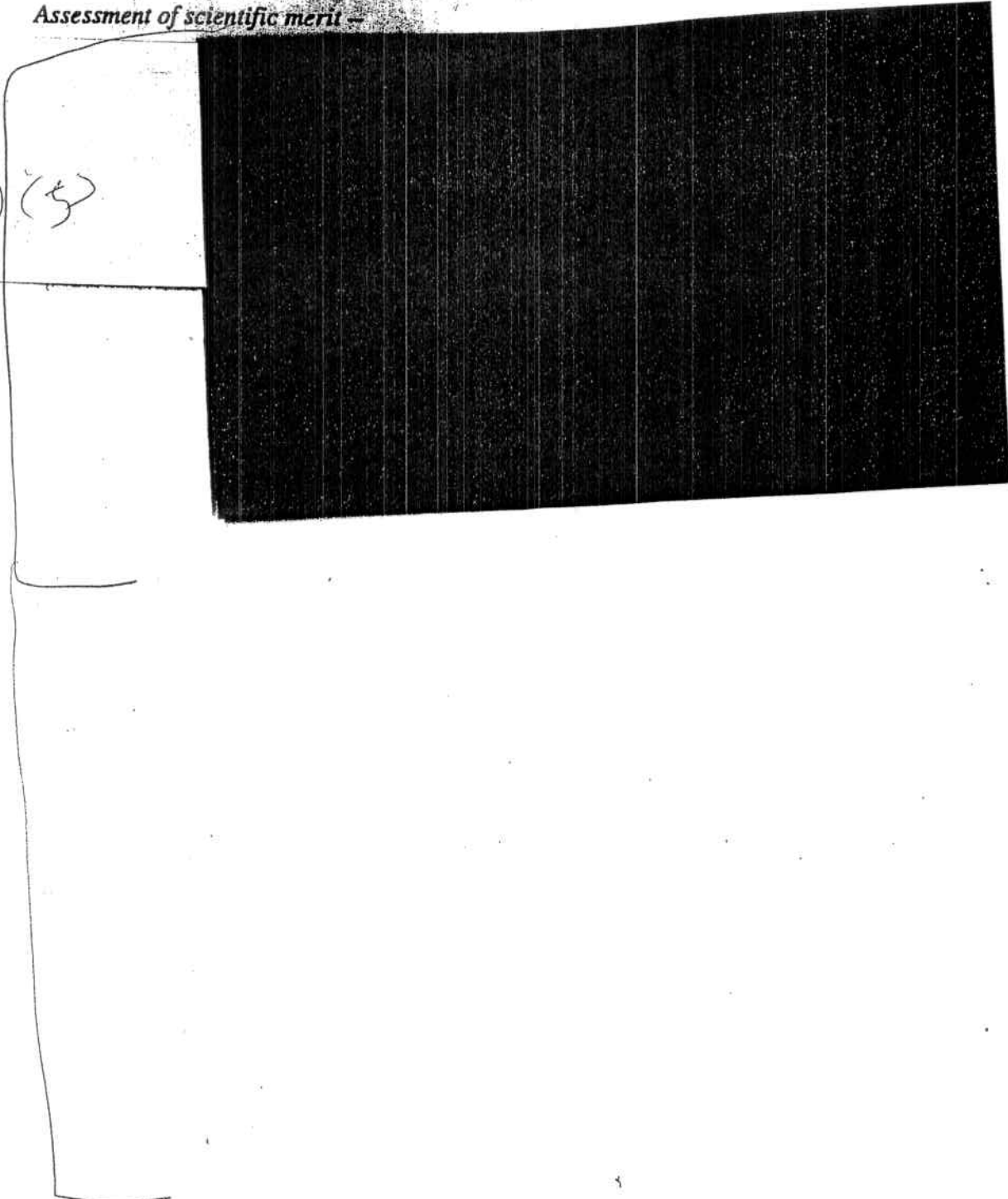
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The RSRP recommended that for some populations the fitness (breeding success and progeny survival) of naturally spawning hatchery fish be assessed.

*Assessment of scientific merit --*

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**Estimate straying rates for wild salmon**

*Summary of RSRP recommendation –*

The RSRP noted that most current estimates of salmon stray rates were obtained from hatchery fish, and suggested that efforts should be made to gain additional stray rate estimates from natural populations. They recommended using a tag/recapture approach, focusing on particularly important or representative populations.

*Assessment of scientific merit –*

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**Estimate the fitness effects of hatchery release by conducting phenotypic selection analysis and breeding experiments on hatchery and wild fish**

*Summary of RSRP recommendation -*

The RSRP recommended that phenotypic selection experiments (essentially regressions of fitness on trait value) be conducted on both hatchery and natural populations in order to determine the targets of selection in hatchery and in the wild. They also recommended

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breeding experiments involving crosses between hatchery and natural fish that could be used to map and identify the genes involved in differential adaptation to the wild and the hatchery.

*Assessment of scientific merit –*

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**Conduct a multi-regional analysis to evaluate the contribution of hatchery releases compared to other potential negative effects**

*Summary of RSRP recommendation* – The RSRP recommends that to estimate the effects of hatchery production on the genetics, fitness and population dynamics of wild salmon a number of critical uncertainties must be resolved. Primary among these key unknowns is the impact of hatchery releases on wild fishes relative to other effects (e.g., harvest, habitat degradation, hydropower). The RSRP recommends adopting a statistical modeling approach to this question, especially if the development of such quantitative tools is done in conjunction with the implementation of small- and large-scale manipulations.

*Assessment of scientific merit* –

One page

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**Conduct large scale experiments involving controlled closures of hatcheries in order to empirically estimate the magnitude of deleterious hatchery effects and determine the potential for, and time scale of, wild stock recovery after hatchery releases cease**

*Summary of RSRP recommendation* – The RSRP recommends that some hatcheries be closed in a controlled manner in order to definitively evaluate the impacts of hatcheries on the abundance and productivity of nearby natural populations. The type of study they suggest would involve paired treatment and control streams. Treatments would be streams with hatchery closures, and controls would be similar streams with no closure and/or streams with no hatchery. Ideally, data would consist of a time series of abundance and survival data for both treatment and control streams for several years before and at least 10 years after hatchery closure.

*Assessment of scientific merit* –

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**Expand the NATURES program for production of fish with wild-like morphology, physiology, behavior, and post release survival**

*Summary of RSRP recommendation –*

The RSRP suggested expansion of natural rearing enhancement system (NATURES) research that has shown promise for increasing post release fitness of hatchery fish through structural enrichment of hatchery rearing habitats. In particular, they recommended research that would help determine the relationship between potential deficits in brain development of conventionally reared hatchery fish and maladaptive traits. The RSRP further recommended economic assessment of the benefit of producing more wild-like hatchery fish.

*Assessment of scientific merit –*

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## RSRP RECOMMENDATIONS

FINAL

Subject: Habitat Delisting Criteria and Habitat Improvement

### Summary of RSRP Recommendations:

Delisting criteria--The RSRP found that sufficient scientific information does not exist to set specific habitat delisting criteria as uniform standards for listed Pacific salmon (Meeting Report August 27 - 29, 2001). They concluded: "...we are convinced that the specific models connecting habitat conditions to population growth rates and viability are not sufficiently reliable to accomplish the task at the present time".

Restoration as experiments--The RSRP's initial review of habitat recovery planning (Meeting Report January 3 - 4, 2002) found that there was a need for a coordinated action plan to implement habitat improvements in an adaptive manner. The Panel also stressed the importance of using habitat restoration actions as experimental manipulations. Culvert replacement, water diversion, and siltation all appear to be opportunities for restoration as management experiments.

### Center's Assessment of Recommendations:

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Two pages

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## **Response to RSRP recommendations**

### **Integration**

#### **Summary of RSRP Recommendations:**

The panel has expressed these observations, concerns and recommendations

- Coordination and integration among agencies is critical
- The link between research and management is weak
- The panel is concerned about studying each "H in a vacuum," resulting from the lack of integration between groups working on isolated "H's". They suggest that the organization of NMFS itself 'seems to inhibit the very integration that is needed.'
- A coordinated strategy is needed for interfacing the work of individual groups
- The importance of designing recovery and restoration projects in an experimental framework

#### **Assessment of the Recommendations:**

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Three pages

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## RSRP RECOMMENDATIONS

Final

**Subject:** Ecosystem Diagnosis and Treatment

### Summary of RSRP Recommendations:

The RSRP reviewed several models and a version of Ecosystem Diagnosis and Treatment (EDT) at their meeting in December 2000 (Meeting Report, Dec. 4 - 6, 2000). Their review addressed "styles of models and their underlying philosophies" and contrasted EDT with other models. The presentation on EDT primarily addressed the intended use of EDT to identify habitat actions that have the potential to meet population targets. The panel made the following observations and conclusions:

#### Observations:

- The management of natural populations is an exercise in quantitative science. This makes the use of models essential. However, they must be used wisely and with understanding of limitations.
- As a model becomes complex, its transparency decreases and there is introduction of inaccuracy, uncertainty and propagation of error.
- The key to intelligent modeling is to find the optimal level of detail and to suppress confounding statistical noise.

#### Conclusions:

- As the number of parameters increases, the potential for mischief increases. Thus, it is essential to rid models of irrelevant parameters, and to identify key relationships, as well as locating what aspects of the model most likely lead to propagation of error.
- Data are not always available for estimating parameter values. Models are useful in helping to gain insight into the behavior of populations beyond the range of variables for which we have observational data. This highlights the need for recognition of the limits of predictability of a model, the use of adaptive assessment and management, and the need for experimentation to elucidate underlying mechanisms.
- EDT seeks to relate habitat conditions/quality by incorporating 45 habitat variables to multiple stages of the salmon life history.
- A substantial portion of the relationships included in EDT may never be known, and yet the assumed nature of the relationships between habitat variables and salmon survival strongly influence the dynamics of the model.



- EDT can incorporate expert opinion, which makes it more subjective than strictly data-driven models. It also may be impossible to validate the model by observation or experiments, and difficult to pinpoint structural features of the model that explain deviations from expected results.

**Center's Assessment of the Recommendations:**

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Four pages

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