Guidelines for Use of Captive Broodstocks in Recovery Efforts for Pacific Salmon

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Purpose

- Display the decision process and scientific standards
- Provide a framework for systematic development and evaluation of effective captive propagation measures

Captive propagation is:

- Only appropriate if the risk of extinction is greater than the risks of intervention;
- Rarely, if ever, a complete recovery program;
- Unproven for long-term rebuilding of naturally spawning populations;
- An experimental and temporary conservation measure in the context of an overall recovery strategy.

Decision Standards

- Population status
- Importance of population
- Scale of Project
- Goals and Performance standards
- Project duration

Decision standards: Population Status

- Population is at a high risk of extinction:
  - Very low abundance (< 50 fish per year)or,
  - Low abundance and declining, or,
  - Little or no natural production predicted for at least one generation.

- Population is of very low abundance relative to available habitat and short term supplementation is deemed appropriate

Decision standards: Importance of Population

- Unique genetic qualities
- Unique adaptations to specific habitats
- Low likelihood of successful natural recolonization in the event of extinction
- High potential productivity, or unique social, economic or cultural value

Decision standards: Scale of Project

- Production based on number of fish needed to:
  - Prevent extinction of target population
  - Represent genetic and life history variation
  - Minimize genetic change in captivity
  - Reestablish fish in the wild
- Duration should be short (one to three generations)

Decision standards: Measures of Success

- Successful programs will
  - Substantially reduce risk of extinction
  - Cause minimal genetic change from target population
  - Reintroduce fish that are phenotypically similar to wild fish
  - Increase the number of fish reproducing successfully in the wild

Decision standards: Changing or Terminating the Program

- Risk of immediate extinction lessens
- Phase into reliance on natural spawning
- No success toward recovery in three generations
- No progress on correcting factors for decline
- Negative genetic or phenotypic effects of captive propagation

Operational Standards for Captive Propagation Projects

- Brood stock collection
- Spawning protocols
- Rearing protocols
- Release of juveniles
- Management of returning adults
- Other disposition of fish
- Monitoring and Evaluation

Operational Standards: Brood Stock Collection

- Take all remaining individuals of wild population into brood stock, or
- Develop a broodstock selection protocol to ensure that all life history and genetic variability is represented.
- Continual infusion of wild fish into successive year classes to avoid domestication and artificial selection

Operational Standards: Spawning Protocols

- Spawn all available adults
- Retrieve all possible eggs from mature females
- Use spawning protocols to maximize effective population size
  - Factorial or single pair matings
  - Cryopreserved sperm
  - Induced spawning

Operational Standards: Rearing Protocols

- Use prudent fish culture practices
- Mimic wild rearing conditions for fish to be released into the wild
- For fish to be reared to maturity in captivity
  - Divide fish among two or more facilities
  - Pathogen and predator-free water supplies
  - Rear smolts to be adaptable for seawater rearing
  - Protect seawater facilities from catastrophic loss
  - Equalize contribution of all parents to the next generation

Operational Standards: Release Protocol

- Release fish at a life stage where probability of survival is greatest
- Acclimate fish to locations where they are intended to return
- Integrate releases with wild fish at same life stage or maturity
- Disperse releases
- Minimize stress caused by handling
- Minimize negative interactions with other species

Operational Standards: Management of Returning Adults

- If the program meets all other criteria, there would be no general restriction on the proportion of hatchery-origin fish on the spawning grounds for the first three generations.
- Non-ESU hatchery fish should not exceed natural straying levels or 1% if natural straying levels are unknown

Operational Standards: Other Disposition of Fish

- If captive propagation programs produce more fish than are needed for future broodstock or release, the extra fish will be disposed of in a manner that is agreeable to co-managers and consistent with permit restrictions.
- Develop biologically sound and socially acceptable off ramps in advance.

Operational Standards: Monitoring and Evaluation

- M&E for fish in captive propagation will include:
  - Survival at life history stages to adulthood
  - Viability of gametes produced in captivity
  - Behavior, morphology and reproductive success
- M&E for fish released to the wild will include:
  - Survival and migration success
  - Ability to return to natal area
  - Ability to successfully reproduce

Development of an Operating Plan

- Use the “Hatchery and Genetic Management Plan” (HGMP) template from NMFS-NWR web site to clearly define:
  - Program scope and goals
  - Target stocks and watersheds
  - Performance standards and indicators for risks and benefits
  - Effects on listed species and other management objectives
  - Facilities and operating standards

Benefit : Risk Analysis

- Benefits:
  - Increase abundance of target population
  - Preserve genetic heritage, avoid extinction
  - Restore listed population to native habitat
- Risks:
  - Genetic effects including inbreeding, loss of variability, accumulation of mutations
  - Cultural risks including domestication and catastrophic loss in hatcheries
  - Ecological risks including predation, competition, disease

Thank you…

- Any Questions?

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