Genetic effects of Straying

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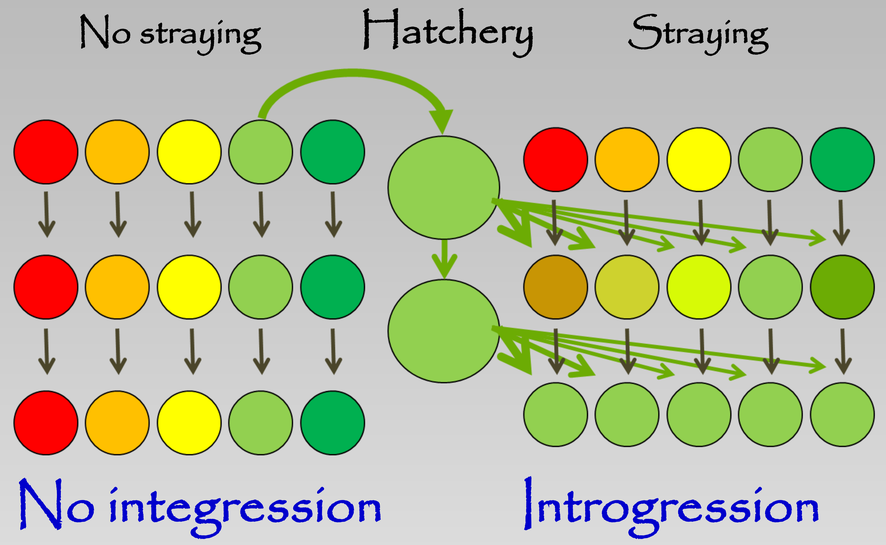
Why worry about hatchery strays?

- Hatchery culture can shift the genetic makeup of fish[1]
- Introgression reduces adaptive fitness of wild fish
  - Quantitative genetic model predicts decline in fitness[2]
  - Shift in run timing with persistent straying[3]
- Strays can influence wild populations ecologcally
  - Straying can reduce effective size of wild population
  - Compete for mates.
  - Compete for spawning sites.
  - Hybrid offspring compete with wild offspring

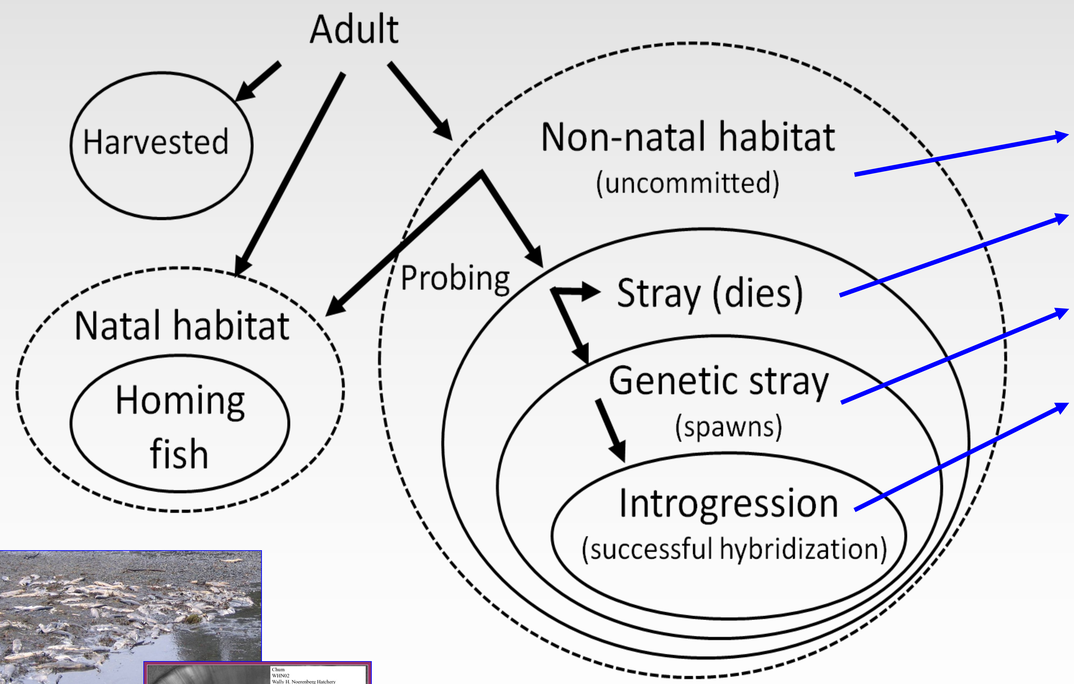


Genetic effects of straying

- Colonize new habitats
- Hybridization may produce mal-adapted offspring
- Straying can lead to genetic swamping (Ryman-Laikre effect)[4]
- Introgression can lead to reduced fitness of wild population.
- Persistent straying reduces genetic diversity among wild populations.

What influences straying?

- Life history differences among species
- Size of hatchery release
- Method of releasing & imprinting
  - -remote releases
  - - freshwater-salt water transition
- Distance from release site

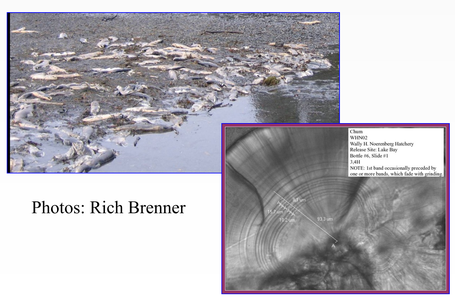


Not all 'stray' fish spawn

- Some fish probe into but will eventually home to their natal area
- Some fish die before spawning—naturally or by predation
- Some fish spawn with wild fish to produce hybrids.
- Introgression occurs only when hybrids survive, return and spawn

How to identify a stray?

- Physical marks—CWT, thermal
- Genetic marks
- In-season identification is difficult.



Photos: Rich Brenner

References:

1. Sundstrom LF *et al.* 2004 Hatchery selection promotes boldness in newly hatched brown trout . . *Behav. Ecol.* 15:192-198.
   Fritts AL *et al.* 2007 The effects of domestication on the relative vulnerability of hatchery and wild origin spring Chinook salmon to predation. *Can. J. Fish. Aquat. Sci.* 64: 813-818.
   Kowstow KE. 2004 Differences in juvenile phenotypes and survival between hatchery stocks and a natural population provide evidence for modified selection due to captive breeding. *Can. J. Fish. Aquat. Sci.* 61: 577-589.
   Araki H *et al.* 2008 Fitness of hatchery-reared salmonids in the wild. *Evol. Appls.* 1: 342-355.
2. Ford MJ 2002 Selection in captivity during supportive breeding may reduce fitness in the wild. Cons. Biol. 16: 815-825.
3. Ford MJ *et al.* 2006 Changes in run timing and natural smolt production in a naturally spawning coho salmon population after 60 years of intensive hatchery supplementation. *Can. J. Fish. Aquat. Sci.* 63: 2343-2355.
4. Ryman N & Laikre L. 1991 Effects of supportive breeding on the genetically effective population size. Cons. Biol. 5: 325-329.