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Effect of commercially available egg cures on the survival of juvenile salmonids.

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Background.

A number of anglers use cured eggs in salmon fisheries throughout the Pacific Northwest. These eggs may either be purchased pre-cured or anglers can purchase the cures or cure ingredients and prepare their own eggs. Typically, the cures consist of a mix of preservatives, dyes, salts, and sugars. However, the exact composition of many cure compounds is unclear due to the proprietary nature of the industry. In 2008, ODFW was approached by a group of anglers who were concerned that some of these cured eggs may be toxic to juvenile salmon. ODFW and OSU researchers have investigated this over the past year. The following is a summary of the research findings.

Methods and Results

The researchers initially tested the effects of 4 or 5 commercially available cures in a laboratory setting. This represents a limited sample of the commercially available cures. The cured eggs were fed to groups of juvenile chinook and steelhead held in tanks over a period of 23 days. The researchers also examined whether there were any differences among pre-smolts (juvenile salmon or steelhead that have not yet reached the physiological state known as a smolt) and smolts (juvenile salmon that are undergoing physiological changes to migrate from fresh

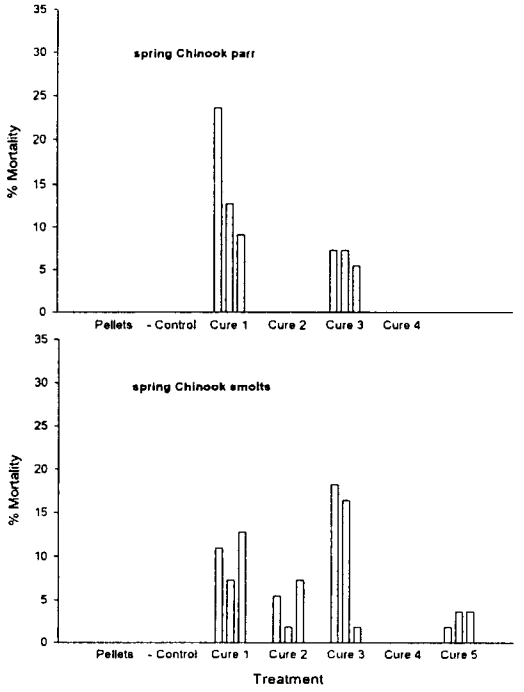

Fig. 1. Mortality of juvenile spring chinook parr and smolts following feeding for 23 d with pellets, salmon eggs (- control), or salmon eggs cured with 1 of 4 or 5 commercially available cures. Bars represent the % mortality in each replicate tank (N=55 fish per tank).

to salt water). Mortality was assessed following each feeding and all dead fish were autopsied.

The results of these experiments confirmed that some of the commercially available cures caused mortality in both steelhead and chinook juveniles (Figs. 1 and 2). In any given tank mortality ranged from 0-30% during the 23 day period. However, researchers also found that there was considerable variability in the individual sensitivity of the juvenile

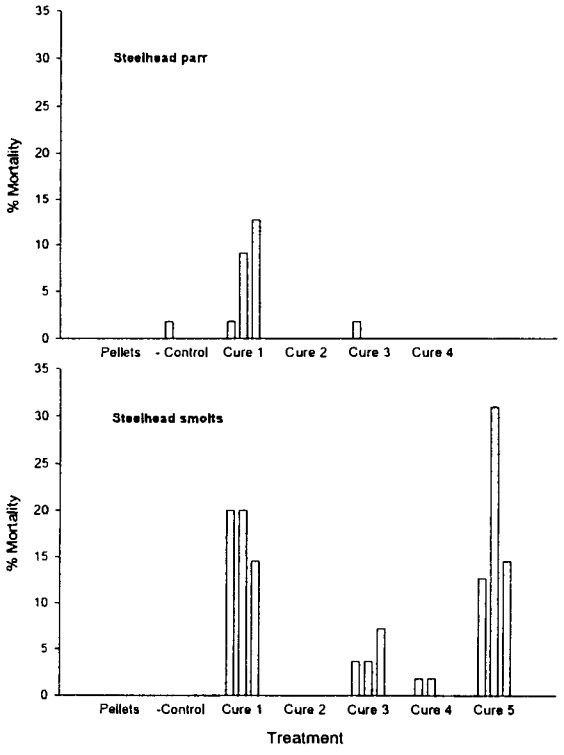

Fig. 2. Mortality of juvenile steelhead parr and smolts following feeding for 23 d with pellets, salmon eggs (- control), or salmon eggs cured with 1 of 4 or 5 commercially available cures. Bars represent the % mortality in each replicate tank (N=55 fish per tank).

fish. Some fish died after apparently eating a single egg whereas most were able to persist after 23 day of (presumably) consuming the eggs.

The researchers then focused on determining the likely cause of this mortality. Based on a list of ingredients supplied by several of the manufacturers, sodium sulfite was identified as the most likely cause. Researchers tested this by removing the sodium sulfite from two of the cures that were used in the first round of experiments. Groups of fish were fed eggs that were cured with or without the inclusion of sodium sulfite in the cure. Mortality was again recorded daily. Removal of sodium sulfite appeared to eliminate the mortality (Fig. 3). To confirm this, the researchers also injected cured eggs directly into the stomach (to ensure consumption of a known amount). Injection of eggs cured with sodium sulfite caused 30-35% mortality within a 10 day period. Removal of sodium sulfite eliminated the mortality (0%).

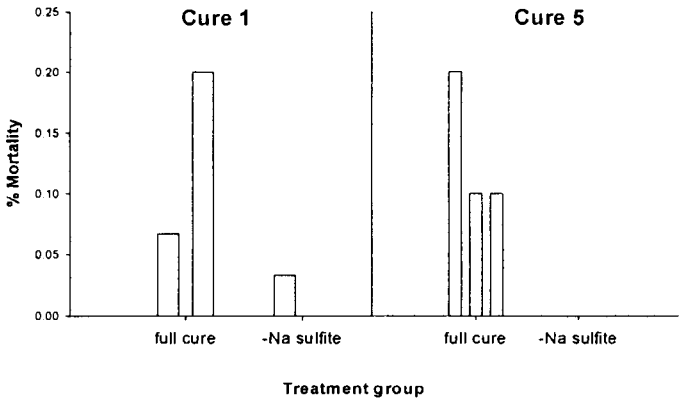

Figure 3. Effect of sodium sulfite on mortality in juvenile spring chinook. The fish were fed eggs that were cured with the full cure or the same cure without sodium sulfite,(N=30 fish/tank)

Researchers also tested whether the effect could be minimized by pre-soaking the eggs prior to feeding, as might occur in the wild. The cured eggs were soaked for 0, 30, or 60 seconds, or 10 minutes prior to feeding. There was no difference in mortality for the pre-soaked eggs as compared to the unsoaked eggs.

Conclusions. Based on these results the researchers concluded that some commercially available cures caused elevated mortality in juvenile chinook and steelhead. The mortality is most likely cause by the inclusion of higher levels of sodium sulfite in the cures. It is also highly likely that fish that consume these particular cures in the wild will respond similarly. However, we have no data to suggest that this may be significant at a population level.

Note: These findings have yet to undergo formal peer review. However, they have been informally reviewed by two independent toxicologists who reached similar conclusions. That is, some cures cause mortality and sodium sulfite is likely involved in the response.