

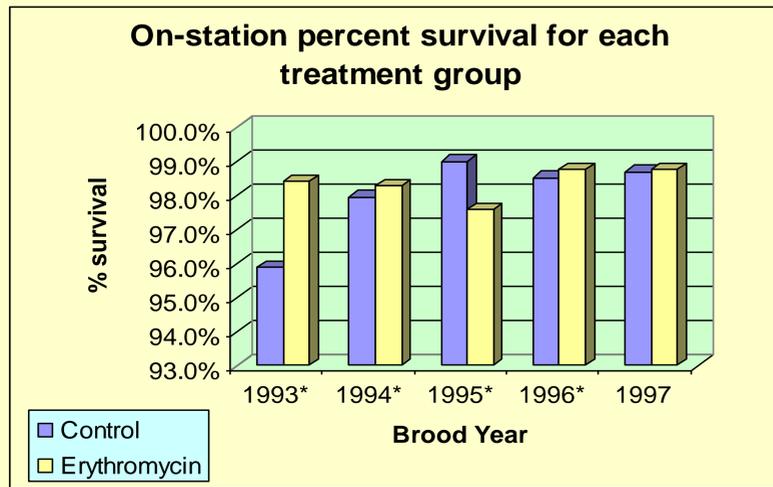


# The Effect of Erythromycin Feed Treatments on Prevalence of Bacterial Kidney Disease and Survival of Spring Chinook Salmon at an Oregon Hatchery\*

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### Juvenile survival

A 2x2 Chi-square analysis found a significant difference in survival at the hatchery in 4 of 5 brood years. Statistically higher mortalities for brood years 1993 and 1994 are due to the presence of BKD in the control ponds. The statistically higher mortality in BY1995 was due to coldwater disease in the erythromycin-treated group. There was very little BKD on-station in 1996 or 1997. The statistically higher mortality in 1996 may have been due to heavier than normal parasite loads in the control group. The erythromycin treatment was apparently effective in reducing mortalities during those years in which BKD was contributing to pond mortalities.

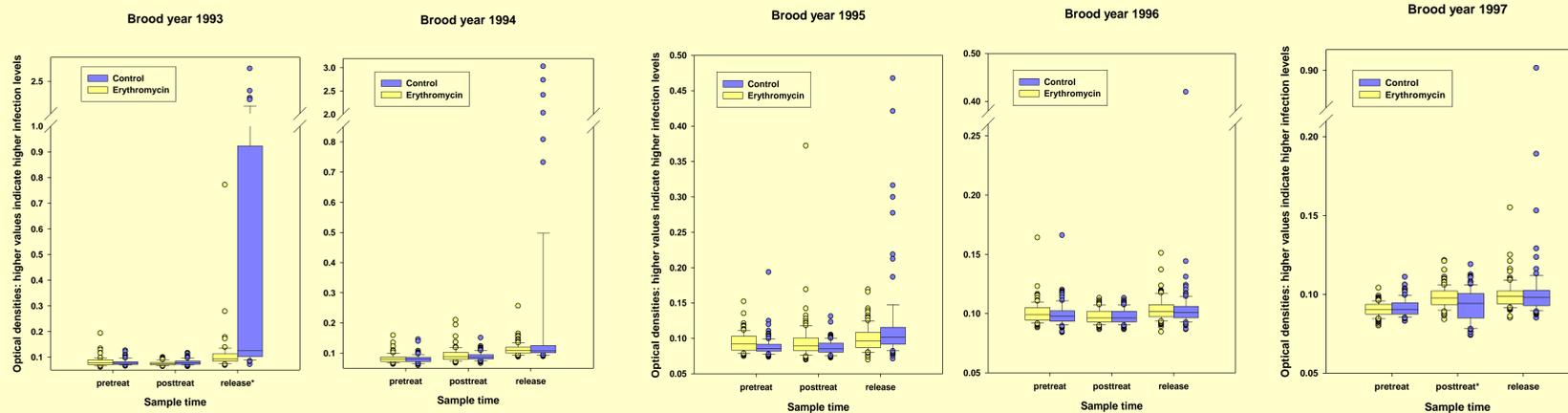
### ELISA testing on juvenile fish for bacterial kidney disease

The Enzyme-Linked Immunoassay (ELISA) for bacterial kidney disease (BKD) is a double-antibody test which detects the presence of the antigen from *Renibacterium salmoninarum*, the bacteria which causes BKD. Individual kidneys from juvenile fish were excised aseptically, processed and assayed by ELISA (Pascho and Mulcahy, 1987; Pascho et al. 1991) to determine the level of infection by *R. salmoninarum*.

Thirty juvenile fish from each of the control and treated raceways were collected at three time periods:

- 1) the day before erythromycin treatment began,
- 2) the day after erythromycin treatment ended, and
- 3) just prior to release from the hatchery into the river.

Results are reported as optical densities for each fish; a higher optical density indicates a higher level of infection.



### Statistical analysis of ELISA data

Optical densities are not normally distributed, therefore, data were transformed with the Box-Cox method (Ecological Methodology, Krebs, 1999) to minimize skewness between data groups within each brood year. Data for each brood year (3 time points and 2 treatment levels) were then analyzed with a General Linear Model and Tukey post-hoc tests, both of which are robust for departures from normality (Biostatistical Analysis, Zar, 1999).

### ELISA results

For each brood year, the ELISA results were significantly higher at release in the spring than before treatment in the previous fall ( $p < 0.001$ ). The only year there was a significant treatment effect was for BY 1993; the control group had higher ELISA values than the treated group,  $p < .001$ . This was also the only year in which there was clinical BKD resulting in epizootic mortalities. The smaller, but still significant, difference in survival for BY1994 due to BKD was not significant by ELISA; however, there was a greater range of OD's in the control vs. treated group. There was no difference at release between the treated and control groups in the remaining brood years. ELISA results for juveniles showed a significant difference in treated vs. control groups only when there were high mortalities due to BKD.

### Introduction

Bacterial kidney disease (BKD), caused by *Renibacterium salmoninarum*, most often results from a chronic, slowly progressing infection that can inflict serious losses in both hatchery-reared and wild salmon stocks. Spring Chinook salmon reared at Warm Springs National Fish Hatchery, Oregon are infected to varying extent with *R. salmoninarum*, and have been treated prophylactically with erythromycin in feed to reduce the prevalence and severity of *R. salmoninarum* infections at the hatchery. The purpose of this study was to determine the effects of oral erythromycin treatment on:

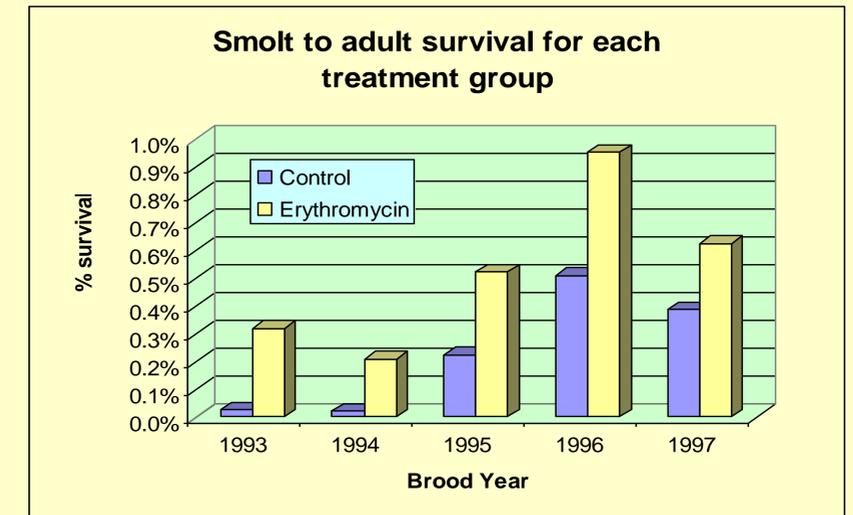
- 1) survival of juveniles in the hatchery
- 2) level of infection of juveniles in the hatchery as measured by ELISA
- 3) survival from release to adult return to the hatchery

### Erythromycin treatment

Juvenile fish in brood years 1993-1997 were treated prophylactically with erythromycin thiocyanate (Aquamycin 100) at a rate of 100 mg/kg body weight in May and September for 21 to 28 days depending on brood year. Erythromycin was incorporated into the feed for the treated group, the control group received the same diet for the same number of days with no erythromycin. Unique coded-wire tags were used to differentiate each brood year and study group. Mortalities were recorded for each raceway throughout the rearing cycle.

### Release and adult returns

Fish from all study groups were released on-station usually in mid-April during their second year of growth (typical spring yearling release). Adult fish from each release were recovered back at the hatchery after spending one to three years in the Pacific Ocean.



### Adult survival

A 2x2 Chi-square analysis found a significant difference in adult return to the hatchery in all 5 brood years. We observed a two to ten fold increase in smolt to adult survival in the erythromycin treated groups. This large difference in adult survival was surprising based on the ELISA results in juvenile fish. We expected an adult survival benefit only in brood year 1993, however, all 5 years showed increased adult returns from using erythromycin medicated feed.

### Conclusions

- 1) Survival of juveniles at the hatchery
  - a) was improved with erythromycin treatments if there was BKD on-station at a high enough incidence to affect mortality;
  - b) but was not improved with prophylactic treatments of erythromycin (when there was no BKD on-station).
- 2) Differences in the level of infection of juveniles in the hatchery as measured by ELISA
  - a) were detected in the control vs. treated groups only when there were high mortalities due to BKD
  - b) were detected over time: OD's were higher at release in the spring compared to before treatment the previous fall.
- 3) Survival to adult
  - a) was significantly higher in the treated group compared to the control group.
  - b) was not predicted by ELISA results in juveniles

There was a clear, consistent benefit to smolt to adult survival from using erythromycin medicated feed, although the ELISA data did not show a difference in levels of infection of *Renibacterium salmoninarum* at time of release.