

**Roundtable Discussion – Final Session of the Bacterial Kidney Disease Workshop
November 17, 2005. Seattle Washington**

What are the next steps we need to take to better understand, manage, and regulate Bacterial Kidney Disease (BKD) and its causative agent, *Renibacterium salmoninarum* (Rs)?

Kevin Amos, NOAA Fisheries. Regulatory and commerce issues:

- Disease control regulations implemented by Federal, State or Tribal governments need to be science-based.
- States need to determine if their intent is to regulate the disease (BKD) or the causative pathogen (Rs) and accompanying regulations and policies should reflect the management intent.
- On a national basis, it is desirable to have consistency in regulations from state-to-state, recognizing it is within a State's or Tribe's right to have disease control regulations that are more strict than national standards. It should also be understood that if a State or Tribe chooses to have policies stricter than national standards, they should have justification for their appropriate level of protection ("ALOP") and the BKD control program in place should be consistent with their policies and regulations.

Hugh Mitchell, Novartis Inc. Veterinary practitioner

- Support a state-by-state risk assessment, preferably a quantitative RA, to provide a science-based rationale for regulations.
- Fighting disease takes a multidisciplinary approach and that any "silver bullet" is the exception, not the rule. BKD research should be distributed without neglecting any of the 5 key areas of disease control: 1) Genetics, 2) Risk factor identification/mitigation, 3) Bacterial load reduction rearing methods; 4) Early disease diagnosis / treatments, and 5) Vaccines. These all compliment each other in producing and maintaining BKD. All too often the pursuit of disease controls ignores the inter-relationships and/or puts too much emphasis on the latter two.
- There is a dearth of BKD epidemiological research and risk factor identification (see above). Statistical projects like: multivariate and odds ratio analyses across state/federal hatchery systems with varying degrees of BKD would yield valuable information into those factors that predispose to BKD. More scientific models of *Renibacterium salmoninarum* infection and BKD occurrence in populations (species and strains) are needed in order to better understand the disease progression, especially in relation to factor of 2).
- Technological advancements into rapidly/instantaneously measuring the clinical and sub clinical effects of BKD in populations (e.g.: growth and the feed conversion ratio) would be invaluable in tracking which production measures and fish health tools produce incremental effects in fighting the disease (e.g.: the effects of a particular vaccine may be useful, but not all or nothing).
- Vaccination application technology can be as important as the vaccine itself, in making a vaccine effective. The fact that fish are numerous and of relative low value can be an impediment to the adoption of a technologically advanced immunoprophylactic tool.
- Sociological research into the perceptions and attitudes of hatchery workers/managers should not be ignored in instigating any control program. These can be as crucial to a control program as any technological tool.

Keith Johnson, Idaho Dept.of Fish and Game. State fish agencies' perspectives on research needs for BKD

Diagnostics:

- Non-lethal sampling methods.
- Defining risk of vertical transmission in a manner similar to that currently used in ELISA.
- Improved targeting of diagnostic test based on immunogens.
- Understanding why bull trout kidney tissues often cross react with current KPL ELISA test systems yet fail to yield positive test results with PCR, FAT, etc.
- Implementation of qPCR in temporal sampling of cultured lots to allow improved therapy applications.
- Need for standardization within qPCR assays (sample collection of focal infections, positive controls, single copy sequence tests).

Vaccine Development:

- Identification of immunogens that salmonids recognize to provide a protective response.
- Improvement in delivery systems in order to become cost effective.
- Examination of “strains” of *R. salmoninarum*.

Therapy:

- Complete registration of erythromycin.
- Additional antibiotics needed to treat BKD.
- Defining antibiotic resistance mechanisms.
- Implementation of qPCR into post-therapy efficacy evaluations.

Water Supply Issues:

- qPCR applications of establishing risk of adult anadromous salmonids released into hatchery water supplies, same for resident species in the water supply. Add to this use of carcasses for nutrient enrichment.
- Investigate efficacy of various water depuration methodologies.

Fish Culture Practices:

- Determination of shedding rates over time post-exposure in an infected population.
- Determine the role of the several strategies to break the vertical transmission of BKD (culling, segregation, density reduction, flow increases) and efficacy of quarantine methods.
- Marking practices confounding therapy timing: NMT MART trailers without re-circulating anesthetic baths, does this offset former concerns identified with CWT practices. Utility of vaccination component of these trailers.
- Validate claims of feed manufacturers on enhanced diets for cost/benefit ratios.

Epidemiology:

- Defining the role that BKD plays in “delayed mortality” of Snake River Sp/Su Chinook. This was identified in 2004 Comparative Survival Study workshop.
- Prevalence and intensity of infection in key anadromous salmon natural populations.
- Fate of BKD in released trout into watersheds with natural susceptible trout species and whether it persists over time.

Regulatory:

- Is there a regulatory significance to “low level” detections from a risk stand-point. Ever present, long-standing regulatory “pathogen-versus-disease” issues.

Per Heggelund, Aquaseed Inc. Private aquaculturist:

- Raised the issue that the regulatory climate, including disease regulations, has prevented or reduced growth in the aquaculture industry, consequently, the industry has been outsourced to foreign countries.
- BKD is a difficult disease to manage in ESA restoration programs due to policies which require sourcing eggs and fry from redds, thus preventing the use of prophylactic measures in adult salmon.
- Need to develop non-lethal tools to test for pathogens.
- The cut-off points for testing, be it ELISA or PCR are not clear. Need definition in relation to true disease threat.
- In order to be successful now and in the future in aquaculture, need to have ability to move live product. Current commerce/health rules prevent commerce that is low-risk.
- Need mechanisms to reduce costs of transactions for health certificates, such as e-certificates and transfer permits.

Mark Strom, NOAA Fisheries. Researcher: Research Needs

- Improved diagnostics
 - rapid
 - specific

- non lethal
- validated
- Better understanding of fish immune system
 - biomarkers of function
 - antigen trafficking
 - antigen presentation
- rational vaccine design
 - appropriate antigens to stimulate a protective immune response

Specific *R. salmoninarum* Research Areas that should be targeted

- How variable are Renibacterium isolates and do variations correlate with disease severity?
- Development of repository of strains with detailed case histories
- Whole genome microarray
- What is the nature of the Renibacterium putative extrachromosomal element and does it contain additional virulence factors besides msa?
- Are there additional invertebrate/vertebrate hosts?
- What cytokines are associated with protective immunity and how are they best induced?
- Development of high throughput assays to assess vaccine candidates.