

WLAP – Aquaculture Waste Control Regulation SAG Teleconference Meeting Minutes

Wednesday, December 19, 2001 (10:00 AM to 12:10 PM -hosted by RRU)

Recorder: Nancy Kwong (RRU)
Attendees: Asit Mazumder (UVic)
Tom Pedersen (UBC)
Scott McKinley (UBC)
Doug Bright (RRU)

Agenda:

1. House keeping issues and general comments;
2. Discussion on key documents (electronically circulated):
 - Waste Management Act Aquaculture Waste Control Regulation, DRAFT AMENDMENTS #14 December 03, 2001 ([WLAP document](#))
 - Re-Analysis of Relationships Between Sediment Chemistry and Infaunal Macrobenthic Community Responses, Based on Brooks (2001) Data ([Bright document](#))
 - Performance Based Standards and an Environmental Management System for the British Columbia Salmon Farming Industry – Economic and Technical Considerations ([BCSFA document](#))
3. Recommendations for knowledge needs towards next round of improvement in the regulation.

1. General Comments:

SAG members interactively discussed general issues arising from mandate and development of draft regulation in general.

Issues arising:

- Compressed timelines and pressures – SAG members not willing to jeopardize professional credibility in support of outcome unless it is scientifically defensible.
- There was general discussion about parallels and differences in process and underlying issues with the process on drinking water management initiatives.
- With regard to the aquaculture regulation, it was emphasized that limited data available, mostly in the Brooks (2001) study, is inadequate for use in establishing hard performance-based standards. SAG re-iterated their recommendation for adoption of an interim regulation that will be re-visited in 3-5 years.
- Interim period should be an active period wherein resources are committed to addressing critical knowledge needs. The SAG will provide concrete recommendations for follow-up studies that will allow improvement of the interim regulation and/or provide confidence in the approach and particulars adopted initially (see agenda item 4)
- One comment that this (recognition of an interim reg.) could allow a more liberal standard initially.
- General re-iteration by all SAG members of the importance of having a tiered approach. The regulated community should be able to respond to early warning indicators. Industry should also be provided an opportunity to invest in detailed studies that better addresses site specific responses to waste discharge provided that these demonstrably contribute to an environmentally sustainable industry (e.g. not just total Zn in sediment, but the biologically



available and toxicologically relevant fraction of Zn species present).

- Some discussion of BCSFA's justification of sulfide thresholds based primarily on economic viability arguments. Such arguments undermine other stated commitments that involve no net change in environmental conditions beyond the tenure boundary. SAG agreed that it cannot be influenced by such arguments. SAG expressed interest in meeting with stakeholders (e.g. Brooks, BCSFA) directly as part of Feb. 7th open forum, perhaps initially in camera. The scientific rationale for 6,000 uM (based on Bay of Fundy study) was rejected. ... noted that assertions did not even respect conclusions by Brooks (2001) for BC sites.

ACTION: Bright to request that time be set aside at the Feb. 7th Open Forum for SAG to discuss technical issues with industry participants.

- Concern that documented assertions are being made about adherence to practices that involve no statistically significant deviation in the benthic community from reference conditions. Bright pointed out that several sites already exhibit a departure from the range of reference site conditions at considerable distance from the footprint (up to 75 - 225 m away) based on sensitive multivariate community techniques (which are likely to be much more sensitive than species richness). This doesn't necessarily mean that the ecosystem has been adversely affected, however. The concept of ecosystem health is a subjective rather than hard scientific construct. Species shifts might involve changes without being valued as either good or bad. While the concept of "no net deviation" is easier scientifically and administratively than some other environmental protection goals, it does not address the ecological significance of environmental change.
- Use of taxon richness is obviously an alternative. We don't know what the larger implications are however for overall ecosystem functioning of loss of a certain percentage of the taxon richness as opposed to loss of key species. Benthic indices based on ecologically important and otherwise valued groupings might be a useful basis for assessing degradation in the future (see Bright – table 2: taxa listed as category 1 to 4: sulfide facilitated to enrichment intolerant).
- It appears that current site selection criteria may neglect some ecologically/environmentally important species. (Can protection of benthic community functioning, by extension, also prevent impacts to other important biota such as transitory epifauna?)

Discussion of 2. the Draft Reg. and 3. BCSFA proposal

- SAG recognizes a few weak technical aspects. For example, regulation of Cu, Zn does not reflect scientific understanding of environmental fate processes that control bioavailability and toxicity.
- Question about whether we know enough about characteristics of feed and faecal waste to rule out loading onto seabed of other substances such as mercury (or organochlorines). Health Canada measures contaminants in tissues of ~ 200 fish/yr to protect against human health risks, but no concerted effort to look at cumulative loading at aquaculture sites and effect on organisms other than humans (the fish data are also deemed to be confidential, and are not available publicly). SAG recognized current efforts of aquaculture agencies to improve quality of feed. The feeling, however, was that in terms of environmental sustainability and life-cycle assessment, there is a need to create an even **more firm management link between assessment of the nature of the feed materials and waste discharges**. Agreed that too little is known about this issue to credibly suggest incorporation into regulatory strategies. This should go in the knowledge gaps category for possible re-visiting in the interim period.



- Good discussion about the viability of using a “**maximum allowable load**” concept to limit organic carbon inputs to below sediment assimilative capacity (refer to conclusions by Findlay and Watling, 1994, for example). It was pointed out that the issues get really complicated very quickly. Organic carbon assimilative capacity is directly related to oxidant abundance, including both O₂ and sulfate. Question is not how much organic matter can be broken down (e.g. by sulfate-reducing bacteria) but how much of the metabolic byproducts (sulfide) can be tolerated by resident biota. View that regional assimilative capacity (and regional carrying capacity) are probably not being approached under current conditions, except in poorly flushed locales. Need to place waste discharge in context of high naturally occurring organic C loading plus other anthropogenic sources. Suggestion that this logic actually supports need for furthering “maximum allowable load” concept (SAG also recognizes and applauds the current efforts by WLAP and MAFF personnel to refine linked models for better assessing and predicting implications of waste input at a variety of geographic scales in the B.C. coastal zone).
- Discussion on proposal for a **30 m “initial impact zone”**. SAG recognizes the design characteristics that allow for lateral drift of structures and billowing of nets. Agreed that the industry is unlikely to intentionally design for greater current – induced drift from a narrower foot print, given other disadvantages. If, however, regulation includes various zones, the actual foot print of operations must be legally and firmly defined. Some current net pen locations, it was noticed, do not even appear to respect existing lease boundaries, and this is important for the application of a performance-based regulation.
- **Monitoring of Non-depositional Environments:** SAG is collectively skeptical of the value of video monitoring techniques to facilitate environmental protection goals as might be established in a performance-based standard (see also our comments in our first report to WLAP on this issue). It was argued that better techniques are being used by the Norwegians and there are a number of alternatives that offer better promise; for example, use of artificial substrate colonization or other mesocosm studies. In particular, hydro-acoustics appears to have the potential to allow for mapping of zone of influence and detecting changes in the attached biological community.

Action: McKinley to provide a brief summary for further discussion of use of hydro-acoustics and other techniques as an alternative to video survey techniques. McKinley also to provide a copy of the Norwegian regulations.

Question arose as to the expected return for the industry of hydroacoustic and other more sophisticated techniques (while the techniques are currently available, there are a limited number of qualified practitioners, and acquiring their services is not likely to be cheap). SAG felt that ROV and diver-facilitated video ‘sampling’ was likely to comprise a large financial commitment by aquaculture site operators (one firm spends ~ \$1 m annually on scuba diving to inspect nets; video surveys would probably be more intensive than this, albeit at a much reduced frequency). Given the uncertainty about the scientific and regulatory value of video surveys, alternatives should be actively pursued following adoption of the interim reg.

- **REDOX measurements as a regulatory requirement:** While SAG sees the value of sulfide measurements as a chemical surrogate, our experience is that use of a Redox electrode is likely to lead to data artifacts due to a tendency for continuous drift and need to arbitrarily decide when to record the ORP, in addition to susceptibility to microzone variation. Bright explained that Redox and TVS were justifiable only as secondary measures; i.e. as quality control checks against the reported sediment sulfide data. SAG members argued against this approach. SAG advocates instead that an independent monitoring and audit function



better served to ensure that industry collected and reported data accurately reflects environmental conditions.

- **INDEPENDENT OR REGULATORY AUDIT FUNCTIONS:** SAG strongly recommends that the regulation be revised to include a new section on audit/quality assurance requirements. This should specify responsibility in terms of personnel and costs for audits of environmental performance, self-reporting, and self-management, the minimum number of (random?) audits over a given time period, conditions deemed to constitute a pass or fail, and the consequences of these.
- **Sulfide measurements:** SAG expressed concern that an operational use of sediment sulfide concentrations as a regulatory tool could be problematic given the anticipated lack of precision of the performance indicator. Sulfide pore-water concentrations are likely to exhibit very steep gradients in the near-surface sediments. Further, use of a grab sample is likely to disturb the top 2 cm based initially on the pressure wave from the descending grab, and secondarily based on plastic deformation of sediments when the grab closes – especially in poorly consolidated organic oozes. After this, it is difficult to conceive how field personnel can precisely remove 2 cm of surface sediment, as opposed to 1 – 4 cm depth, across the surface of the grab. The increased variability of sediment sulfide levels based on techniques that are hard to apply with precision relative to an operation definition of sediment sulfide may have influenced in part Brooks (2001) observations about variability in biological response thresholds. In addition, SAG asserts that sulfide measurements taken during the focus study represent optimum conditions with regard to data quality relative to prospects for routine application of regulatory requirements.

While we don't see any easy "quick fix" for this problem, we certainly see the imminent need for development of better assessment tools, such as use of "peepers". Overall, concerns about precision of reported sulfide values reinforce our request for a strong independent audit function to ensure the long-term credibility of important data.

On a related note, the SAG sees major benefits in a requirement for training and certification of environmental monitoring personnel in support of administration of the regulation.

- **TVS:** Aside from some limited scientific information on the relationship between total volatile solids and total organic carbon [(TVS = 0.009 + 1.59*TOC) according to Brooks, 2001] the SAG was not sure how this measure related to marine environmental quality. It was pointed out that organic N and organic C budgets better relate to coastal eutrophication. While TVS might be of limited value initially, it was suggested that studies be undertaken to assess relationship between this and organic C, N, P fractions.
- **Sediment Grain Size Analysis:** Particle size is an important co-variate of benthic infaunal responses to waste inputs as well as early diagenetic changes. It is not obvious, however, how the ongoing (annual?) measurement of grain size within the lease boundary would provide information of relevance to either day-to-day environmental management or regulatory decisions. SAG felt that this should definitely be a part of data collection requirements in the pre-operational period (for siting purposes), and again following lease abandonment, it may not be necessary for ongoing operational monitoring.
- **Other potential stressors - Ammonia**

Bright earlier proposed that ammonia toxicity or other effects might be an issue. The SAG agrees that, while information is available on toxicity thresholds for individual species based on laboratory toxicity tests, little if anything is known about interrelationships between



sediment ammonia levels and marine benthic community impairment. In many cases, it might be expected that elevated sulfide (from sulfate reduction) and elevated ammonium (as a breakdown product of N-containing macromolecules) in pore water, owing to excessive organic carbon inputs, would co-vary within a relatively narrow stoichiometric range, provided that dissolved iron in pore water was sufficiently low to not otherwise scavenge the sulfides in an insoluble form (dissolved iron concentrations are expected to be sufficiently low to preclude this as a major factor at most sites). On the other hand, anecdotal evidence suggests that sulfide alone cannot explain benthic community responses at the focus study sites. Ammonia, therefore, is flagged as an issue that requires resolution following the initial adoption of the interim regulation.

- **Implementation and administrative issues:**

- reg. should allow for an early warning system;

- as initial threshold is being approached, should be required to contact regulator and enter into discussions on pollution prevention strategies.

- ideally, opportunity to address environmental performance short-falls is during transition period from one production period to the next (e.g. annually) toward longer term goals, rather than through the need for drastic operational changes in the middle of an aquaculture operation period.

- above all, building on major outcomes of the Salmon Aquaculture Review and a variety of other deliberations, SAG stresses the need for a regulation that embraces harmonization with the goals of other regulatory agencies, including Federal agencies, and for the need for independence in enforcing/encouraging environmental sustainability through administration of the regulation. (Bright commented that BCSFA in their document apparently misconstrued the appropriate relationship between performance-based regulatory compliance and adoption of an environmental monitoring system, EMS. These do not occur at poles of an evolutionary spectrum, but are both advocated in parallel, since the regulation provides public assurance of the appropriate level of influence on non-private resources, while an EMS is an internal management tool best suited to setting internal corporate (not necessarily societal) goals and gauging success in achieving them, with respect to environmental externalities.

- gathering and interpretation of regulatory compliance data should be accessible by and transparent to the public.

4. Knowledge gaps:

- feed analysis and relationship with waste quality (to determine if Hg is an issue)?
- Regional carrying or assimilative capacity taking into consideration nutrient flux (N, P, C)
- “initial impact zone” determination of an acceptable distance that is scientifically defensible
- redox potential requirement
 - any other criteria that could be used in a practical manner?
- relationship between TVS, %N, and %C?
- sulphide measurement and analysis
- larger ecological relevance of decreased species richness; possibility of supplementing or replacing with indices of functional impairment based on ecologically allied taxa?



- alternatives to seabed video surveying (rock/gravel cage artificial substrate studies, remote sensing approach, hydro-acoustic)?
- relationship between NH₃ and benthic community impairment?

Action Items:

- Doug to propose to Kathleen to arrange for SAG to have an in-person meeting with BCSFA
- Scott to provide information on alternatives to seabed video surveying
- Scott to provide Norwegian regulations on fish farming
 - which parameters are monitored against what thresholds?
- Scott to consult with Norwegian colleagues regarding sulphide measurement threshold
 - supplemented with relevant references

Timeline:

<u>Current</u>		<u>Proposed</u>	
Monday, December 31, 2001	○ comments to Technical Co-ordinating Team (TCT)	Monday, January 7, 2002 (on or before)	○ comments to Technical Co-ordinating Team (TCT)
Thursday, February 7, 2002	○ SAG Meeting	Thursday, February 7, 2002	○ breakfast “in camera” session BCSFA – SAG Meeting (for a few hours) ○ TCT-SC-SAG meeting to follow

Next Meeting:

Thursday, February 7th, 2002

(SAG to correspond electronically in interim to report back to WLAP on the interim regulation)