Deliberations of the Scientific Advisory Group (SAG)

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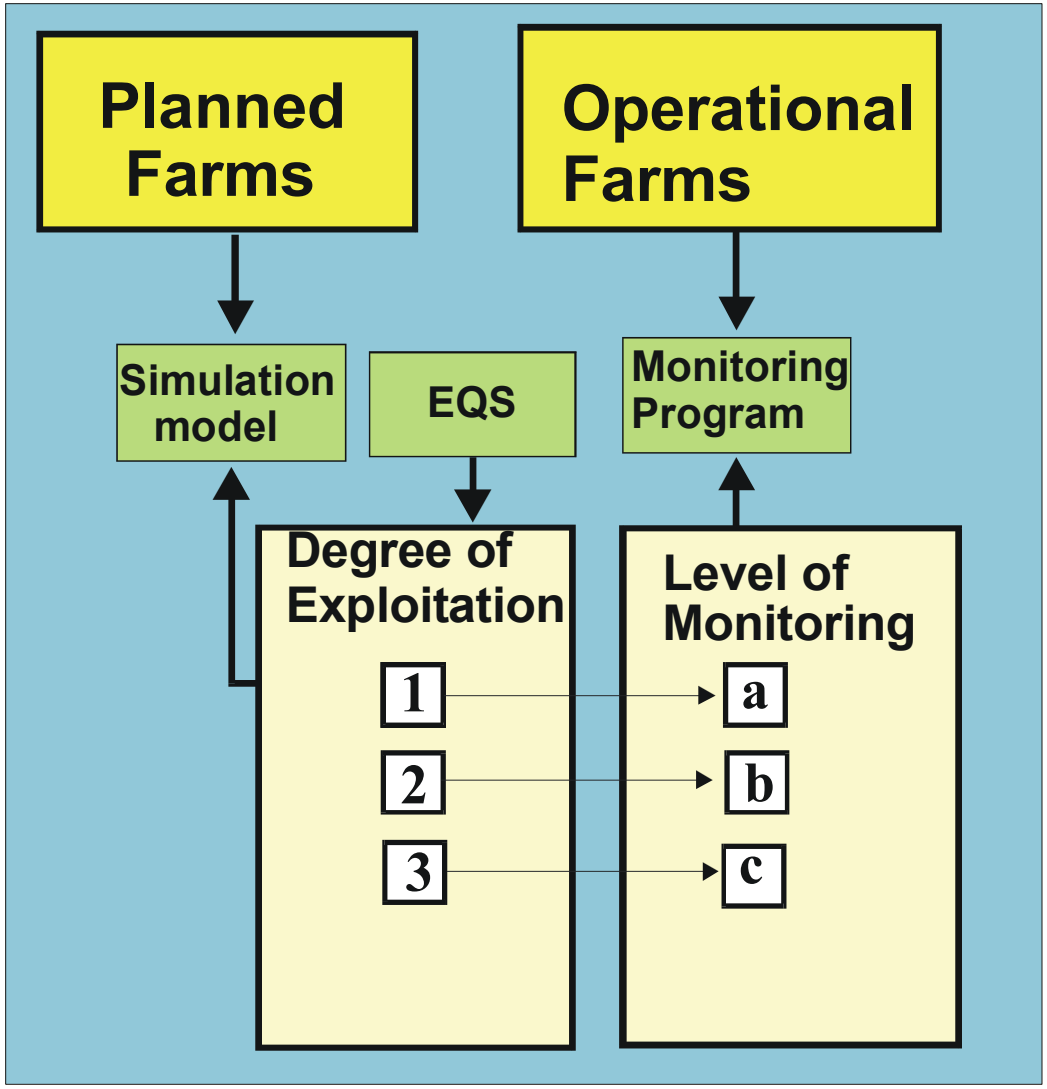
Critically Important Issues Not Addressed Under the Draft Regulation

- **CUMULATIVE EFFECTS NOT ADDRESSED Within Framework: Waste Management Act as Enabling Legislation is Best Suited to Managing Individual Operations**

- **MAXIMUM LOADING Based on Assimilative Capacity**

  (Need to manage in consideration of all coastal inputs, not just aquaculture)

- **Need Formal, Effective Mechanism to Fix Several Important KNOWLEDGE GAPS**



Norwegian situation

New fish farms:

model predicts degree of exploitation versus impact.

Operational farms:

monitoring performed

Apply Env. Quality Stds.

which discriminate levels of impact

Monitoring Level of Effort

commensurate with degree of expoitation and expected impact.

Focus is on biological monitoring, not chemical surrogates

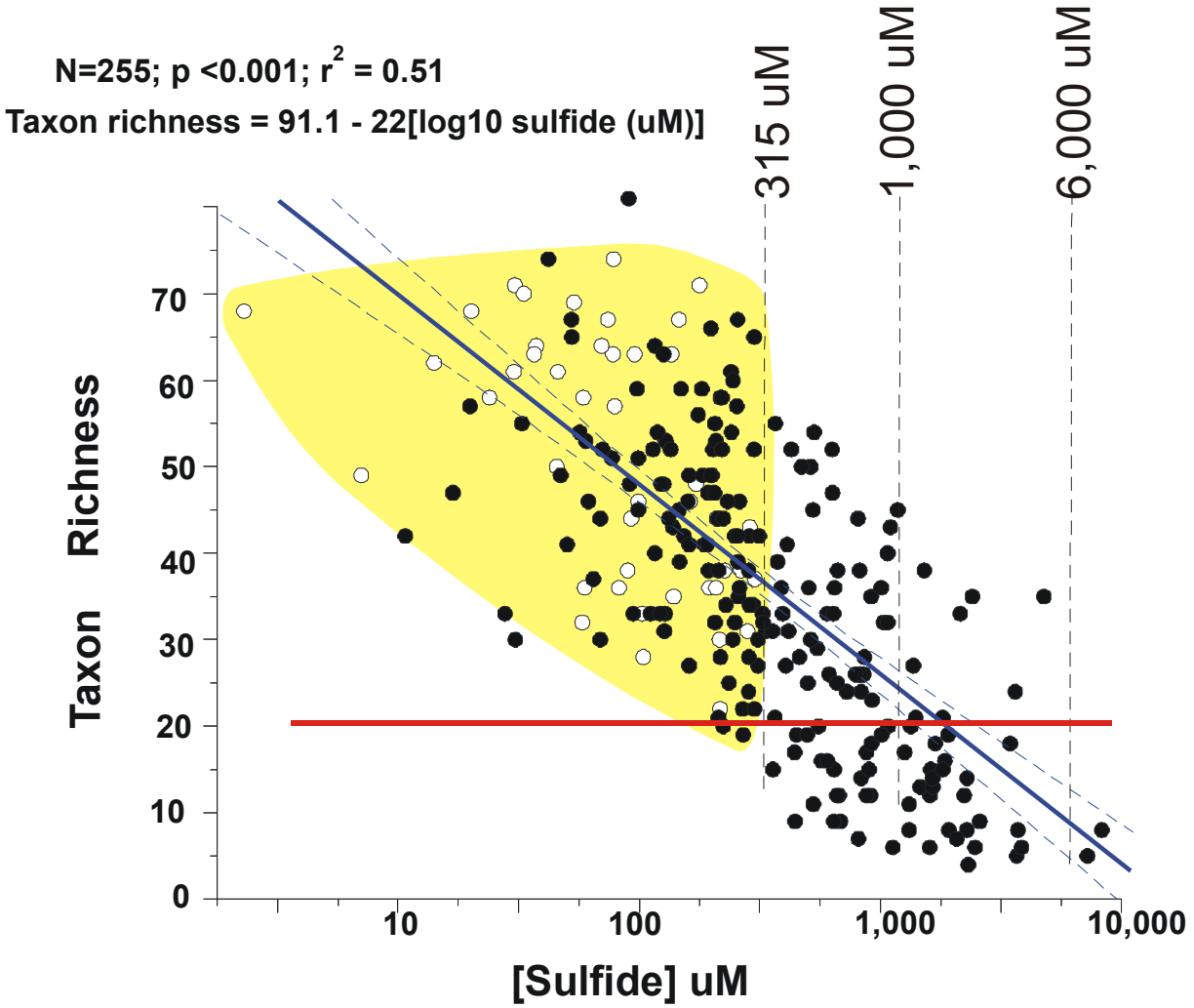
So what about sulphides ??

- Measuring sulfide in top 2 cm of sediment tells us nothing about what is happening in ecologically important surface sediment depths
- Steep concentration gradients in sulphides near surface lead to high variability in measured concentrations

- Link between sulphide and ecological impairment is tenuous – there is definitely a relationship but it is highly variable across sites
- Finding consensus on generic sulphide threshold for protection will not be possible

Relationship between benthic community impairment and sediment sulfide levels (adapted from Brooks, 2001).

Open symbols are data for reference sites (≥ 300 m)



Sulphide level associated with a 50% species reduction – 30 m from net pen

	Low Salinity	Medium Salinity	High Salinity
Fine Grained	65 uM	190 uM	350 uM
Medium Grained	260 uM	720 uM	1300 uM
Coarse Grained	730 uM	2100 uM	3900 uM

- Mean sulfide concentrations shall be significantly ≤ 6000 µM at 30 metres outside of the Direct Impact Zone (statistical test: one-sided *t-test*, α= 0.05).

Supporting Comments

Sulfide levels below this level generally support a high level of biodiversity & sediment impacts that may occur remediate very quickly. A sulfide level of 6,000 µM is considered the transition to an anaerobic environmental condition (Wildish, 2001).

BCSFA, Oct. 2001

What Wildish *et al.* (2001) actually said:

"In the present study we identified organic enrichment impacts of the order of tens of meters. This is consistent with a severe effect near the centre of the steel cage array, which persisted with negative redox and sulfide > 6000 uM, for ~12 mo after cessation of salmon feeding."

Other things we've heard during deliberations

- **Siting will be most important aspect that limits environmental effects**
- **…but there aren't enough higher current sites, so there is a real possibility of expanding in fine-grained, more sheltered areas**
- **Net-pen productivity levels have not been managed in the past in consideration of the capacity of the receiving environment**

Other things we've heard during deliberations

- **Sediments under or adjacent to all net pens *will* exceed 6,000, and even 10,000 uM sulfide at peak production**

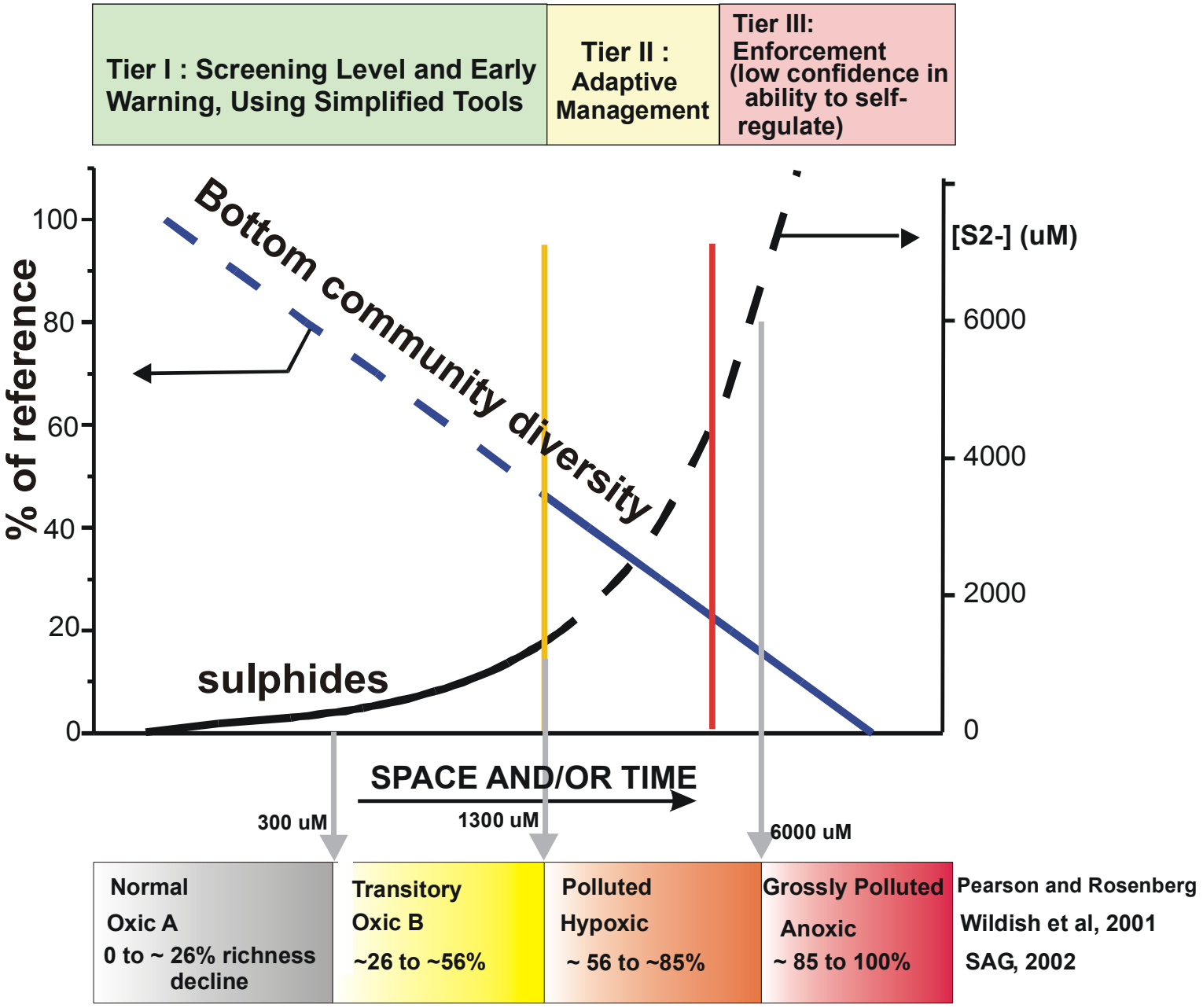
  Lack of info. has resulted in technical debate about this claim

- **What matters more is that sediments recover rapidly**

  the available scientific information does not support claims

Critical Issues

- CUMULATIVE EFFECTS NOT ADDRESSED
- MAXIMUM LOADING APPROACH NEEDED, considering all coastal activities
- KNOWLEDGE GAPS


Tier I : Screening Level and Early Warning, Using Simplified Tools
Tier II : Adaptive Management
Tier III: Enforcement (low confidence in ability to self-regulate)
Bottom community diversity I
% of reference
100
80
60
40
20
0
[S2-] (uM)
6000
4000
2000
0
sulphides
SPACE AND/OR TIME
300 uM
1300 uM
6000 uM
Normal
Oxic A
0 to ~ 26% richness decline
Transitory
Oxic B
~26 to ~56%
Polluted
Hypoxic
~ 56 to ~85%
Grossly Polluted
Anoxic
~ 85 to 100%
Pearson and Rosenberg
Wildish et al, 2001
SAG, 2002