A comparison of the nearfield footprint associated with salmon aquaculture in the Northeast Pacific with some other methods of producing food

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The environmental cost of a loaf of bread
Soil loss from cultivated land in the United States averages 4 tons/acre-year

Soil loss in Washington State's wheat growing area is 4 to 11 tons/acre-year. Soil losses are 16 to 300 times higher in other countries. Topsoil is being lost 17 times faster than it is being replenished.

Categorizing Environmental Costs

- **Category I – common – managed for avoidance.**
  - Fuel spills, navigation hazards, waste, etc.
- **Category II – inevitable costs – managed to control**
  - Metabolic products – nutrient enrichment, energy use
- **Category III – not inevitable but likely - managed to minimize**
  - Metals from boats, nets, feeds, etc,
- **Category IV - possible effects – difficult to detect and characterize**
  - Disease transfer from farmed to wild fish, genetic interaction of farmed and wild fish

Benefits and economic costs associated with salmon aquaculture by a single British Columbia Company

- 2005 production 38,690,000 kg of salmon
  (309,520,000 125 gram meals)
- Production per site = 3,500 to 4,000 mt
- Feed used 45,277 mt
- Biological FCR 1.16
- Water area covered by 38 netpens = 15.2 ha

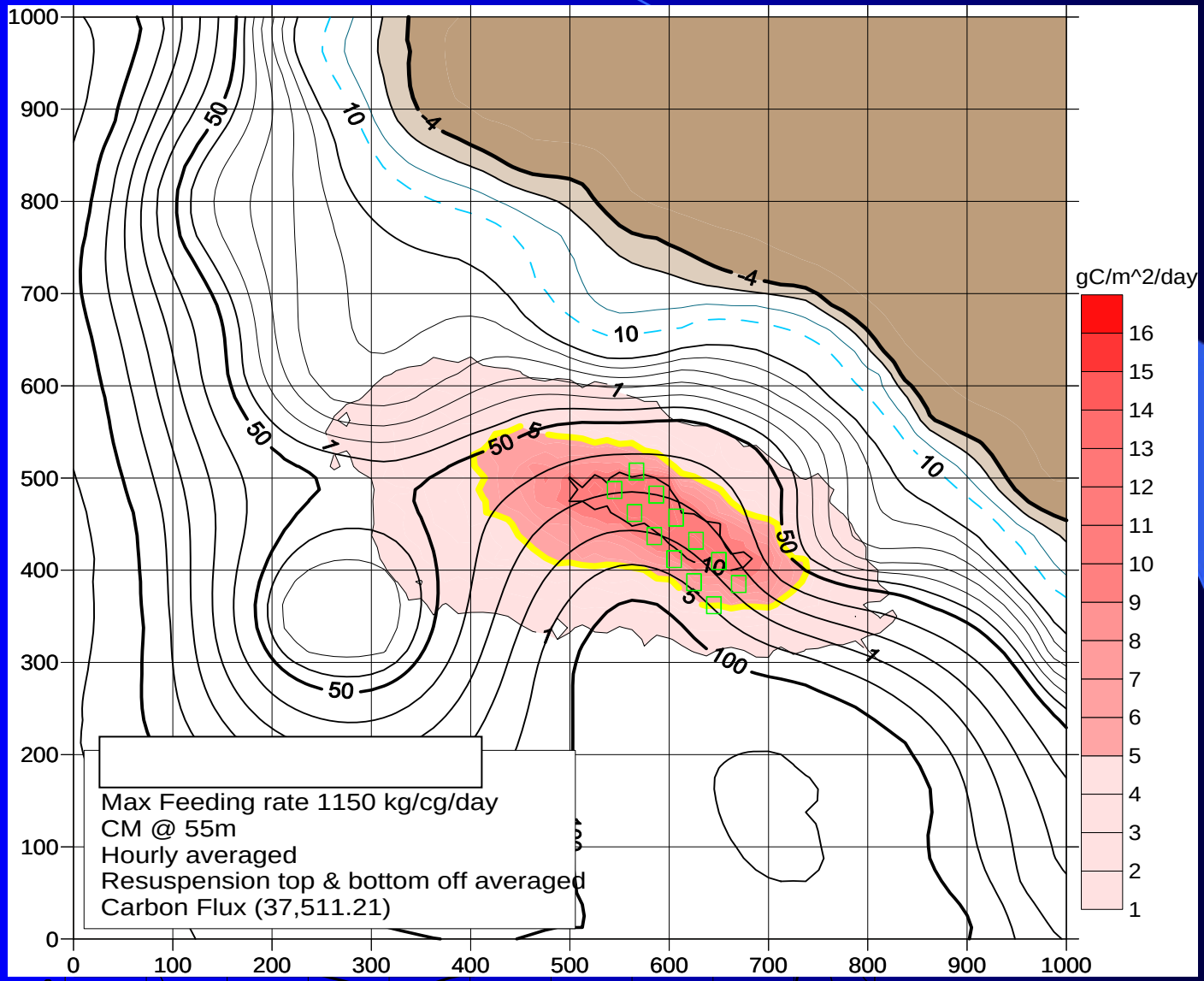
Dissolved nutrients from salmon farms in the Northeast Pacific

- Nutrient concentrations infrequently elevated within 3 m downcurrent of netpens
- Nutrient concentrations never significantly increased 30 m downcurrent in comparison with upcurrent levels
- No evidence from numerous studies that salmon farms affect phytoplankton production

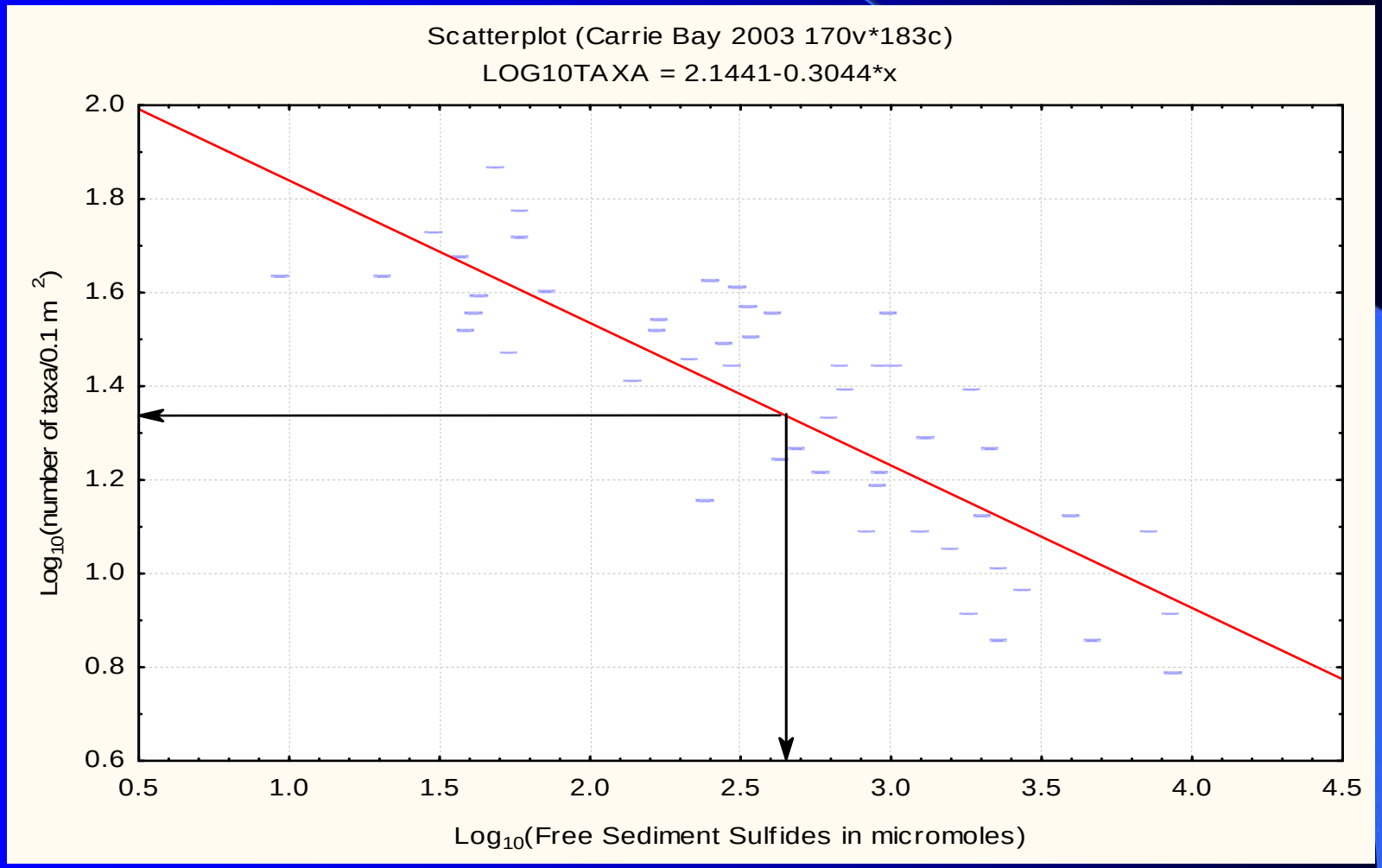
Benthic effects

- Category II hazard.
- Inevitable effect of some kind will occur.
- Effects can be positive or negative.
- Nearfield effects that can be assessed at specific points in time.
- Effects are best managed by proper siting to avoid sensitive areas and production management to avoid long-lasting effects.
- Macrobenthic environments have always been found to naturally remediate.

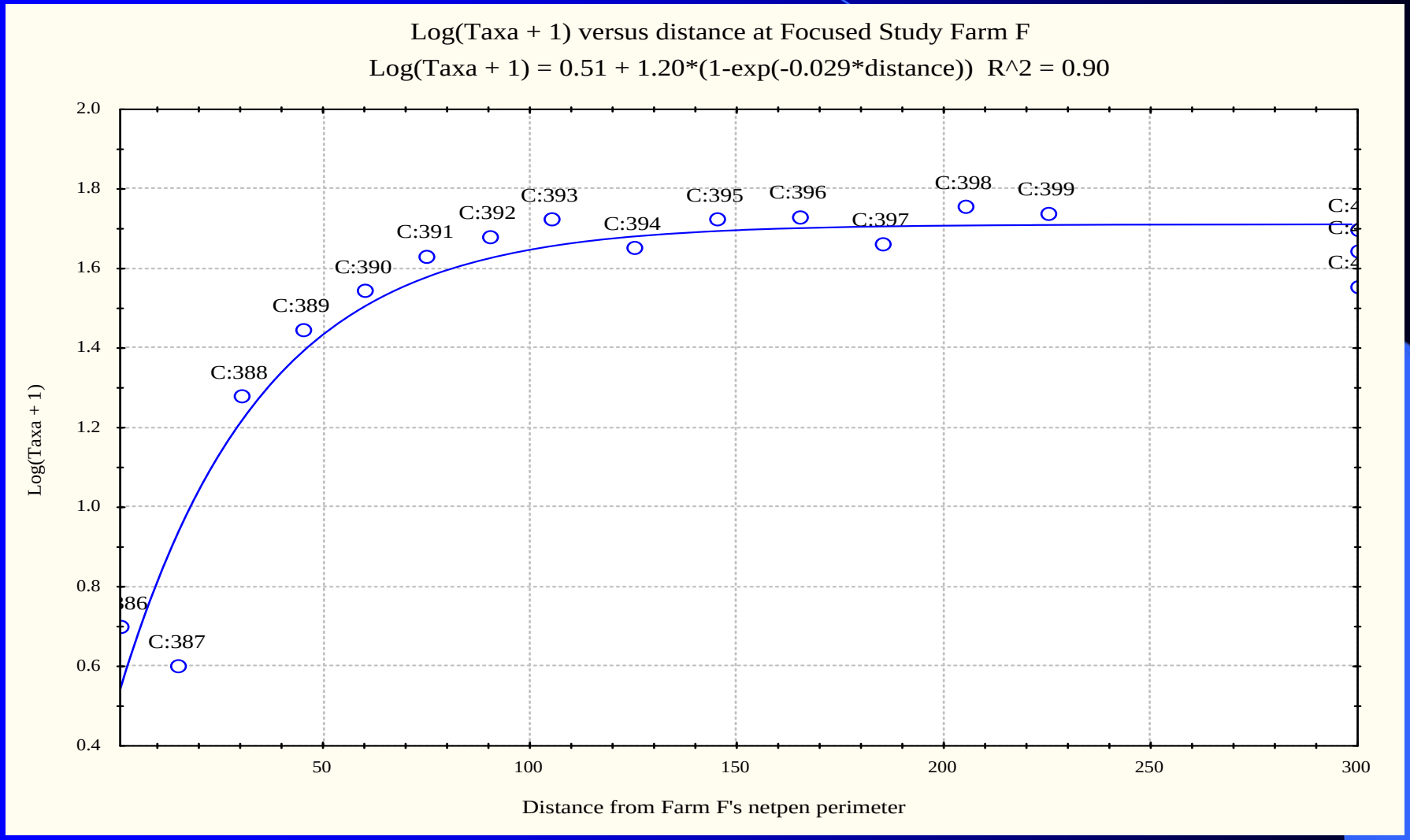
Computer modeling of carbon deposition rates (DEPOMOD) has proven predictive



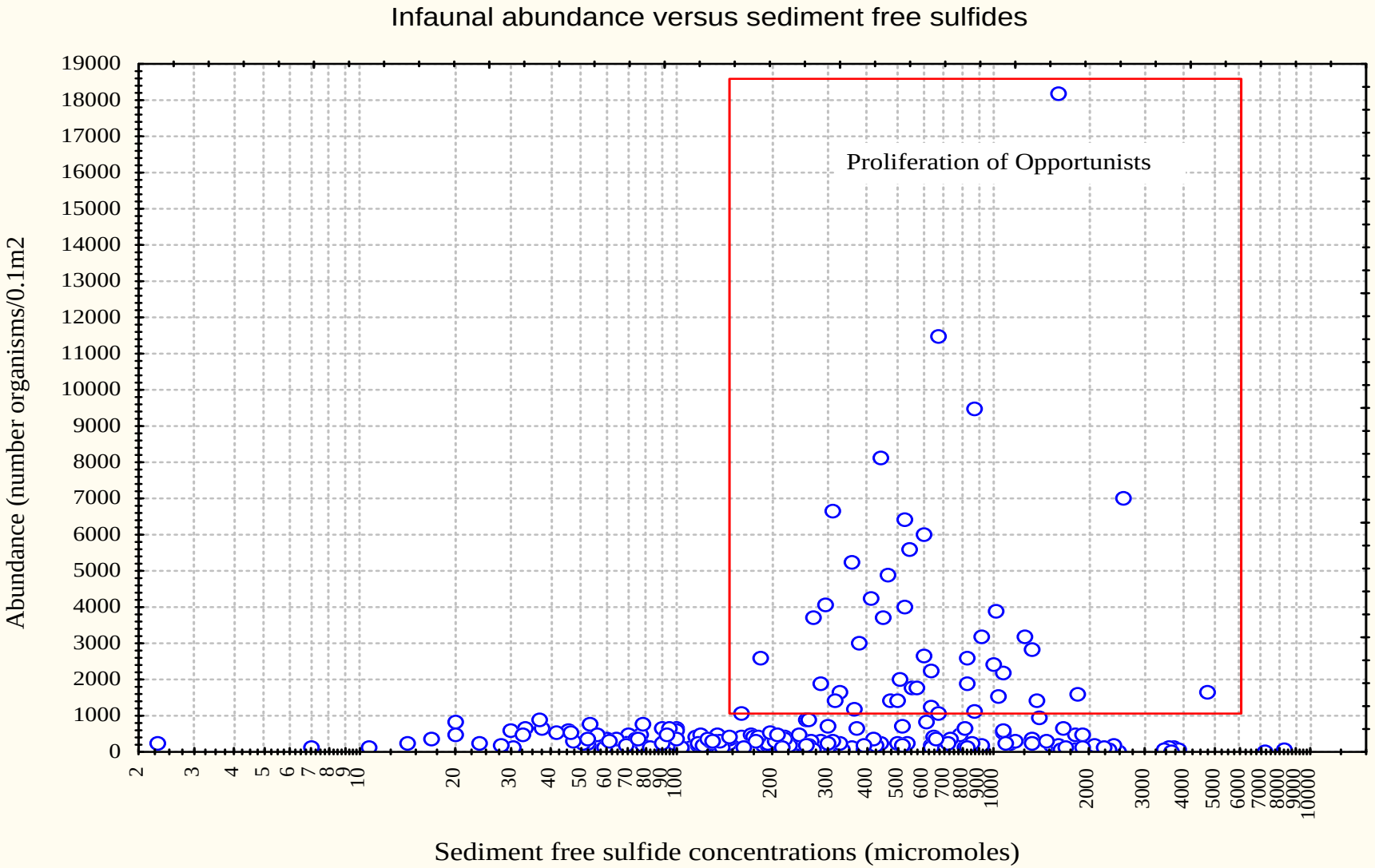
Number of taxa versus free sulfides in a mollusk dominated community



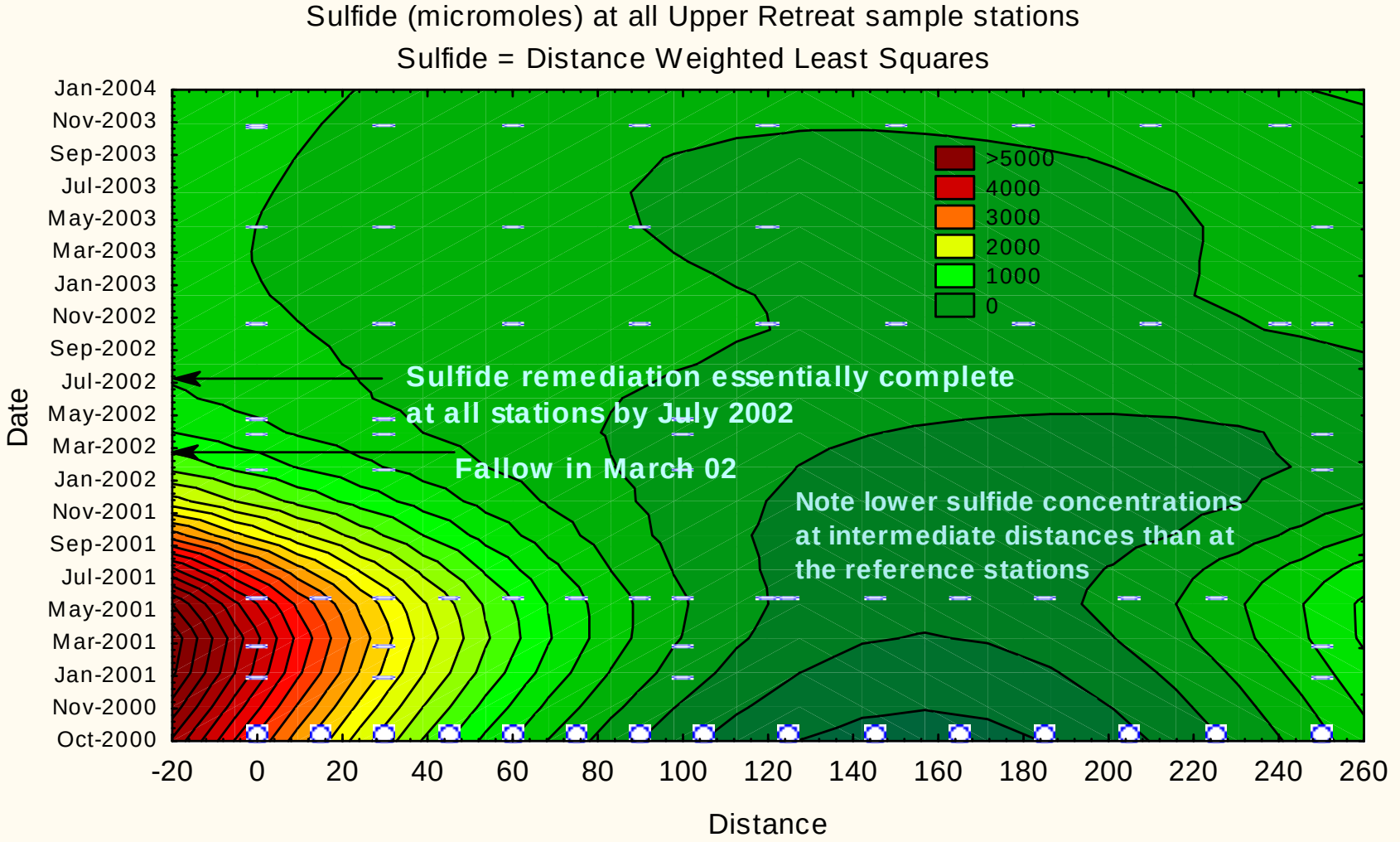
Number of taxa versus distance from a typical Northeast Pacific salmon farm



Abundance of macrofauna vs free sulfides



Environmental costs have spatial and temporal dimensions



The environmental costs associated with benthic enrichment

- Loss of macrofaunal community species richness, and in some cases of abundance and biomass;
- Loss of wild fish production due to loss of prey;
- The average significant footprint of Northeast Pacific salmon farms is ~1.6 ha
- The average temporal extent of the adverse effects during production and remediation is ~44 months.

What do these losses mean?

- The temporal and spatial footprint of an average salmon farm equates to the loss of ~307 kg of wild fish (84 kg/year)
- In exchange, the average farm produced 1,081,684 kg of salmon during these 2000 surveys.
- On average, 12,624 times more salmon was produced than wild fish was displaced.

How do these costs compare with the costs of beef production in the Northeast Pacific?

Whispering Ridge Farm in 2005

My cattle deplete the soils of nutrients; they destroy brush, trees and riparian habitats; they add to greenhouse gasses; they compact the soil; they add excess nutrients to surface waters; etc. But they are an a valuable source of meat that helps feed people

Spatial and Temporal Footprint Cost Comparisons

The environmental costs to produce 1,250 mt of edible salmon flesh versus 1,250 mt of edible beef.

	Salmon	Beef
Spatial footprint	1.6 ha	3,174 ha
Temporal footprint	2 to 4 yrs	200 + yrs

Costs of commercial fishing

The real costs include habitat destruction, lost fishing gear that continues to fish and etc.

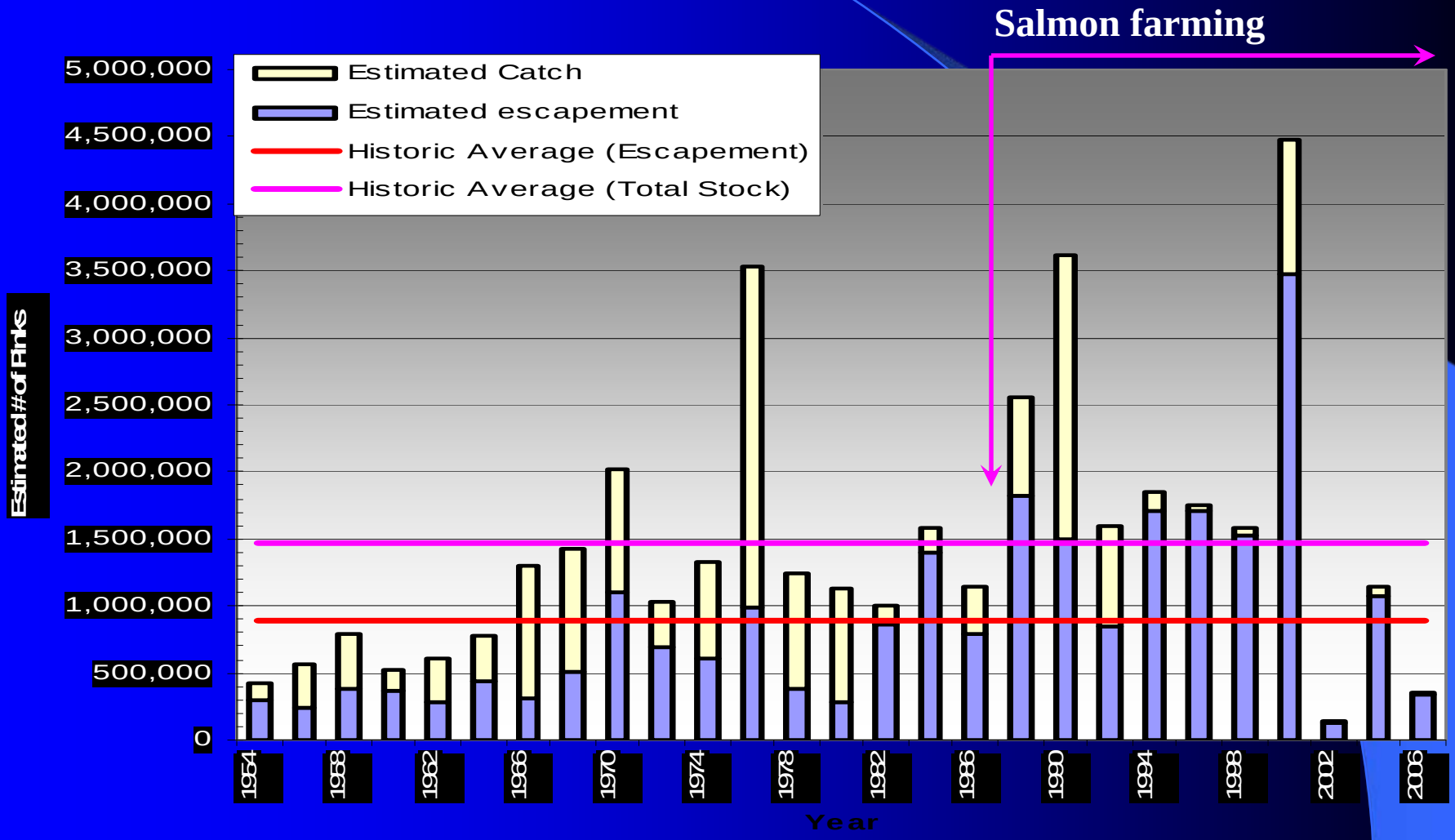
There are environmental costs associated with every form of food production

- Society needs to understand and accept that there are costs associated with a loaf of bread, a hamburger or any other food;
- We need to prioritize environmental costs and focus our energy on solving problems rather than using the environment as a battlefield upon which debate social and economic issues.

Ten years ago opponents of salmon aquaculture claimed that the waste was creating deserts under and near netpens

- Eutrophication is real, but the changes are not always negative and they are manageable.
- Today, opponents claim that:
  - sea lice are extirpating pink salmon runs in the Broughton Archipelago
  - and that escaped Atlantic salmon will out-compete and displace native Pacific salmon

Even year pink salmon returns to the Broughton Archipelago



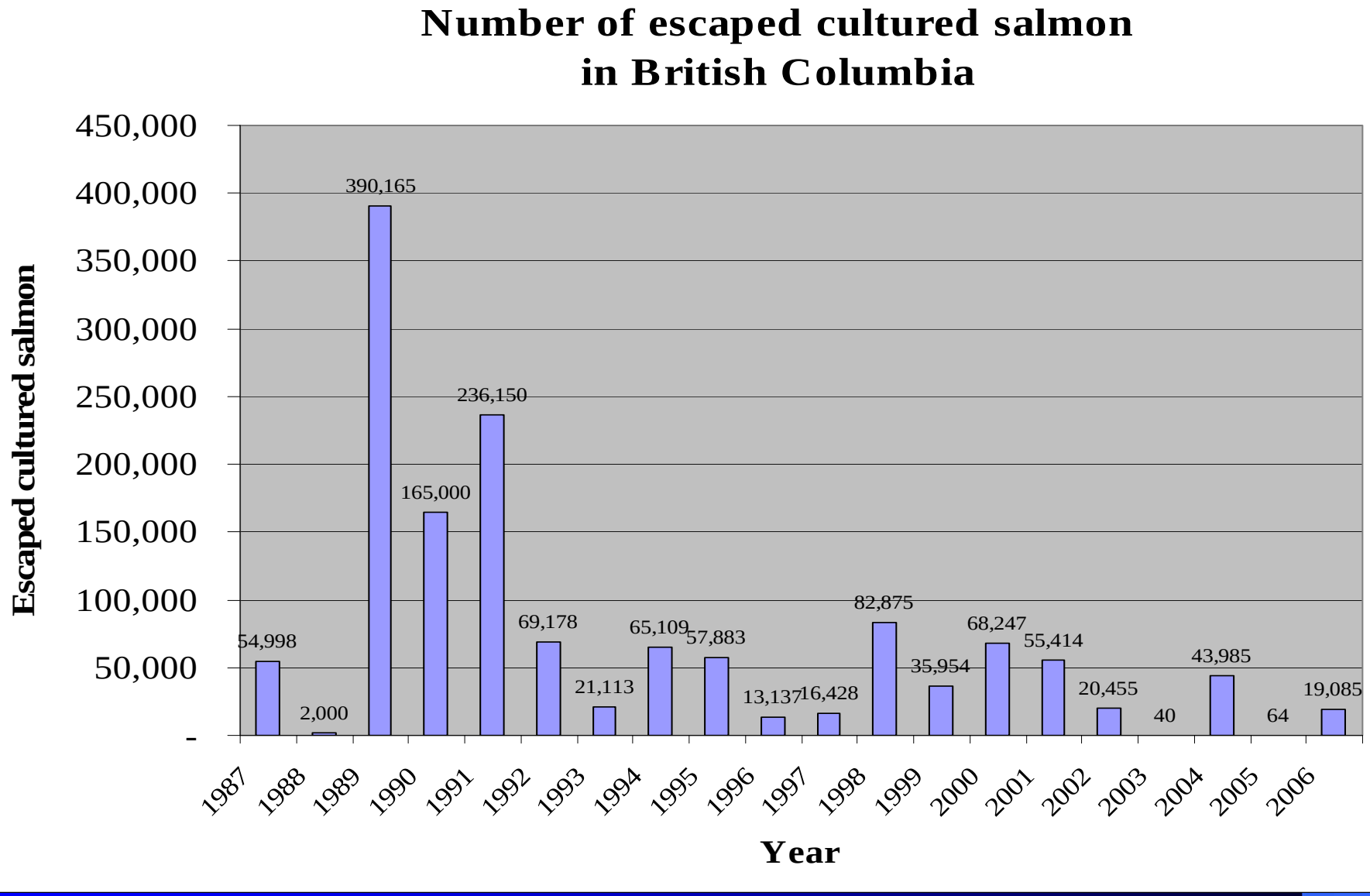
Marine survival of pink salmon originating in the Broughton Archipelago

- **2004 = 23.0%**
- **2005 = 3.4%**
- **2006 = 1.0%**
- **2007 = 2.6%**

Frazer River stock marine survival averages 1.2% and coast-wide, survival averages 2 to 3%.

Bottom line is that marine survival of pink salmon originating in Broughton Archipelago watersheds has equal to or better than average.

Escapes of farmed salmon in British Columbia



Organic standards for netpen aquaculture environmental standards

- Environmental standards must either be vague or they must be specific at least on a regional basis.
- 205.250 (5) – All aquatic animals possessed and grown at an aquaculture facility must be in compliance with all applicable laws.
- Within those laws, give producers flexibility such as you have provided in 205.255 (i) “with the goal of eliminating escapes”

Montgomery's Pond on Whispering Ridge

My bit of heaven on Horsefly Lake


The only conservation that counts is the conservation actually put on the ground
We will make more progress toward sustainable agriculture by challenging producers to do a better job than we will by constantly criticizing them

The 2002 decline in pink salmon returns