Guiding Principals

- ***What are the management objectives?***

1. **Maintain Assimilative Capacity Within Lease**
2. **Prevent Anoxic Conditions**
3. **Maintain Organisms that Bioturbate (re-work, re-oxygenate sediments)**

What Does Assimilative Capacity Mean?

- In broadest sense – generally taken to mean capacity of environment to accept materials/stressors without evidence of significant structural and functional change relative to natural state, including variation. Implies no net change in ecological productivity.

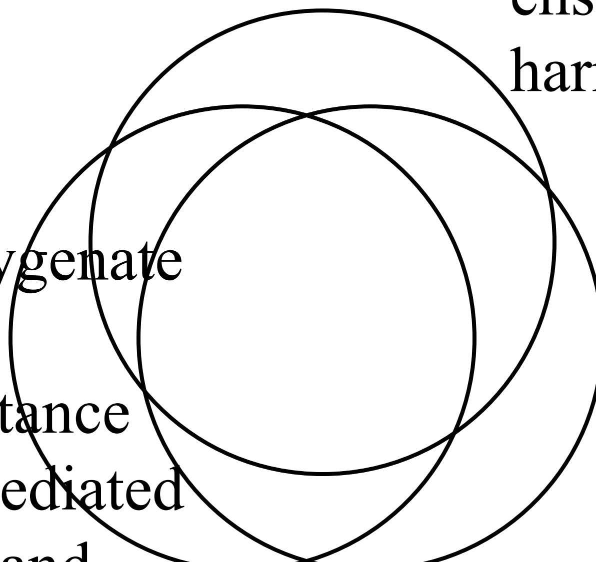
General agreement that there should be no detectable change in structure and function of the marine environment beyond the lease boundary.

- In narrower sense, term has been used to denote a state in which the loading of materials (especially organic matter) to the seabed should not exceed the capacity of resident microbes, meiofauna, and macrofauna to break it down, and through respiration convert it to CO2, H2O and other simple inorganic molecules *(not ammonia or methane except in trace quantities typical of nearshore oxic sediments)*.
- Where sulfate reduction is the governing process, sulfide, a toxicant for most macrofauna, will be produced

- Management Objectives overlap strongly but not completely

Assimilative Capacity – ensures no longer term harm

Avoid loss of Bioturbators – Because
(i) They re-oxygenate sediments;
(ii) Have importance for food-web mediated energy transfer and ecosystem function



Prevent Anoxia – minimizes microbial sulfate reduction, fermentation reactions, Methanogenesis. Ensures That aerobic organisms can survive

Loss of bioturbators is best indicator or benthic community health

State II

Bioturbators present

Good sediment working and re-oxygenation through to 5 – 20 cm

Organic matter decomposition is fast (aerobic); does not tend to build up

Benthic standing stock biomass is good food source for native fish

↔

State I

Bioturbators absent

Top 0- 2 mm of sediment: sulfate reduction and anaerobic breakdown of organic matter.

After sulfate depleted, OrgC decomposition rates slow drastically.

Sulfide produced is toxicant – inhibits larval settlement and survival

State I

Anoxic at surface
Sulfide tolerant only
Beggiottoa, Capitella

Only top ~ mm oxic
Sulfide intolerant spp.
in surface sediments
But don't go deeper
because of toxicity

Mixture of sulfide tolerant
and very small less
tolerant, primarily
nematodes and very
small polychaetes
(Lots of different kinds!

State II

Large macrofauna thrive by modifying sediment in which they live. Not sulfide tolerant. Take a long time to establish (larvae, juveniles can't withstand anoxic conditions). Presence facilitated by other colonizers. High secondary productivity and biomass.

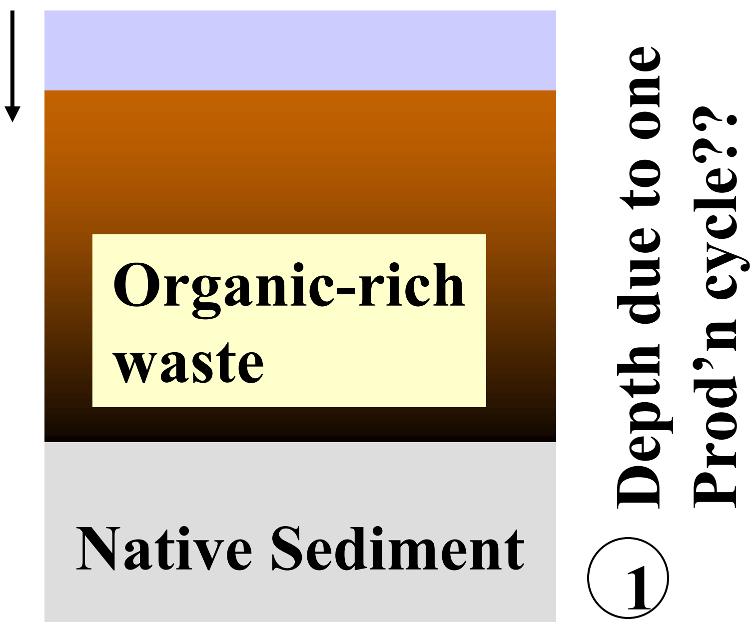
Evidence of recovery

Chemical – tells us only about upper 2 cm

Spp. Richess – might even be indicative of less than upper 2 cm

2 Recovery:

Occurs from sediment-water interface downward



Management Solution?

I) Prevent severe anoxia in the first place,

II) Commit to details studies of sediment geochemistry and organic matter flux required to test claims of no net loss of assimilative capacity, *or*

III) Ensure no elimination of macrofauna that remain (and minimum level of spp. richness) are capable of reworking sediments to depths of 5 cm or greater (this is unlikely to the case in a community with 25% of the natural spp. richness)

Examples

>> *xxx* no./sq. m seabed of the following:

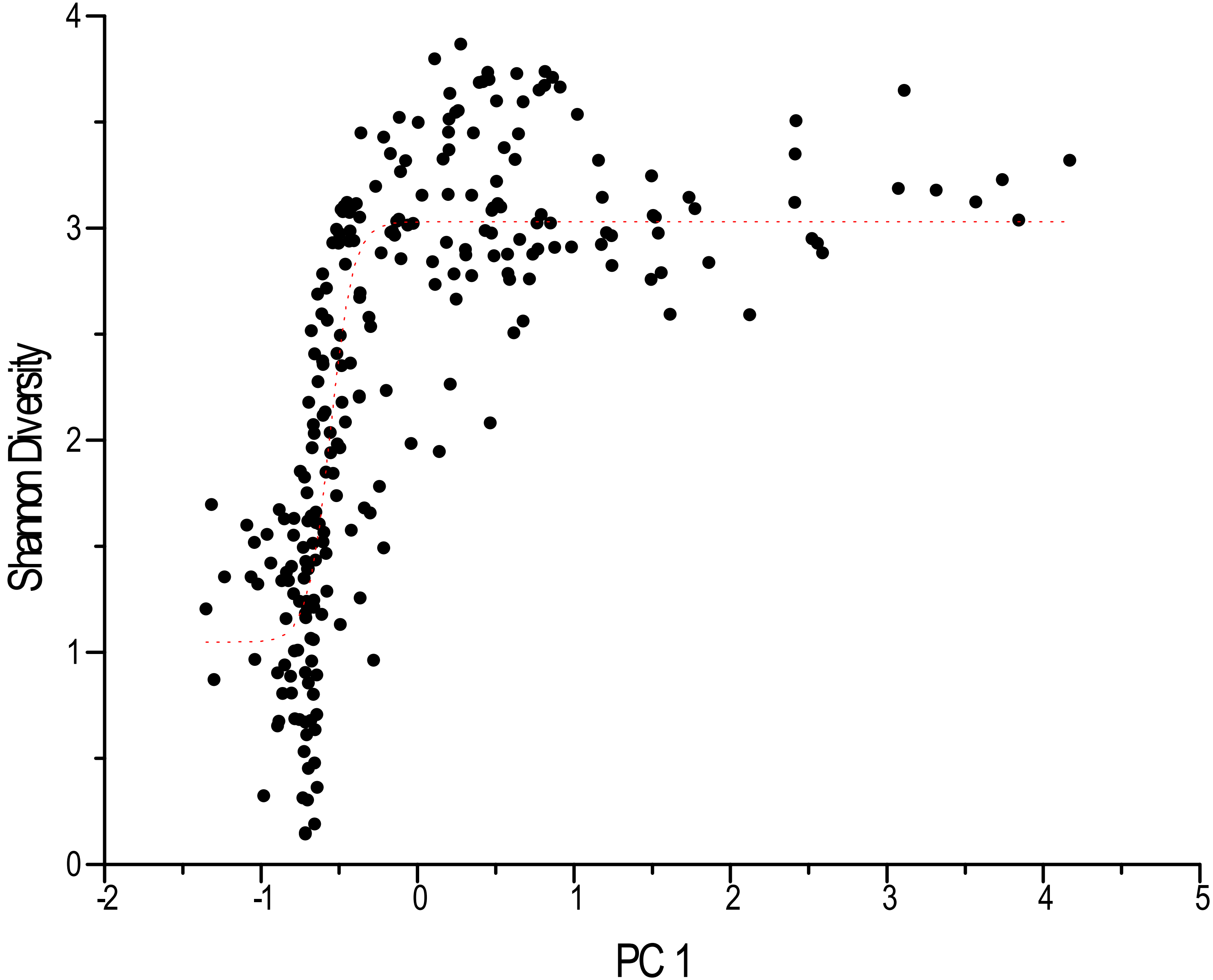
- Bivalves excluding Lucinids and *Solemya* spp (*Macoma* spp. and other tellinids, venerids, *Cooperilla, …)*
- *Cylichna* and other gastropods
- Lumbrenereid, maldanid, ophelinid and other larger sedentariate and errantiate polychates;
- Crustacea such as *Heterophoxus*
- Burrowing echinoderms such as heart urchins, *Cucumaria,*

…

Taxon	**1st Principal Component**
Chaetozone setosa (annelid)	**0.78**
Lumbrineris luti (annelid)	**0.74**
Axinopsida serricata (mollusc)	**0.72**
Glycymeris subobsoleta (mollusc)	**0.66**
Tachyrhynchus lacteolus	**0.62**
Chaetozone spinosa (annelid)	**0.62**
Solariella vancouverensis (mollusc)	**0.60**
Euclemene zonalis (annelid)	**0.60**
Cooperilla subdiaphana (mollusc)	**0.60**
Sphaerodoropsis biserialis (annelid)	**0.58**
Leitoscoloplos pugettensis or Orbinidae (a)	**0.58**

… (plus 10 more)

Correlation between 1st Principal Component and Taxon Richness: r = 0.77


Shannon Diversity
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