



Indicators and the 3 Ms

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ECASA Indicators

- The ECASA approach has four components:
 - Identification of indicators of the impact of aquaculture on the environment
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 - Development and testing of models which use these indicators as system descriptors
 - Producing a “toolbox” of applicable methods for management of aquaculture-environment interactions

WGEIM and Indicators

- The WGEIM Terms of Reference (ToRs) for the 2007 meeting included identifying “Indicators of Sustainability”.
- These involve socioeconomic factors as well as measures of physical and biological impact.
- In the absence of any social scientists, the WGEIM redefined the ToR but did not make significant progress on this topic.

Indicators in EAA

- At present it seems that the ECASA project is playing the lead role in identifying indicators that can be used to characterise the interaction of aquaculture with ecosystems.
- Numerous projects cover indicators of other aspects, such as CONSENSUS and SEACASE which deal with indicators of product quality.

Issues of Scale

- Indicators provide information about the ecosystem at various scales in both space and time.
 - Nutrient release from aquaculture is a localised variable in both space and time.
 - Regional indicators include national aquaculture production, or production per kilometre of coastline as suggested by the EEA.
 - Global indicators are total world production and consumption of fish meal and fish oil.

More Indicators

- For a complete EAA additional indicators in many areas are needed, especially in the socioeconomic aspects.
- There are many projects in the EU and elsewhere dealing with indicators, too many to discuss here.
- I therefore turn to the role of indicators, and a framework for using them.

The Three Ms

- I have long advocated an approach to managing environmental impacts based on the Three Ms:
 - Modelling, to show where the system is going
 - Monitoring, to see if it is on the right track
 - Mitigation, to fix things if they go wrong
- Indicators need to fit in with all three components to be useful for EAA.

Modelling

- Models require specification of variables as input, and as output predict these and perhaps other variables into the future.
- Indicators must therefore correspond to identifiable quantities which can be modelled.
- Indicators which measure functional aspects of the ecosystem are more likely to be useful than phenomenological ones.

Monitoring

- Indicators used for monitoring must not only be meaningful, but they must be affordable & practical, as well as relatively easy to measure and suitable for a wide range of habitats.
- Measurements should be easily repeatable, as time series are important in order to spot any problems as early as possible.
- Measurements must therefore be nondestructive.

Mitigation

- The ability to correct any environmental damage beyond what is anticipated is an essential part of EAA.
- Irreversible damage is unacceptable.
- EAA should include assessment of possible risks with plans for dealing with them if they occur.
- We need indicators that tell us not only if the system is off track, but that indicate how far it is off, and help us get it back in place.

Summary

- EAA requires the use of indicators of how the ecosystem (in the broadest sense) is functioning and developing.
- These indicators can be defined for many different types of effect and at many different scales in space and time.
- The Three Ms provide a context for defining and using indicators in EAA.