Network session Report

Ecological Carrying Capacity of Aquaculture

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Given the current levels of understanding and experience in the implementation of ecological carrying capacity monitoring for aquaculture, there is now a need to explore the possibility of developing guidelines for more cost effective, less data intensive ecological carrying capacity monitoring techniques. It is important that these guidelines draw on expert knowledge to provide guidance on the choice of indicators for ecological carrying capacity (ECC) of aquaculture.

During the network session, the conveners presented the results of a systematic literature review that was conducted in advance of the meeting. The goal of the review was to identify indicators of ecological carrying capacity for bivalve aquaculture and seaweed aquaculture. This review parallels the earlier work published on environmental indicators of salmon work.

To compliment the identification of indicators for ECC of aquaculture, and to bring additional context to the discussion, the network session was used as a platform to address four (4) questions that challenge scientists and resource managers. The 16 session participants entered their responses in SLIDO polling system and then verbally shared their responses with the group. The review and the discussion generated at the network session were intended to address WGECCA's ToR c pertaining to indicators of Ecological Carrying Capacity.

Models vs observations

Some indicators, such as phytoplankton depletion, are very challenging to measure due to natural variability but relatively easy to model. When prompted with the question "***Should decisions makers disregard modelling estimates and focus on in situ data?***", 88% (14/16) of respondents answered "no". Most respondents were in favor of using a mixed approach that incorporated both *in situ* data and modeling, recognizing that direct observations were of "key importance" yet "provide a snap shot in time". "Models can be more integrative" and be used to predict future situations. Models were regarded as "important tools", especially for large data sets, and *in situ* data is needed to verify and "ground truth" these models.

Universal thresholds of resilience

EAA requires that aquaculture does not cause degradation of the environment. Determining the tipping points of ecological resilience is challenging and they are affected by local conditions, triggering a compromise between practicality and ecological relevance. When prompted with the question "**Should monitoring plans embrace pragmatic indicators and universal thresholds at the cost of sacrificing ecological relevance and the considerations of local conditions?**", 75% of respondents replied "no". "Ecological carrying capacity is highly depends on the local situation and circumstances" and using universal thresholds disregards environmental variability. However, some respondents recognized that a set of universal thresholds is sometimes necessary within a management system to "reduce confusion and uncertainty among stakeholders."

Scalability

EAA requires considering multiple scales but collecting data at large spatial scales can be expensive, triggering a compromise between budget and scalability. When prompted with the question "**Should**

monitoring plans allocate most of the resources to sampling the vicinity of the farm at high spatial resolution or should they include the larger ecosystem at the cost of losing spatial resolution?", 93% of respondents thought that monitoring at a lower spatial resolution so that the larger ecosystem could be included was the best approach. Almost all of these respondents thought that both scales were important, and the best decision would be dependent on available resources or the specific objective.

Ecosystem services and other ocean users

EAA requires equitably accommodating multiple oceans uses. When regulations focus on negative impacts, disregarding the enhancement of ecosystem services, it reflects a bias between regulatory needs and the consideration of broader ecosystem effects. When prompted with the question "**Should regulations include indicators of positive and negative effects of aquaculture or focus only on negative aspects?**", 88% of respondents thought that both positive and negative aspects should be included in regulation decisions. "Having positive aspects might help prioritize sustainable or regenerative aquaculture".

In conclusion, the discussion generated during the network session affirmed the importance of integrating observations and models, designing indicators specific to the local conditions, monitor for farming affects across a larger ecosystem scale, and consider both negative and positive effects of aquaculture. Incorporating all four of these recommendations in designing appropriate indicators for ecological carrying capacity for aquaculture is challenging and should lead to responsible resource management of ocean farming systems.