aquacross

Understanding the Socio-Ecological System: Developing relevant Indicators

WHAT ARE INDICATORS AND WHY ARE THEY USEFUL FOR MANAGING AQUATIC BIODIVERSITY?

Indicators provide consolidated information, simplifying complex issues or phenomena into something simple and easily communicable. For example, coral reefs are important indicators of marine ecosystem health. While indicators by definition are reductive, this simplification is useful for management. For example, it allows targets to be set, monitored, and evaluated – and communicated with non-expert stakeholders. As such, indicators are well-suited for informing how an ecosystem is managed and how it affects and is affected by human activities.

Indicators can be selected to describe every element of society's relationship with aquatic ecosystems. They can be used to understand human activities, while others can indicate the pressures on the ecosystem. For example, the number of fishing boats can be an indicator of fishing and of associated pressures (see Case Study: Azores). Indicators can also be used to understand the state of the different components of the ecosystem (species and habitats) – e.g. the presence of invertebrate animals can indicate river health (see Case Study: Swiss Plateau). They can also be used to understand different benefits to society of healthy ecosystems - e.g. tonnes of fish caught are an indicator for the provisioning value of an ecosystem (see Case Study: North Sea). By simplifying complex phenomena, these indicators support management decision making. By describing how these different components interrelate within the system, indicators help to understand the overall social-ecological system.

Selecting the right indicators allows evaluation of the impacts of human activities on the ecosystem, and measurement of how the ecosystem in turn provides us with valuable benefits from nature. Understanding these impacts is important to identify the causes of biodiversity loss and prioritise effective management measures and appropriate monitoring. Indicators communicate complex information in a simplified way and are therefore useful for supporting decision makers and other non-scientists.

1 **Step 1 – Understand the linkages in the ecosystem**
To choose indicators that will be helpful for understanding how human activities affect the ecosystem and its provision of ecosystem services (i.e. the benefits provided by nature), we need to identify which parts of the ecosystem and which ecosystem services are most important. To do this, we need to:

1. Know what pressures a human activity introduces to an ecosystem component (e.g. habitat, species) of interest, and how it affects that component;

2. Know which ecosystem services (i.e. benefits provided by nature) that habitat supports;

3. Know in what way this ecosystem component supplies those services.

The AQUACROSS Linkage Framework is a structured framework that can be used to identify these links between human activities and the ecological system (see Linkage Framework).

2 Step 2 – Consider data availability

The AQUACROSS case studies show that the availability and quality of potential indicator data varies widely among countries. If enough good-quality data is available, quantitative approaches can be used, often enabling even spatially-explicit assessment of the ecosystem. Otherwise, semi-quantitative or qualitative assessments can be used.

Tip! When there is not enough relevant data or it is not of good quality, involve stakeholders to verify your results (see Mobilising stakeholders for supporting EBM).

3 Step 3 – Select indicators

The choice of indicators is made according to the goal of the assessment and the type of data available, taking into account how human activities affect the ecosystem and provision of ecosystem services, and how these are measured. Therefore, indicator selection is specific to the context in which the ecosystem assessment is being made.

In all cases, however, several criteria should be met to ensure high-quality indicators are selected. There should be a scientific basis to the ecosystem relevance of the indicator, it should be cost-efficient, and it should be possible to set targets using the indicator.

Tip! From freshwaters to marine waters, AQUACROSS described the interactions between the human activities that put pressures on a specific ecosystem that supplies ecosystem services. Example lists of possible indicators that describe the possible interactions in a given ecosystem are provided. This helps to describe the overall social-ecological system being assessed (see D5.1 Annex).

Tip! Using expert knowledge and the wealth of scientific literature available, it is possible to make assessments without local data, albeit while making many assumptions.

Tip! Indicators are often chosen to assess aquatic ecosystems to meet legal reporting requirements (e.g. for EU directives or national/regional legislation). However, ecosystem-based management objectives may be different (see Integrative environmental policy objectives) and therefore may require different indicators.

Tip! There is often overlap between the objectives of different environmental policies, including EU policies such as the Water Framework Directive, and Birds and Habitats Directives (see Integrative environmental policy objectives). Coordinating indicators across different Directives, along with monitoring and evaluation timelines, can save money and increase knowledge (see Case Study: Ria de Aveiro, Portugal)

Further information

This is one of 38 short briefs summarising the key results of the AQUACROSS Project. For more detailed information on the topics covered in this brief, see the following:

- O'Higgins et al. (2016) Review and analysis of policy data, information requirements and lessons learnt in the context of aquatic ecosystems. Deliverable 2.2, European Union's Horizon 2020 Framework Programme for Research and Innovation grant agreement No. 642317. (Deliverable)

- Pletterbauer et al. (2016) Drivers of change and pressures on aquatic ecosystems. Deliverable 4.1, European Union's Horizon 2020 Framework Programme for Research and Innovation grant agreement No. 642317. (Deliverable and Executive Summary)

- Nogueira et al. (2016) Guidance on methods and tools for the assessment of causal flow indicators between biodiversity, ecosystem functions and ecosystem services in the aquatic environment. Deliverable 5.1, European Union's Horizon 2020 Framework Programme for Research and Innovation grant agreement No. 642317. (Deliverable and Executive Summary)