Science to Management

LME: LEARN POLICY BRIEF

Addressing Information Gaps for Decision Making for Large Marine Ecosystem Management

Translating science to management is a key issue for all natural resource managers. Yet, in many situations, access to information or data is unavailable and often unknown. Making decisions in these situations is not easy and can require being resourceful with what knowledge is available and strategic in how to fill any information and data gaps. This policy brief will provide useful examples of how to address issues translating science to management for policy makers based on lessons learned in the GEF International Waters Large Marine Ecosystem portfolio.

Context and importance of the problem

In areas where there is a lot of information known (data-rich environments), the challenge can be synthesizing and analyzing complex and disparate information into a useful form to support decision makers. In areas where the marine environment and its resources are not well known (data-poor environments), the challenges are often quite different but not insurmountable. For many of the issues addressed by the GEF International Waters portfolio, taking decisions in data-poor environments is not uncommon. However, a lack of available data and information about resources does not mean informed decision making is not possible. In fact, translating science to management is even more important in data-poor environments, as scientific concepts and theoretical constructs can be used to accurately substitute information gaps to inform decision making.

When translating science to management, it can often be important to discern the differences between data, information, and knowledge (Figure 1). The three terms, **data**, **information**, and **knowledge** can all be viewed as levels of abstraction. Moving from data as least abstract to knowledge being most abstract. Data is simply a value assigned to something and has no standalone meaning. Data that is analyzed and interpreted so that it has meaning then becomes information. Knowledge is then the practical use of this information and is often enhanced as additional information becomes available.

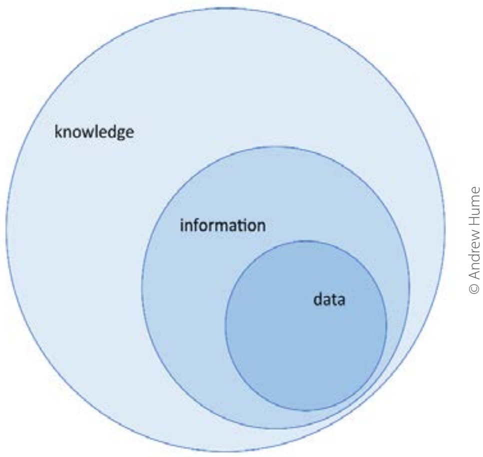

Figure 1:
Relationships between data, information, and knowledge

For example, the sea surface temperatures of a marine area could be considered ***data***. Analyzing this data to discern ocean warming trends could be considered ***information***. And a report containing best practices to manage changing fish stocks due to warming oceans could be considered ***knowledge***. Thus, to successfully translate science to management of future fish stocks requires a deeper level of understanding beyond simply access to data about sea surface temperatures or fish stocks.

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Critique of Policy Options

Translating science to management first starts with recognizing what key data or information is critical for taking a specific management decision on a natural resource or an issue but does not yet exist and may require effort to collect. This often involves a brief discussion with experts and local stakeholders familiar with the issue. Based on an initial review of available information, it is important to then distinguish between **perceived information gaps** and **actual information gaps**.

A perceived information gap includes situations where data may not be immediately available but may be available elsewhere in the region/globe or sometimes can be extracted from within other types of information. Talking with technical experts, academic institutions, and local experts, may help advise on if an information gap is perceived or a real gap. It is often the case that a perception of an information gap may not actually prevent a decision being taken. For many situations a substitute or proxy set of information can still be used to make an informed decision. For example, substituting local unknown seagrass species composition with studies from similar habitats in the region in order to inform conservation measures.

FILLING INFORMATION GAPS IN PALAU

To support implementation of Palau's National Marine Sanctuary (PNMS), marine resource managers relied on research institutions and academic literature to make informed decisions in absence of available reef fish stock data. Synthesis of known datasets, proxy data, and regional research from the Pacific Islands Forum Fisheries Association was critical to inform initial decisions. The government also commissioned new targeted research to better understand the domestic fisheries economy.

Palau, like many Pacific Island nations, have generations local community expertise managing marine resources. For example, the Palaun concept of 'Bul', a customary type of marine closure, is informed on the health of local fish stocks. This customary practice has been adopted as a critical part of both the design of protected area locations and overall policy implementation.

"The fundamental reality driven by the nature of scientific research itself, is that even in the best-funded programmes in the wealthiest countries there will probably never – within useful time scales for planners and managers – be enough scientific (which usually means quantitative) data for the development and implementation of rigorous management plans for those systems, on the best scientific principles."

Recognizing what data or information is missing to inform resource management decision is a critical first step. For many issues, there is likely similar scientific evidence either for another region or similar species/ resource that can inform management purposes. Local and regional academic institutions can often be a valuable partner to understand the realm of information options available. And with many remote sensing and other passive technologies coming online, the number of information gaps that truly lack essential information are declining.

Another valuable potential source of information is the local community that relies on a natural resource. By engaging with the local community, valuable information can often be revealed that might not otherwise be readily available. In these circumstances it is important to recognize that data may present itself as either qualitative (i.e. data that is typically non-numerical approximations or categorizations and cannot physically be measured) or quantitative (i.e. physical measurements). Qualitative data, such as interviews and survey responses, is equally scientific and often very useful to inform management decisions. For some issues, it's also good to remember that remotely sensed quantitative data, such as satellite imagery, may be freely available but managed by organizations elsewhere around the world. It will often be in a resource manager's best interest to invest time understanding the information options available to them first before deciding to collect primary data. It is nearly always the case that there is sufficient information (qualitative and quantitative data) to take initial management decisions while more (or better) information is collected.

In certain situations, a lack of data to translate science into management is an important barrier for taking even initial policy action. In these truly data-poor environments, a lack of information about a marine resource still should not necessarily result in a lack of action. In many of the world's Large Marine Ecosystems, sound decisions are often being taken following a precautionary approach.

Taking a Precautionary Approach:

It is often the case that resource managers do not have enough time or money to collect primary data to fill an information gap. In these common situations, it is best to take a precautionary approach based on the best scientific advice available, even if it is very limited information. The precautionary approach states that a modest action taken as a precaution to mitigate an issue based on good judgement will nearly always be less costly and have a positive impact than no action at all over the long term. In other words, a precautionary approach involves taking cautious action based on the best information available at the time to avoid a situation of no action that may accidently allow serious or irreversible harm to natural resources to occur, such as passing an ecosystem threshold or tipping point.

A precautionary approach should be based on scientific advice, especially when the science may not be exactly applicable to the local circumstances. If the specific area lacks sufficient scientific data, it is often incorrect to assume this is the equivalent of a lack of information. Examining adjacent (or even far away) but similar marine environments can often be a valuable source of information to infer information for the local issue being addressed. Even if time or money is insufficient to collect qualitative or quantitative data, investing limited time to understand what information may be readily available to inform a precautionary approach is still prudent.

Targeted versus Scientific Research:

If it is decided that primary data collection is the best path forward to inform management, targeted research* can be employed, but is often very time and resource intensive. Targeted research can differ slightly from scientific research as the former is aimed at answering a specific problem, while the latter

* An important clarification - targeted research discussed here should not be confused with the GEF Scientific and Technical Advisory Panel (GEF STAP) Targeted Research policy for GEF Operational Strategies, though they share similar concepts.

is often aimed at advancing scientific knowledge. The audience for the two types of research differ too. Targeted research is often communicated to decision makers, stressing results and data-based policy recommendations, while scientific research focuses on peer-reviewed academic journals. While dissimilar in several ways, the two types of research are not mutually exclusive. The results of either approach should be transferrable and abide by high quality standards of research design, methodology ethics.

Building Transparency and Trust:

Data-based decision making provides transparency and can build trust with the community, especially when local stakeholders are involved in the data collection or monitoring process. The collection or production of data does not always come from scientists and academic institutions. In fact, many targeted research projects often are led by local non-government organizations, community groups, and local government agencies. Engaging with local stakeholders to design, implement, and long-term collect and monitor data for natural resource management can go a long way towards building transparency and trust into policy decision making processes. Additionally, such local buy in can promote sustainability of results past a single intervention as local data collection programs slowly become mainstreamed.

Long-term data collection is also a powerful tool for measuring impact and a critical set of information to adaptively manage any natural resource. Committing to long-term data collection provides a set of indicators that are consistently measured over time. This provides decision makers with both the current information on a natural resource or issue, but more importantly, how the natural resource or issue has changed. Thinking critically upfront about baseline measurements that will be used to compare future monitoring indicators against can ensure policy makers have the right information to translate science to management on an ongoing basis as part of adaptive management principles.

Policy Recommendations:

Successful translation of science to management can be the difference that ensures proper long-term management. Understanding how to access data and information and make use of what's available to take informed decisions is generally a good policy practice. Considering the below policy recommendations can help decision-makers better translate science to effective management.

- Assess readily available data, information, and knowledge before taking any action. Scientific data is not always quantitative and can often include valuable qualitative context.
- Distinguish between perceived information gaps and real information gaps. Data may not be immediately available but may be available elsewhere in the region/globe that can be used as a proxy, or may be extracted from other information.
- When faced with taking initial data-based management decisions, a minimum amount of qualitative and quantitative data is nearly always available for an initial decision while more or better data can be collected.
- When short on time or money to collect primary data, it is best to take a precautionary approach based on available scientific advice. For addressing most natural resource management issues, this means a modest action based on good judgement will nearly always be less costly and have a positive impact over the long term than no action at all.
- Data-based decision making provides transparency and can build trust with the community, especially when local stakeholders are involved in the data collection or monitoring process.

Case Study: Bay of Bengal Large Marine Ecosystem:

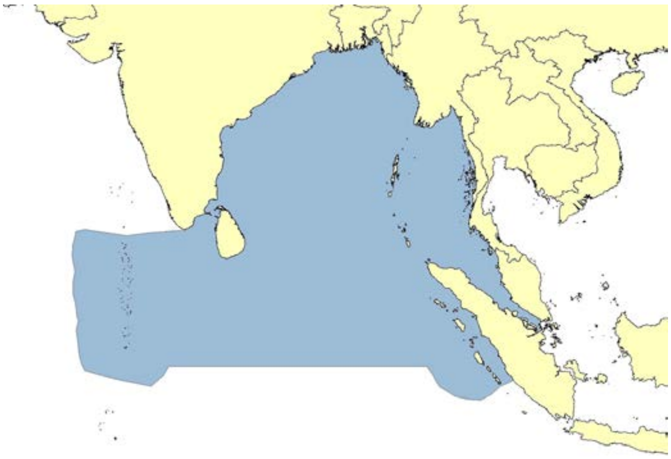

Figure 2:
Bay of Bengal Large Marine Ecosystem. Source: www.boblme.org

Bringing the governments of Bangladesh, India, Indonesia, Malaysia, Maldives Myanmar, Sri Lanka, and Thailand together to manage marine resources in the Bay of Bengal Large Marine Ecosystem (BoB LME) presented many situations where limited scientific information was available to inform resource managers (Figure 2). The development of the BoB LME Transboundary Diagnostic Analysis (TDA) provided a helpful methodology to guide the countries through a process of assessing what information was already available and what may require further effort. The BoB LME TDA acknowledged that two categories of information gaps were relevant to their LME managers. The first information gap dealt with information where there is an actual lack of essential information that was preventing action, and filling the gap required financial resources. The second information gap was a perceived information gap that actually could be filled by considering proxy data, scientific studies, and discussions with local experts.

While the BoB LME TDA process was not intended to recognize and fill all possible information gaps in the BoB LME, it presented a first comprehensive assessment of all key national and transboundary marine resource challenges that countries needed to consider – both individually and collectively. The important role of national resource managers is making use of the TDA and similar transboundary assessments to understand what information is known and available to inform management immediately, and what information is unknown and important for managers to begin collecting.

When translating science to management in data-poor situations, the governments of the BoB LME embraced a precautionary approach towards management, promoting the concept that any informed action was often better than no action at all. This proactive science-based management approach was core to the BoB LME TDA, recommending that "***Management need to anticipate the possibility of ecological damage, rather than react to it as it occurs***."

For long-term success of a healthy BoB LME, ongoing translation of science to management will required establishing a robust monitoring framework based on common indicators at the subnational, national, and LME-wide level. This is captured in the BoB LME Strategic Action Program (SAP). The BoB LME worked closely with the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) to design the data sources for on-going LME-wide monitoring needs. BoB LME resource managers are working with existing public databases maintained by a range of intergovernmental organizations, foreign governments, and academic institutions. The key publicly available data sources that are being used for ongoing monitoring of the BoB LME to inform future decision making include data on: a) remote sensed primary productivity; b) sea surface temperature; c) mapping cumulative human impacts in LMEs; d) fisheries catch and aquaculture; e) marine habitat mapping; f) modelling of nutrient inputs; g) deltas risk indices; h) coral reef monitoring; i) marine pollution, and; j) socioeconomic metrics.

These indicators do not represent the full range of data being collected, but rather the framework to support any translation of science to policy. Regional and national sources of data are then being used to enhance decision making at the national level. Importantly, BoB LME resource managers have established partnerships with these international institutions to ensure the necessary support and data remains publicly available.

Case Study: Caribbean Large Marine Ecosystem:

The Caribbean Large Marine Ecosystem project (CLME) consists of the Caribbean and Northern Brazil Shelf Large Marine Ecosystems (Figure 3). Collectively the project coordinates across 22 independent countries and 17 dependent territories of the USA, UK, France, and the Netherlands. The CLME has the largest number of maritime boundaries of all the LMEs. Translating science to management within and among a large number of governments represents a significant and persistent challenge for resource managers.

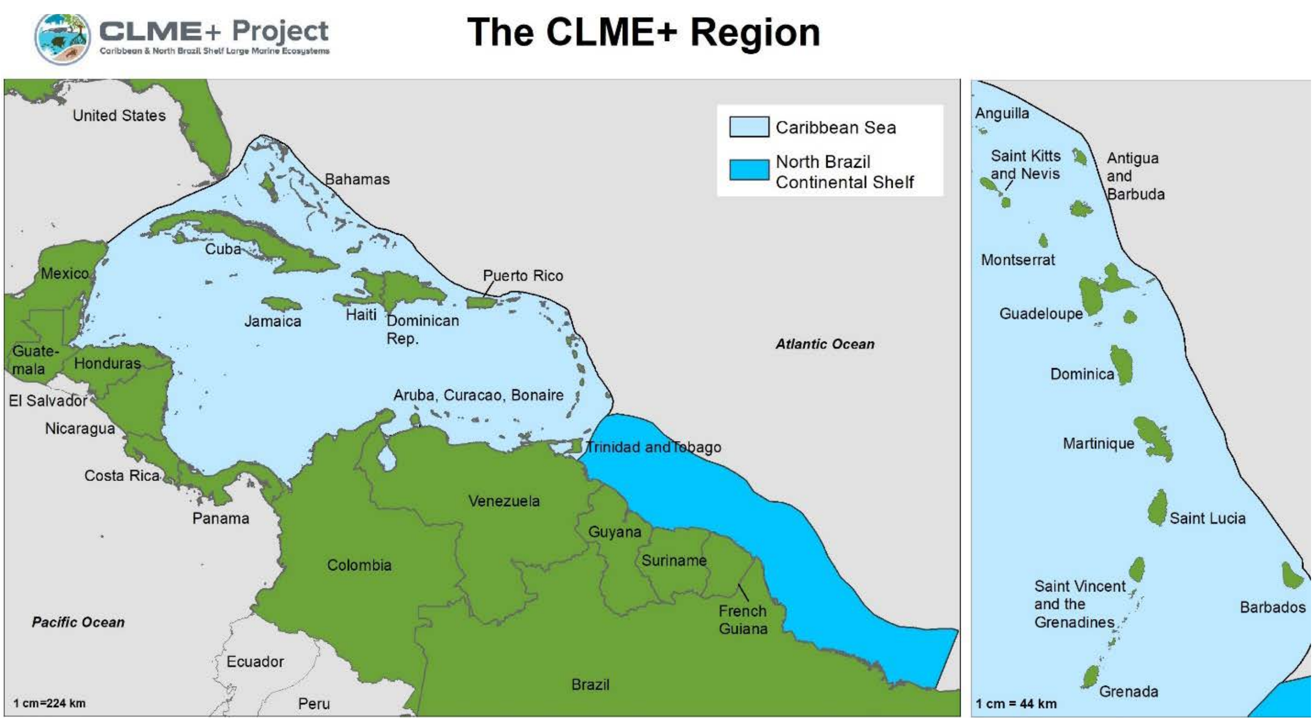

Figure 3:
CLME Regional Map. Source: www.clmeproject.org

Fisheries is a key economic driver for the CLME (and for many other LMEs too), especially large pelagic species. Having a solid baseline understanding of the fisheries sector in the CLME at both the national and regional level was critical for resource managers to make informed decisions to sustainable manage future fish stocks. The CLME project addressed this issue by working with key regional fisheries management organizations, including the International Commission for the Conservation of Atlantic Tuna (ICCAT). The CLME project partnered with ICCAT to update the information base of fish stocks that were emerging as commercially important but not under ICCAT jurisdiction, as well as understanding new pressures such as growth in recreational fishing. Through a stakeholder workshop, the project partners pulled together existing knowledge to develop an information base that would improve the collective understanding major large pelagic fisheries, including information on the nature and importance of recreational fishing activities. With such an information base in place, recommendations were developed to promoting ecosystem-based management (EBM) options to conserve commercially important large pelagic fish stocks.

The CLME Large Pelagic Fisheries workshop, in partnership with ICCAT, enabled individual nations to share existing knowledge, data, and scientific research, collectively improving all countries awareness for future management needs. Such information was also important to inform the CLME project TDA, including: a) filling information gaps regarding existing large pelagics data not under of ICCAT jurisdiction (i.e mahi mahi, blackfin tuna); b) using available data and information to inform the status of key regionally-distributed large pelagic species, and; c) understanding the importance of recreational fisheries in the region.

This CLME fisheries case study is a good example of managers coming together to pool existing knowledge – both of the issue, but also sharing awareness of available data, scientific research, and non-government institutions that can help to fill information gaps. While each Caribbean island may have unique challenges that necessitate additional information to translate their existing science into management, all governments now have a minimum information base to initiate management. Had each country tried to manage their large pelagic fish stocks unilaterally, the likelihood for redundant primary data collection would have, wasting precious time and resources. When translating science to management in data-poor environments, it is often the case decision can still be taken based on the best available information – even if it is not immediately apparent data is available.

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GEF LME:LEARN

GEF LME: LEARN is a program to improve global ecosystem-based governance of Large Marine Ecosystems and their coasts by generating knowledge, building capacity, harnessing public and private partners and supporting south-to-south learning and north-to-south learning. A key element of this improved governance is main-streaming cooperation between LME, MPA, and ICM projects in overlapping areas, both for GEF projects and for non-GEF projects. This Full-scale project plans to achieve a multiplier effect using demonstrations of learning tools and toolboxes, to aid practitioners and other key stakeholders, in conducting and learning from GEF projects.

This global project is funded by the Global Environmental Facility (GEF), implemented by the United Nations Development Programme (UNDP), and executed by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization. The GEF LME: LEARN's Project Coordination Unit (PCU) is headquartered at UNESCO-IOC's offices in Paris.

Honorable Bernhardt Esau, Namibian Minister of Fisheries and Marine Resources, opening the Benguela Current Commission Office

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