Climate Change Adaptation

Taking a proactive approach towards mainstreaming long-term climate change adaptation strategies

LME: LEARN POLICY BRIEF

Context and importance of the problem

Across the world's 66 Large Marine Ecosystems (LMEs), anthropogenic climate change is already having profound impacts to terrestrial, coastal, and marine environments. Unfortunately, the impacts of climate change have already begun to manifest in numerous ways in coastal and marine environments. Coastal and ocean waters have warmed by approximately 1.3°C over the past 100 years and continue to warm at alarming rates (Figure 1), impacting global climate dynamics, species distributions, and even causing water to thermally expand contributing to rising sea levels. Ocean waters have also become 30% more acidic over the past 200 years due to the absorption of atmospheric carbon, resulting in profound effects on marine trophic interactions that could jeopardize food security for millions and millions of humans. Many tropical and sub-tropical locations 5° off either side of the equator are starting to experience tropical cyclones that are increasing in intensity and frequency.

Worse yet, many of these climate change impacts do not occur in silo. For example, bleaching coral reef have been attributed to not just ocean warming, but also ocean acidification, and even land-based stressors. Climate change impacts on land, such as exacerbated flood and drought conditions, can also disrupt delicate natural balances that can force ecosystem phase changes or exceed tipping points that can reduce or eliminate important ecosystem services. The interactions of a changing climate vary in both space and time, leading to major differences in how climate change has affected marine and coastal environments and the human populations that rely on these environments to survive.

Government approaches to address the impacts of climate change are often divided into two categories: climate change mitigation and climate change adaptation. Climate change mitigation focuses on interventions aimed at reducing the impacts of increased greenhouse gasses warming the atmosphere. In contrast, climate change adaptation focuses on reducing the impacts of climate change. The major difference is that climate change adaption assumes mitigation efforts alone will not be sufficient and that a changing climate will continue to persist, or even worsen, in the future. Thus, the two approaches are not mutually exclusive and nearly all countries around the world are simultaneously investing in both approaches. Yet as it becomes apparent that global commitments for reducing the emissions of greenhouse gasses may not be immediately successful, countries around the world, and especially many developing countries, are turning to adaptation as an important front line of defense.

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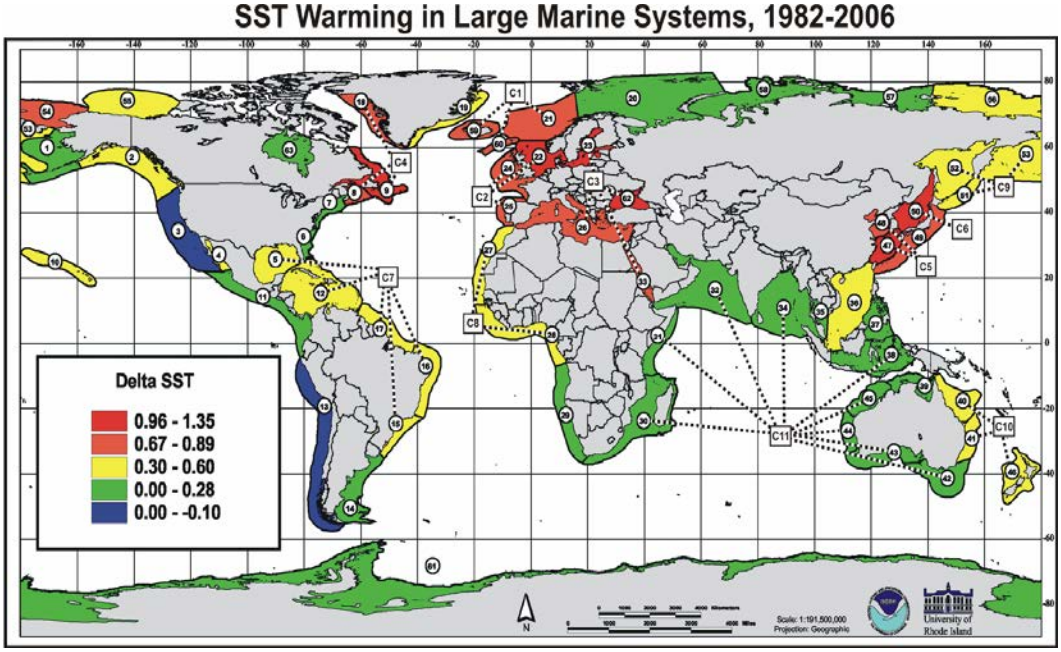


Figure 1: Warming Clusters of LMEs in Relation to Sea Surface Temperature (SST). 1982-2006 (Sherman and Hempel, 2008)

Climate change adaptation has often been focused on a reactive approach where urgent issues are addressed as they become apparent to resource managers. For example, responding to coral bleaching events or beach nourishment and armoring projects in response to severe storms and sea level rise. Yet, the impacts of climate change are exceptionally poorly understood, and worse, the interactions, and indirect impacts of unprecedented global warming will very likely have far-reaching impacts well beyond what the current state of research predicts. A long-term approach that builds from what is known but can quickly adapt to what is not known is a far more prudent investment. This policy brief highlights the importance of taking a proactive and long-term view towards climate change adaptation for successful coastal and marine resources management.

Critique of Policy Options

Taking a Precautionary Approach

To have the best chance at successfully adapting to known and many more unknown long-term climate change impacts requires taking a precautionary approach. A precautionary approach entails proactively taking decisions as best as possible based on available information and continually updating management decisions as new information becomes available. Core to a precautionary approach to climate change adaptation is the mindset that no action can often lead to even worse results than if even a modest management action is taken to adapt to minor climate change impacts before their cumulative impact is devastating. Modest and small actions sooner can add up so that the system has properly adapted over the long-term.

No Regrets and Low Regrets

When it comes to taking long-term decisions on adapting to the impacts of climate change, precautionary approach decisions can be framed as either having no regrets or low regrets. A no regrets decision is a policy decision or action that may provide benefits directly towards the intended climate change adaptation goal, but also yields benefits if climate change impacts are never realized. For example, this might include protecting an existing coastal habitat such as a mangrove forest, which may provide ecosystem services related to both climate change adaptation such as sediment accretion to adapt to long-term risks posed by sea level rise, but also has additional benefits of serving as spawning grounds for

commercial important fish species. A no regret decision will have a positive outcome regardless of climate change adaptation needs as is the ideal situation for taking a precautionary approach.

In contrast to a no regrets option, often there may be some associated costs with taking a policy decision to adapt to the long-term impacts of climate change, but the overall intervention costs are minor when compared to the long-term costs to adapt to climate change in the future. An example of a low regrets situation would include a green infrastructure project, such as establishing an artificial reef to prevent coastal erosion due to increased storm surges and wave energy no longer attenuated because native coral reefs have died off from ocean warming caused by climate change. The upfront costs with planning and implementing a project may be high, and indirect costs with exclusion of access or disruption of fishing local fishing activities may yield unexpected social costs. But these initial costs, while disruptive, far outweigh the long-term costs that would be felt if the same coastal area vanished entirely, having irrevocable impacts on local communities and marine ecosystem function. Balancing the short-term costs with long-term benefits of a climate change adaptation project is an important step to informing sound marine natural resource management.

KEY POLICY APPROACHES

Precautionary Approach: policies that proactively take decisions based on best possible information available, while continually updating management decisions as new information becomes available.

No Regrets: policy decisions that may provide benefits directly towards the intended climate change adaptation goal, but also yield benefits if climate change impacts are never realized.

Low Regrets: long-term policy decisions that may incur initial costs but are relatively minor when compared to the long-term costs to adapt to climate change in the future.

Mainstreaming Climate Change Adaptation

For a precautionary approach to be successful, it is necessary to mainstream management actions into existing governance mechanisms. Any long-term climate change adaptation strategy, especially when focused on marine and coastal management, should not be developed or implemented in silo. Instead, recommendations for adapting to the impacts of climate change should be mainstreamed into existing national and regional marine management strategies.

For many of the world's LMEs, this likely includes updating climate change adaptation recommendations into existing Transboundary Diagnostic Assessment (TDA) and mainstreaming climate change adaptation actions and investments into accompanying Strategic Action Programme (SAP) documents at both the national and regional level. As the key marine management strategies for marine resources, the TDA and SAP contain integrated management and interagency coordination mechanisms. Adapting to the impacts of climate change will be felt not just in the natural resources but also the socio-economic services they provide. For example, changes in some fish stocks due to warming waters may impact marine ecosystem functions, but will also have dramatic effects on commercial fisheries yields, the livelihood of fishing families, and the overall economy of fishing communities. The holistic TDA-SAP approach can account for direct and indirect impacts of climate change as they begin to manifest themselves, serving both as the analysis of the complex issue

but also the coordination document to align often multiple national and regional strategies and plans under an umbrella document focused on marine management, especially as it relates to transboundary resources. Thus, updating and mainstreaming climate change adaptation issues into existing TDA-SAP documentation avoids establishing unnecessary and redundant management mechanisms and strengthens existing national plans by keeping resources focused on the most important issues.

While the TDA-SAP may be the most relevant document for climate change adaptation issues for marine environments, these documents should also be aligned and coordination with more general and larger national climate change adaptation planning documents. For many developing countries, this can include National Adaptation Plans of Action (NAPAs) and National Adaptation Plans (NAPs) which serve often as prerequisite assessments to unlock public funding. The integration of long-term climate change adaptation issues into existing documents will improve uptake and implementation across government agencies, and also leverage existing coordinating and financing mechanisms. This will ensure climate change adaptation of marine management issues are properly situated within larger planning exercise.

Commitment to long-term monitoring

One of the largest threats of climate change are the unknown future impacts. A long-term view towards climate change can help reduce impacts, but it's impossible to manage against something that is unknown. To address this major issue and continually adjust to new and emerging climate change impacts, a quality long-term climate change adaptation strategy must prioritize routine monitoring that feed into good adaptive management practices.

To break this down further, a long-term climate change adaptation strategy for marine management should invest in a robust monitoring system that prioritizes quality collection of high-quality data and information. The collection should focus on known and anticipated impacts as informed by similar environments in the region or the world, and also as informed by the latest scientific research. Proper monitoring should also prioritize a frequency sufficient to monitoring current trends but also capture possible new trends, while accounting for sound statistical practices on sampling and data analysis. For example, measuring sea levels and temperatures to monitoring sea level rise and ocean warming monthly as opposed to annually. The commitment to monitoring should be supported with sufficient financing and capacity on a least a multidecadal timeline to properly adapt to the current and future impacts of climate change.

It should also be noted here that marine resource management monitoring should not just focus on known climate change impacts. Properly adapting to long-term impacts of climate change will require monitoring overall ecosystem health. Measures such as Net Primary Production, keystone species populations, and other proxy measures of ecosystem function can often be early and holistic barometers of changes in marine environments that may be lost if measuring purely physical oceanographic indicators. It is recommended to consult with local academic institutions and non-governmental organizations who are familiar with specific marine environments when designing monitoring programs to inform climate change adaption plans.

Also key to a successful long-term climate change adaptation for marine management monitoring program is establishing measures of all monitoring program indicators. These initial measures are essential for any monitoring program in order to compare future measures against. Known as a monitoring baseline, this first set of information is critical to assess future trends of climate change impacts – allowing for an understanding of a trend direction (worsening or an improvement), magnitude, frequency, and also to identify when new trends emerge. While establishing a specific baseline for a new climate change monitoring program is ideal, it can often not be practical. Relying on peer-reviewed scientific studies, or in the absence of any, local knowledge, can be a good start until more data can be collected.

Monitoring to Adaptive Management

Yet, even the most robust monitoring programs cannot be successful to adapt to climate change unless they inform adaptive management in a timely manner. Adaptive management is management that is intentionally designed and supported by government mechanisms that empower quick decision making as new data and information become available. In the context of long-term climate change adaptation for marine management, this means ensuring that the proper processes are in place to feed data and information from marine monitoring programs to decision makers in sufficient time to properly adapt to the impact of climate change – or to inform initial precautionary approach decision making as new climate change issues emerge. Adaptative management is a good best practice for any project manager, but on longer time scales, can be just as effective and even more important, to properly adapt to emerging climate change impacts.

Policy recommendations

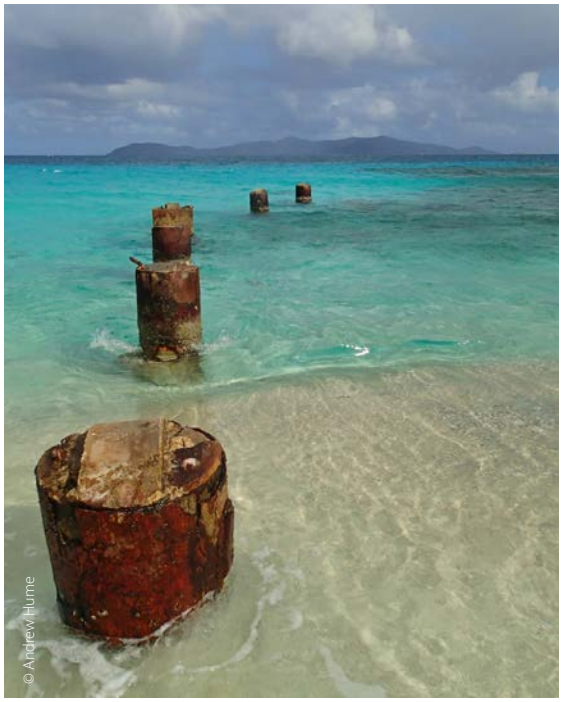
A proactive approach towards climate change adaptation ensures issues have been carefully managed before they become an urgent issue. Taking a long-term approach to climate change adaptation can build from what is known while accounting for and adjusting for what is not known. Often, such a long-term approach entails leveraging policy mechanisms and proactive science-based interventions. The below policy recommendations should be considered by all natural resource managers facing known and unknown climate change threats to the coastal and marine environment.

- Embrace a proactive and precautionary approach towards adapting to the impacts of climate change.
- Recognizing no regret and low regret situations by weighing potential initial costs and long-term benefits from climate change adaption interventions.
- Long-term climate change adaptation goals should be central to any national climate change policy strategy to addresses coastal and marine resource management.
- Mainstreaming long-term climate change adaptation strategies into existing marine management strategies, such as TDA-SAP, ensures proper integration and building on existing management mechanisms.
- To continually adjust to new and emerging climate change impacts, a quality long-term climate change adaptation strategy should prioritize routine monitoring to inform adaptive management.

- Long-term climate change adaptation should be built from baseline measurements of important monitoring indicators. This can allow emerging trends to be identified and managed in a timely manner.

Case Study: Humboldt Current LME

The Humboldt Current Large Marine Ecosystem (HCLME) is one of four global Eastern Boundary Currents, located in the Eastern Pacific Ocean off the western coast of South America. The HCLME is a transboundary LME that spans the countries of Chile and Peru, serving as an important source of economic livelihood, especially from fisheries that depend on its nutrient rich waters driven by seasonal upwelling. It's estimated that nearly 15 percent of the world's fisheries catch is produced by the HCLME.



Like other Eastern Boundary Currents, the HCLME supports a highly productive ecosystem that includes commercially important fisheries, such as sardines and anchovies. These fisheries are known to be heavily dependent on environmental variables such as water temperature, salinity, and even acidity. Small fluctuations in these ocean variables can translate into significant changes in sardine and anchovy abundance.

Unlike other regions of the world's oceans, the HCLME has begun to experience a cooling trend of oceanic waters superimposed with natural climate variations including the El Nino Southern Oscillation (ENSO). These changes to the ocean have impacted important pelagic fish stocks and connected trophic systems. As anthropogenic changes to the global climate have suggested an influence on these natural climate variations, these important fish stocks become more difficult for Chile and Peru to jointly manage. The recent cooling trends of the HCLME are an important management concern that requires a long-term and mainstreamed approach towards adapting to the impacts of climate change.

The increasing uncertainty of climate change on the HCLME and its impacts on natural resources has required the governments of Chile and Peru to take a long-term view of transboundary management of the sardine and anchovy fish stocks. Through the TDA-SAP methodology, the governments have embraced an ecosystem-based management approach towards their fisheries management that includes robust and routine monitoring to inform adaptive management, taking decisions at the LME scale so that both countries mutually benefit. HCLME managers are also cognizant of the fact the HCLME is not a closed system, and is heavily influenced by large-scale oceanographic processes such as ENSO. Therefore, partnerships with research institutions and global government research agencies have been helpful to predict and adapt to future impacts in a proactive way.

Case Study: Pacific Island Food Security

Many Pacific island countries are already dealing with impacts of climate change. From rising sea levels to increasing frequency and intensity of tropical storms, as well as ocean warming and acidification, these island nation's marine natural resources are under immediate threat. With limited agricultural sectors due to small land mass and poor soils, fisheries are often the main source of food. And with climate change impacting fish stocks, concerns about food security are a top priority for many Pacific island nations.

The Governments of Fiji, Niue, Timor-Leste, and Vanuatu have responded to this concern over future food security due to climate change with several short and long-term adaptation measures. One approach to address shorter term concerns of food security has been to deploy fish aggregating devices (FADs), a stationary floating object moored at sea that attracts pelagic fish. FADs are increasingly being viewed as a climate change adaptation strategy to target food security and maintain livelihoods for the fishers residing in the coastal communities. Research has shown that nearshore FADs improve fish harvesting productivity by attracting valuable pelagic species that are otherwise available only to offshore commercial fisheries. Pilot FADs targeting food security concerns in Vanuatu were found to overall decrease fish prices where about 77% of consumption comes from fish protein. The pilot projects also revealed that nearshore FADs reduced consumption of fuel by coastal fishers and improved safety during extreme weather conditions.

To complement the shorter-term interventions, Pacific island governments also prioritized longer term issues associated with declining fish stocks having suitable habitats that match important stages of their life history. For the Pacific island governments, this focused on establishing marine protected areas (MPAs) based on overall marine ecosystem function. For example, marine protected areas that aimed to conserve seagrass meadows and coral reefs that serve as key habitats for fish spawning and juvenile foraging. In addition to conservation of marine habitats, some governments went a step further and protected upland watershed areas that drain into these important marine habitats following a "Ridge to Reef" approach. By reducing sedimentation and pollution draining into the coastal waters, not only will the local marine habitat improve, but also commercial important fish species that are under threat due to climate change. These countries also anticipate that outside the boundaries of MPAs there will be an increase in fish populations, improving coastal fish stocks and fishing communities farther away from MPAs. The long-term and holistic approach taken by pacific island countries protects critical ecosystem services which naturally adapt to climate change impacts such as declining fisheries.

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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.

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