

Recipes for Adaptation – Eastern Tropical Pacific Working Group

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Recommendations:

- Increase collaborative efforts and improve two-way communication between managers and modelers to understand which variables are most relevant (statistical properties) to address specific issues.
- Although models are available for some variables (oxygen, storms, current and wave dynamics, sea surface height), these outputs are not been archived and not being used for management.
- Need to emphasize model variance (ie the range of possibilities) rather than expected means – managers need to learn to integrate the range of possibilities into management.
- Appropriate time scales are also important for managers to be able to use model outputs for making management decisions – i.e managers operate on shorter timescales than models.
- Need to include socio-economic models of climate impacts into management.
- Climate and acidification information needs to be integrated into management actions specific for the ETP at a national level.

1. What marine management currently exists in the ETP?

National/Regional fisheries – mostly managed at country level with national jurisdiction (eg Peru). Shark fishery (and other coastal fisheries) should be handled at a regional level but coordination is missing.

Management agencies:

National level: in each country, Ministry of Environment, fisheries agencies, navy/military, fishers organization (commercial, boat owners), processors/exporters.

Artisanal fishermen. NGOs.

Regional level: CPPS (permanent commission for the South Pacific); Australia, NZ, Chile, Ecuador form the initiative for a commission of the South Pacific. OSPESCA (Central America Commission); IATTC (Inter-American Tropical Tuna Comm); MEXUS (Mexico and US); IAC (Inter-American Sea Turtle Conv); Andean Parliament. CMS global organization that operates regionally; FAO (specifically National Plans of Action; i.e. sharks, bycatch, capacity building, etc), IWC; ACAP; IMO, UNESCO (WHC, with 4 sites within the ETP, Malpelo, GLPS, Coiba, ACG_CR).

Local Fisheries – guidelines can apply for specific fisheries at a local or regional level (i.e. Chile).

Management Agencies: local government; fishing coops; unregulated fishermen (including illegal fishermen). Sport fishermen.

Mariculture – national regulations; industries.

Wetlands and Mangroves – no site specific regulation and enforcement but mangrove included in coastal management plans as protected ecosystem.

Agencies: industries, government agencies.

Tourism – presence in MPAs with regulation & enforcement. Ecotourism (eg Galapagos). Sport fishing.

Agencies: government agencies (ministries, institutes);

MPA – MPAs are functioning at different scales with different levels of enforcement Coastal vs offshore MPAs. In Mexico some fishing ban areas (some enforced) which are regulated differently than MPA.

Agencies: ME, national park services; local government (municipalities and provinces); co-management between government and parks and communities (examples in Chile and CR).

Nesting sites & sea bird rookeries - Turtles nesting sites are included in some of those areas.

Agencies: private operators (hotels) and reserves.

Harmful algal blooms. – toxic dinoflagellates blooms. Are the effects regulated and looked at in a climate change context?

Agencies: Ministry of Health or Environment. Fishery regulat agencies.

Biodiversity/Conservation –

Agencies: ME; regional initiatives (WHMSI), CITES, CBD (biod conv); CMS, etc (several others).

Coastal management (shoreline, biological)

Agencies: Ministries (planning, tourism, environment); local governments (municipalities); Protected areas managing authorities (parks, etc).

2. Where do we have specific examples of climate change and ocean acidification in management?

Climate Change

Mostly small disconnected efforts in region

- Galapagos VA nearly completed;
- CR community (Junquillal, restoration for coastal vegetation) where adaptation of marine turtle nesting sites implemented by local community organization and NGOs (WWF), and will include in the future the local municipality to insert adaption into coastal planning.
- National Adaptation plans being prepared in several countries some of which have weak marine coastal components (Ecuador).

- Mexico (Colola Beach) modelling flooding in prep for climate change.
- NOAA MPA manager training (done at ETP level).

Ocean Acidification – no examples.

Current climate Variability

- Peruvian response to ENSO (anchovy fisheries); Ministry of production would be the managing authorities which can implement different measures to respond to environmental changes (quota, areas). The Ministry has links with climate scientists which can advice in making these decisions.
- Galapagos has a national management plan that can theoretically be adapted in response to changing conditions to regulate activities (tourism, fishing, etc) and reduce vulnerabilities. All countries have agencies to deal with risk and disaster management (some advised by scientific institutions).
- Local fishermen respond to El Nino extremes (change in fishing target areas, using several different gear, word of mouth on good fishing grounds), however specialized fishers have lower adaptive capacity.
- Although smaller fisheries have higher adaptation capacity by shifting target species; small fishing boats may have reduced range as storm frequency and intensity may increase.
- The ETP is starting to integrate ecological studies to management decision (i.e. changes in coral reefs).
- Large scale monitoring systems (Galapagos) started to be integrated into coastal management plans.

3. What models and research should be integrated in management?

- Illustrate using El Nino variability how predictions and responses can be connected. ENSO models and predictions should be integrated into management actions. Some predictions are available (i.e. oxygen, primary productivity, currents), we should integrate these into management decisions.
- How do we use models to respond to the range of possibilities so that adaptation plans can be prepared accordingly to address specific issues or targeting specific scenarios
- Although several models are being generated for CC impacts on the ETP region, the outputs are not targeting specific management actions. Modelers need to get input from resource managers or community to direct model output and format towards providing specific answers.
- Range shift models, looking at some results from IPCC, for fish movements and range shift, are not included into management. The resolution is not necessarily appropriate for small scale decisions but maybe for regional scale decisions. Current shifts, direction and intensity could be very important for FAD (fish aggregation device) fisheries.
- Make flooding models accessible to decision makers to be able to understand coastal changes and to make appropriate management plans.

- Aquaculture could benefit from climate change data. Some areas are now being restored through mangrove reforestation. Information on climate change is missing at the planning level to influence coastal planning, development and coastal restoration projects. Integrated coastal zone management needs to be implemented and used as a mechanism for integrating models outputs.
- MPAs: need to identify climate refugia and include them in MPA planning. Identify ecosystem indicators and methods to measure resilience. Identify sink-source populations.

4. What are the obstacles to addressing (and understanding) climate change and ocean acidification?

- Differences between the ETP and other regions (Bering Sea) where the oceanographic conditions and the models provide more accurate predictions. The ETP is an open system which can be more difficult to model to provide specific answers.
- Inherently more bias and uncertainty in model results in tropics. For example local temperatures trends are not understood.
- There is still limited ability to predict changes in upwelling areas.
- Temperature error is significantly greater in the ETP.
- Ocean-land interactions are poorly understood in a narrow shelf such as the one in the ETP.
- ENSO effects currently used as a proxy for climate change, however this might be misleading for some effects.
- Lack of understanding of climate variability and what variability means. Managers are focused on short-term effects. Confidence level of models is poorly understood by managers and considered as a picture of the future.
- Need information on tectonics to understand sea level rise effects in the region. Some tectonic movements are compensatory hence minimize the effects of SLR.
- Need communication tools to discuss scenarios with fishers. Some of the fishing campaigns need to be based on scientific data to build knowledge and capacity within fishing communities, this will also increase preparedness for extreme events.