

# **Priority adaptations to climate change for the fisheries and aquaculture sector in Kiribati**

## **Based on consultations between MFMRD and SPC in August 2012**

### **Introduction**

Following the participation of MFMRD staff at the SPC/FAO workshop of identifying 'Priority adaptations to climate change for Pacific fisheries and aquaculture: reducing risks and capitalising on opportunities' in Noumea in June 2012, MFMRD requested detailed discussions with SPC's Fisheries, Aquaculture and Marine Resources Division (FAME) to assist senior staff to identify specific adaptations for Kiribati to reduce the threats from climate change to the substantial contributions that fisheries make to government revenue, food security and livelihoods and, importantly, to capitalise on any opportunities for increasing these benefits resulting from climate change.

This document summarises the key impacts and draft adaptations that can be made with regards to economic development (particularly government revenue), food security, livelihoods and biodiversity conservation.

### **Impacts of climate change on fisheries and aquaculture**

1. Oceanic fisheries: Catches of skipjack tuna in Kiribati's EEZ are projected to increase by up to 30-40% over the coming decades due to changes in water temperature and the prime feeding areas of these species. On the other hand, catches of bigeye tuna are eventually expected to decrease. Greater abundances of skipjack and yellowfin tuna within the EEZ should provide Kiribati with opportunities to increase the contributions of licences fees from distant water fishing nations to government revenue.
2. Coastal fisheries: The productivity for coral reef fish and invertebrates in Kiribati is projected to decline by 20% by 2050 due to both the direct effects (e.g. increased sea surface temperature) and indirect effects (changes to fish habitats) of climate change. Kiribati faces further declines in the potential supply of reef fish per person due to the effects of population growth. Possible increased incidence of ciguatera fish poisoning could reduce the availability of reef fish in some islands even further. On the other hand, the nearshore pelagic fishery component of coastal fisheries based on skipjack and yellowfin tuna is projected to increase for the reasons outlined above.
3. Aquaculture: Milkfish farming in earthen ponds is expected to be favoured by higher air temperatures and increased rainfall but the effects of sea-level rise on this activity have yet to be determined. Higher water temperatures and rainfall, and/or increased ocean acidification, are expected to progressively reduce the efficiency of culturing seaweed, giant clams, pearl oysters and sea cucumbers.

## **Adaptations for government revenue and economic development**

### ***1. Vessel day scheme (VDS)***

The VDS administered by the Parties to the Nauru Agreement (PNA) Office provides Kiribati with a practical 'cap and trade' fisheries management scheme to:

- (1) limit the fishing effort of the industrial tuna surface fishery to conserve stocks of skipjack, yellowfin and bigeye tuna at levels that should ensure sustainable future benefits;
- (2) allow increased fishing in Kiribati's exclusive economic zone (EEZ) when the fish are abundant there during El Nino events through the purchase of days from other PNA members;
- (3) enable Kiribati to receive some benefits from tuna resources during La Nina episodes when the fish are concentrated in the western Pacific through the sale of days to PNA members further west.

In addition to providing a practical way of distributing benefits from tuna to PNA members during the variable climatic conditions that exist today, the VDS is also a good adaptation to climate change. The allocation of fishing days is adjusted regularly based on recent catches and, therefore, as tuna move progressively east under climate change Kiribati can expect to be allocated more fishing days. Such allocations should provide Kiribati with the opportunity to increase the contribution of licence fees to government revenue.

To establish records of the demand by industrial fleets to fish within its EEZ, Kiribati can purchase additional fishing days not required by other PNA members. Existing arrangements with PNA allow additional days to be purchased at short notice from other members once all Kiribati's allocated days for the year have been used.

Action needed: By 2015, Kiribati should ensure that bilateral arrangements they have with vessels outside the VDS scheme and US Treaty are concluded so that all fishing effort within its EEZ lines up with the annual allocation of days from the VDS to establish the catch history needed for future equitable allocation of days under the VDS.

Collaborating departments: ??

### ***2. Developing service industries for industrial fishing transshipping vessels***

The prospect of more purse-seiners fishing in Kiribati's EEZ and increased transshipping from Tarawa creates the opportunity for increased economic gains through development of **businesses to service the needs of fleets. Consideration should be given to:**

- Expanding new harbour facilities now under construction so that purse-seine vessels and reefers can come alongside a wharf for service, and that space can be created to **repair nets etc;**
- Improving the internet services available for industrial fishing vessels;

- Providing incentives for local or joint business ventures to (1) establish machine shops to repair parts or fabricate required fittings for vessels; (2) provide salt, fresh vegetables and medical supplies for crew etc; (3) taxi transport and accommodation for crew wishing to come ashore; (4) improved agent services and crewing services; and possibly milkfish bait for the longline fleet; and
- Building another transshipping facility at a northern island, and declare it a national port to make it easier for fleets to tranship within Kiribati's large zone.

Action needed: Feasibility studies.

Collaborating departments: Ministry Commerce, Industry and Cooperatives; Ministry of Public Works and Utilities; Ministry of Finance and Economic Development; Ministry of Communication, Transport and Tourism Development.

## **Adaptations for food security and livelihoods**

### ***1. Networks of inshore anchored fish aggregating devices (FADs) for outer islands***

Because the productivity of coral reef fisheries is expected to progressively decline as coral reefs degrade under climate change, communities on outer islands will need to transfer some of their fishing effort from reef fish to nearshore pelagic fish, particularly tuna.

The most practical way to do this is to install FADs at all islands where reef fisheries are not expected to meet the communities' needs for fish. FADs are a win-win adaptation – they can provide better access to fish now, and tuna should be easier to catch around FADs in the future as more tuna move into Kiribati's EEZ.

Consultations are needed with communities and SPC's SOPAC Division to identify the best locations for FADs at each island (which may include 'lagoonal FADs' in some islands with open lagoons), and to make arrangements for the harmonious use of FADs by all island communities. Wherever possible, FADs should be placed close enough to shore so that they can be reached by people paddling in canoes.

FADs should be regarded as a permanent part of the national infrastructure for food security. Communities should receive training in how to fish around FADs and how to maintain them. Because FADs have a limited life (usually 2-3 years), MFMRD should maintain a stockpile of materials to replace FADs and set up systems with island fisheries officers to replace FADs as soon as possible after they are lost.

Catches of fish made around FADs should be monitored to measure the cost:benefit of FADs and improve site selection.

Programmes will also be needed to make communities fully aware of the benefits of FADs (using brochures etc).

Action needed: Establish a new programme at MFMRD dedicated to FADs. Key functions of the programme would be to (1) receive training in all aspects of installing, maintaining and fishing around FADs from an SPC master fisherman, (2) pass on this training to island communities; (3) maintain adequate stockpiles of equipment to replace lost FADs quickly; (4) maintain supplies of fishing gear needed to fish around FADs for sale to communities at cost price; and (5) monitor the catches of fish made around FADs.

This will be a large programme and should be 'staged' by implementing it at a subset of islands with the greatest needs in the first instance (i.e. islands without lagoons).

Collaborating departments: Ministry Commerce, Industry and Cooperatives; Ministry of Internal Social Affairs.

## ***2. Supply sufficient tuna for the growing population in Tarawa***

Most of the fish required for good nutrition of the population in Tarawa needs to come from tuna. Analysis is needed on the best way to provide access to this fish, and how to ensure that supplies of tuna are adequate during La Nina events when industrial fleets are not fishing much with Kiribati's EEZ or transshipping frequently at Tarawa.

Key components of the supply chains need to be identified and strengthened where they may be weak. Factors to be considered are: (1) using licence conditions to ensure that the necessary amounts of tuna are supplied to Tarawa from industrial fleets and that the fish is in good condition; (2) provision of FADs for the local troll fishery (with submerged buoys to avoid vandalism); (3) adequate onshore frozen storage of tuna for release on the market when fresh fish is not available from the industrial fleet or local troll fishery; (4) establishment of more enterprises for smoking and drying tuna to increase the shelf life of products; (5) increased number of sale outlets; and (6) provide coastal infrastructure to support small scale tuna business at community level

Action needed: Gender-sensitive supply chain analysis

Collaborating departments: Ministry Commerce, Industry and Cooperatives; Ministry of Public Works and Utilities; Ministry of Finance and Economic Development;

## ***3. Protect and improve coastal fish habitat during infrastructure projects***

Population growth and sea-level rise will require new infrastructure, and modifications to existing infrastructure. MFMRD should ensure that fisheries needs are always considered during cross-sectoral planning for infrastructure. For example, causeways should always be constructed with wide culverts to allow water to flow from the sea to the lagoon. Culverts should also be added to existing causeways when they are being modified.

Environmental Impact Assessments (EIA) for infrastructure should include full consideration of possible effects on fisheries and aquaculture and incorporate the expected effects of sea-level rise on fish habitats.

Excavation of building materials should be done with the advice of SPC's SOPAC Division. Consideration should be given to excavating building materials from the dead coral platform intertidal reef flats on the outside of islands to create deep pools on the reef flat. These pools can be expected to create additional habitats for corals and fish and help maintain biodiversity. The pools should be excavated in locations where they will provide the most benefits to communities as swimming areas for tourists, fishing places etc, and where they are unlikely to add to the risk of ciguatera fish poisoning which can occur when reefs are disturbed.

This concept should be tried on an experimental basis in the first instance and monitored with assistance from SPC's FAME and SOPAC Divisions. The research involved would be ideal for a national postgraduate student at USP.

Consideration should also be given to disposing of derelict vessels on outer reef slopes in depths of 30-40 m to create more reef habitat and possible dive sites.

Action needed: Design preliminary experiment for sourcing building materials from intertidal outer reef platforms to create fish habitat

Collaborating departments: Ministry of Public Works and Utilities; Ministry of Environment, Land and Agricultural Development.

#### **4. *Ciguatera fish poisoning***

The increase in dead coral and proliferation of seaweed on reefs expected to occur during climate change could increase the habitat for the toxic dinoflagellate algae, *Gambiodiscus* spp, which causes this type of fish poisoning. Ciguatera may be a greater risk for communities on islands in the south of the country because recent research suggests that the abundance of the toxic algae may be limited by high water temperatures.

Action needed: MFMRD should (1) consult with Ministry of Health to design a form to be used by all clinics in the country to record the number of ciguatera cases to determine if the incidence of ciguatera fish poisoning increases over time; (2) map existing and recent ciguatera events based on data already available; and (3) inform communities about the possibility that ciguatera could increase in the future.

Collaborating departments: Ministry of Health

#### **5. *Make the best use of the pond infrastructure***

The flushing of the existing pond infrastructure near the airport can be expected to be affected as sea level rises, which will influence the effectiveness of using these ponds for various forms of aquaculture over time. At present, this important infrastructure is underutilized.

Assessments are needed to identify the most profitable use of these ponds in the near-term, and how the selected use is likely to be affected by altered flushing regimes as sea level rises. The existing plans to assess the feasibility of using this infrastructure for farming milkfish and sandfish (or possibly co-culture of both species) should be completed as quickly as possible. The Mozambique tilapia in the ponds are a problem for management but they could be kept under control by regular netting to use them for stock or fish feed. Once the most effective way to use the ponds has been identified, the cost: benefit of demonstration projects involving a subset of ponds should be undertaken with a view to calling tenders for use of the entire set of ponds by private individuals/companies.

Action needed: Assessment by SPC's SOPAC Division of the effects of sea-level rise on the flushing of ponds and any engineering needed to optimise the efficiency of the ponds for aquaculture. Feasibility study for best uses of ponds, with assistance from aquaculture staff in SPC's FAME Division.

Collaborating departments: Ministry of Environment, Land and Agricultural Development; Ministry of Public Works and Utilities.

#### ***6. Restoring the fishery for Te Bun (arc shells) in Tarawa***

In the past, the lagoon in Tarawa has yielded 1800 tonnes of arc shells (Te Bun) per year. The arc shells have been overfished and there is also the possibility that the large causeway has also affected the conditions for this species in parts of Tarawa lagoon. Catches are now supplemented with shells from Abaiang. Research is needed to identify the growth rate, age at spawning and recruitment patterns of this species in Tarawa lagoon to determine how best to restore the stocks through an initial closure and then rotational fishing patterns.

Experiments are also needed to determine whether the arc shells survive and grow well when permanently submerged, or whether they are dependent on intertidal habitat because the intertidal habitat will be progressively lost due to sea-level rise.

Investments in basic biological studies and experiments should result in practical restoration methods and a good understanding of the likely effects of sea-level rise on this previously important subsistence fishery. They should also identify the scope for 'seeding' the lagoons in other atolls (where arc shells do not occur) to create subsistence fisheries for this species there.

Action needed: Legislation to prohibit the export of Te Bun from Tarawa lagoon to other countries until the status of the fishery is well understood. Engage SPC FAME Division and other research partners to design the research needed to restore the fishery in Tarawa and obtain funds for a national PhD student to do the research.

Collaborating departments: Ministry of Environment, Land and Economic Development; Ministry of Internal Social Affairs

## **7. Mapping seagrass and intertidal flat habitat**

Some coastal fisheries use habitats other than coral reefs, in particular, arc shells, sea cucumbers, milkfish and bonefish depend on intertidal lagoon flats and seagrass beds. Basic information is needed on the extent of these habitats in Kiribati to estimate their contributions to coastal fisheries.

Much of the mapping can be done with satellite images and ground-truthing. The database can then be used to estimate and monitor the effects of sea-level rise on the contribution of these habitats to coastal fisheries used for food security in collaboration with SPC's FAME and SOPAC Divisions.

Action needed: Train a staff member from MFMRD in remote sensing and habitat mapping to complete the analysis for every island.

Collaborating departments: ???

## **8. Measuring effectiveness of adaptations**

The effectiveness of adaptations for economic development, food security and livelihoods and biodiversity conservation need to be evaluated to determine whether they are having the desired results, and to adjust them if needed. This is best done by including some additional questions in Household Income and Expenditure Surveys (HIES) conducted every 5 years by the government.

The great significance of the fisheries sector to the formal and informal economy in Kiribati justifies the changes to questions in HIES (and the census if practical) to include the key questions on fish sale and consumption.

Action required: Consult with the Statistics for Development Division and FAME Division at SPC to design the additional questions needed for HIES for the fisheries sector.

Collaborating departments: Ministry of Finance and Economic Development

### **Participants in discussions between MFMRD and SPC on priority adaptations**

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