



إندستيتوت فيسرئقن مزلانكس  
INSTITUT PENYELIDIKAN PERIKANAN  
FISHERIES RESEARCH INSTITUTE  
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# Climate Change Impact on Capture Fisheries in Malaysia

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## INTRODUCTION

### What is a climate change?

“Change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods” (UNFCCC, 1992).





## What is the cause of climate change?

The climate change is caused by both natural and anthropogenic drivers as a result of greenhouse gases emission. Greenhouse gases (GHGs) differ in their warming influence (radiative forcing) on the global climate system due to their different radiative properties and lifetimes in the atmosphere. (IPCC, 2007)

Greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) among others





# IMPACT OF CLIMATE CHANGE

## General impact

The change in climate may generally impact these:

- a. Ecosystems
- b. Food
- c. Coasts
- d. Industry, settlements and society
- e. Health
- f. Water





# IMPACT OF CLIMATE CHANGE TO FISHERIES

The impact of climate change on fisheries would be in multiple pathways as figure.



## Global Warming



- Ocean currents
- ENSO
- Sea level rise
- Rainfall
- Evaporation
- River flows
- Lake levels
- Thermal structure
- Storm Severity
- Storm frequency
- Acidification
- Salinity
- Temperature
- Ice cover

## Effects on:

Production  
Ecology

Fishing  
Operations

Communities  
Livelihoods

Wider society &  
Economy

## Impacts on:

Species composition  
Production & yield  
Species distribution  
Diseases  
Coral bleaching  
Calcification

Safety & efficiency  
Infrastructure

Loss/damage to livelihood  
assets  
Livelihood strategies  
Risk to health & life  
Displacement & conflict

Adaptation & mitigation  
costs  
Market impacts  
Water allocation  
Floodplain & coastal  
defense

(Figure from Badjeck et al. 2010)



# Changes in sea surface temperature

## Effects

- More frequent harmful algal blooms
- Increased incidence of disease and parasites
- Altered local ecosystems with changes in competitors, predators and invasive species
- Changes in plankton composition
- Damage to coral reefs that serve as breeding habitats (bleaching)
- Less dissolved oxygen

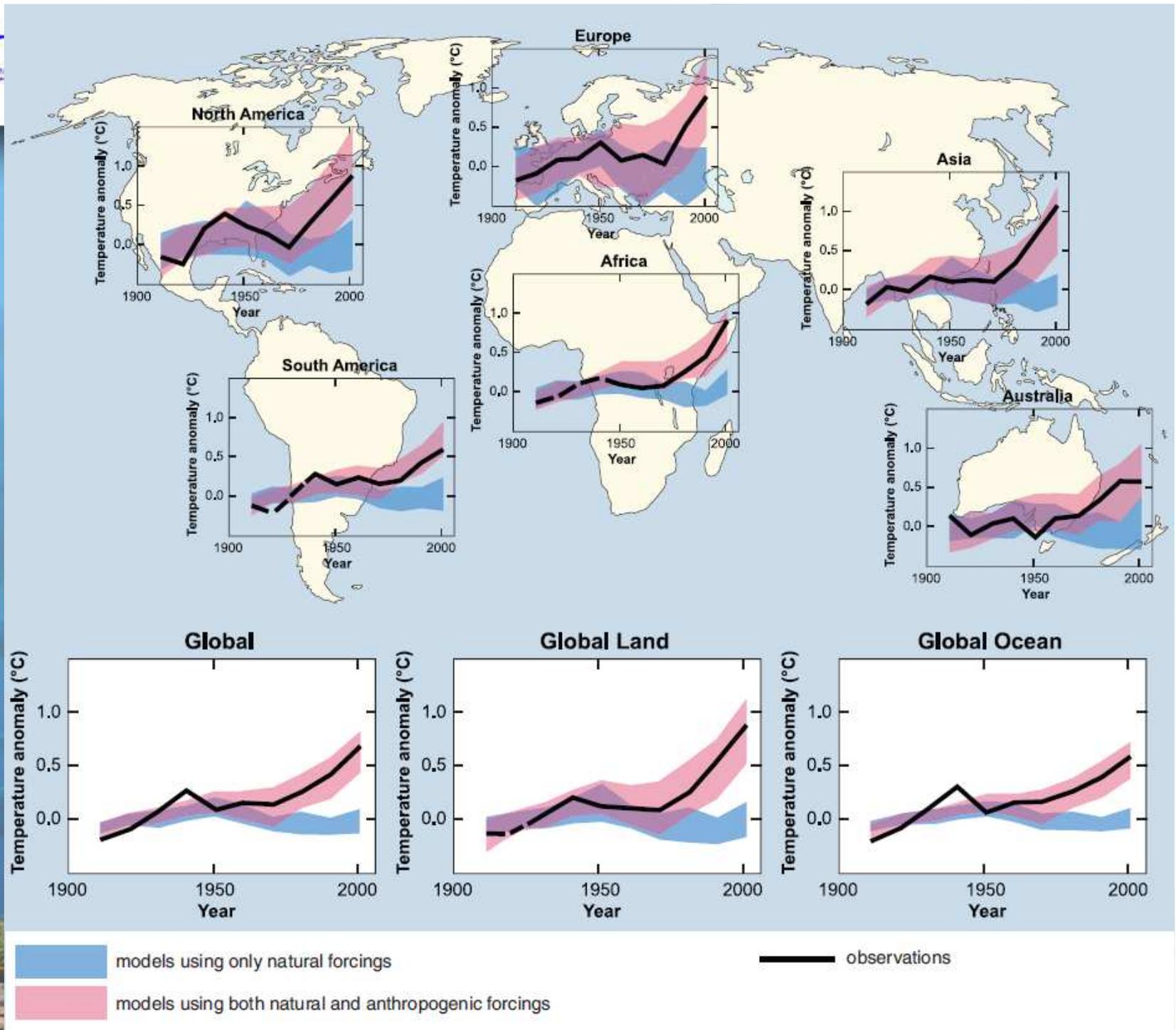
Impacts on the abundance and species composition of fish stocks.





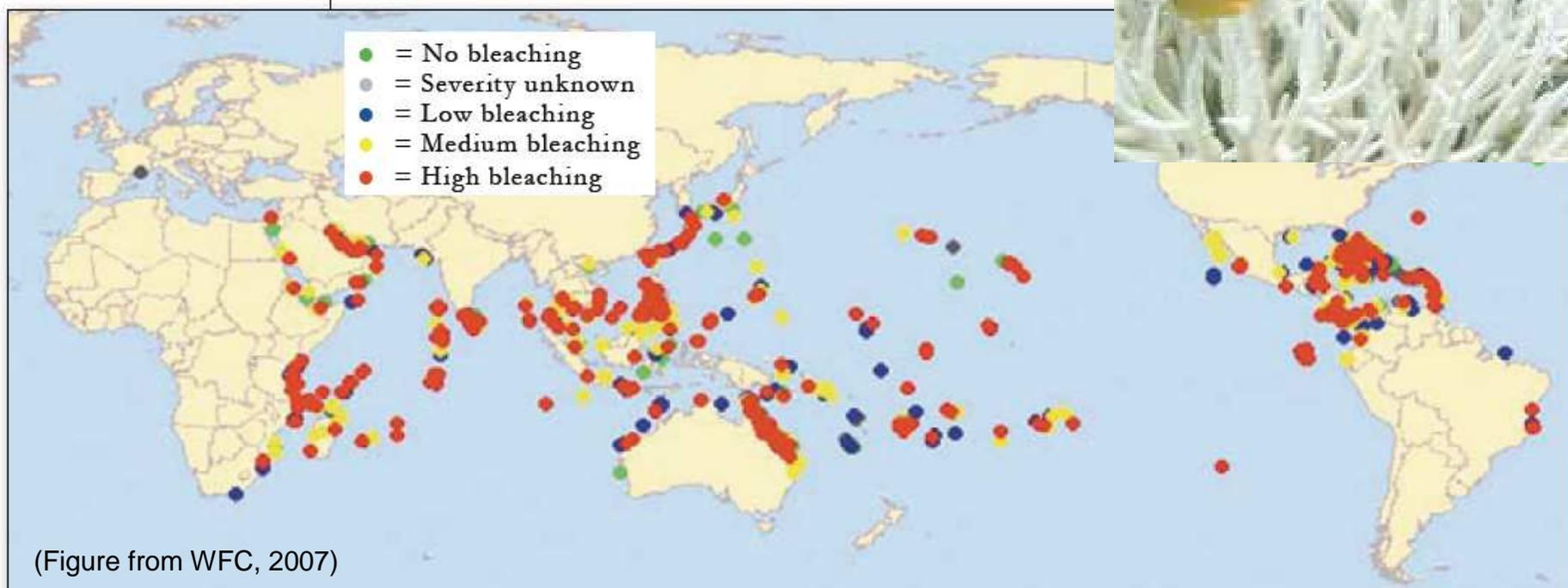
Higher temperatures reduce oxygen solubility in water but can raise the oxygen and food intake demand of fish as their metabolic rates are raised. Associated rises in gill ventilation rates can lead to increased uptake of aquatic pollutants, potentially rendering the flesh unfit for human consumption.







## Coral bleaching severity



Coral reefs provide a permanent habitat for many important fish species and are vital to the juvenile stages or food supply of many others. Higher sea temperature is a major cause of coral bleaching and damage to reef ecosystems around the globe.





## Calcification of coral

Calcification – a process by which corals produce calcium carbonate ( $\text{CaCO}_3$ ).

Coral reef calcification is predicted to decrease 20-60% by the year 2100.

This situation due to ocean acidification as a result of increase of  $\text{CO}_2$  in sea water as atmospheric  $\text{CO}_2$  rises.  
(McNeil et al., 2004 (GRL Vol 31))





## El Niño-Southern Oscillation

Changed location and timing of ocean currents and upwelling alters nutrient supply in surface waters and, consequently, primary productivity.

Changed ocean temperature and bleached coral

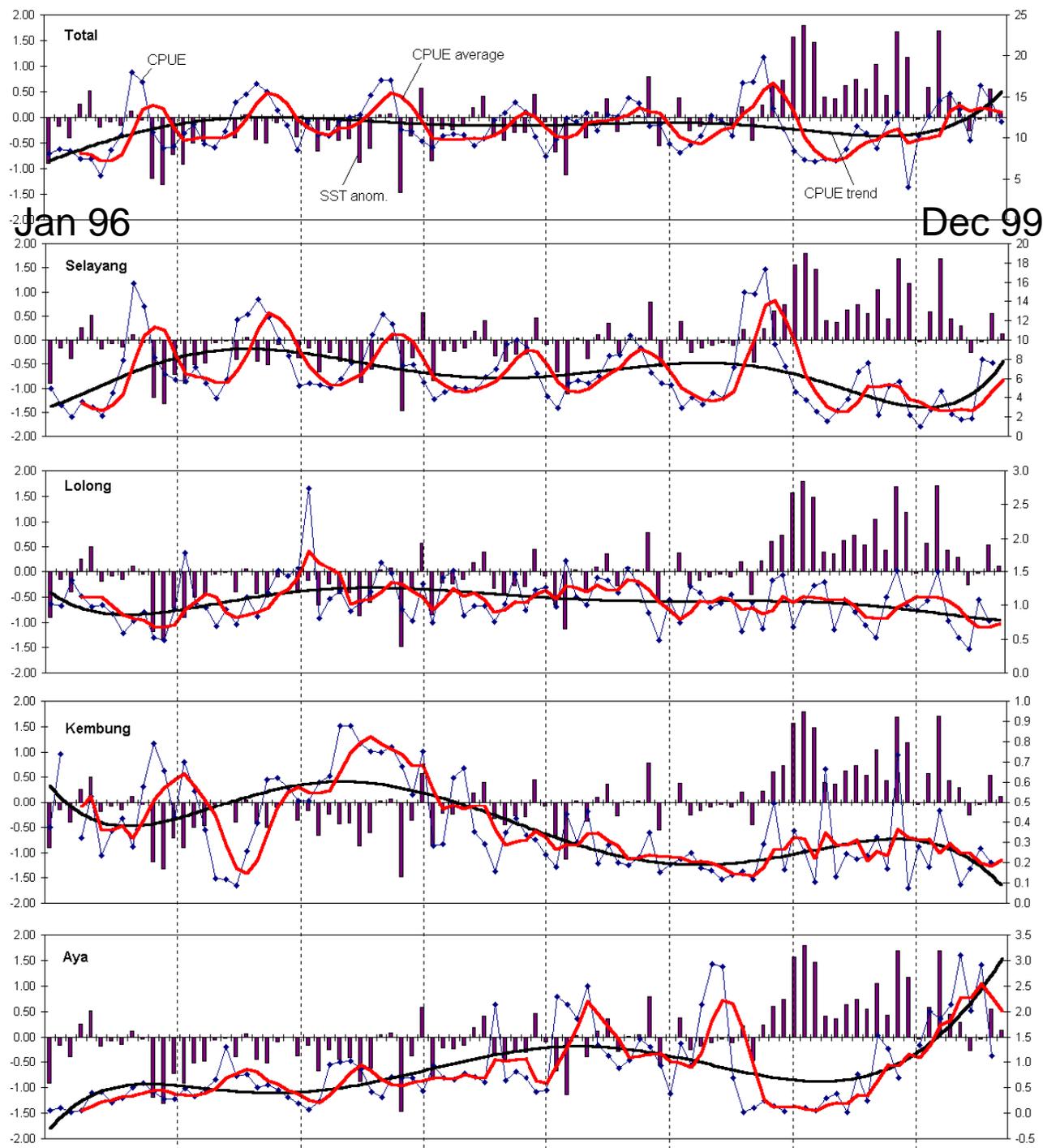
May result in changes in the distribution and productivity of open sea fisheries.

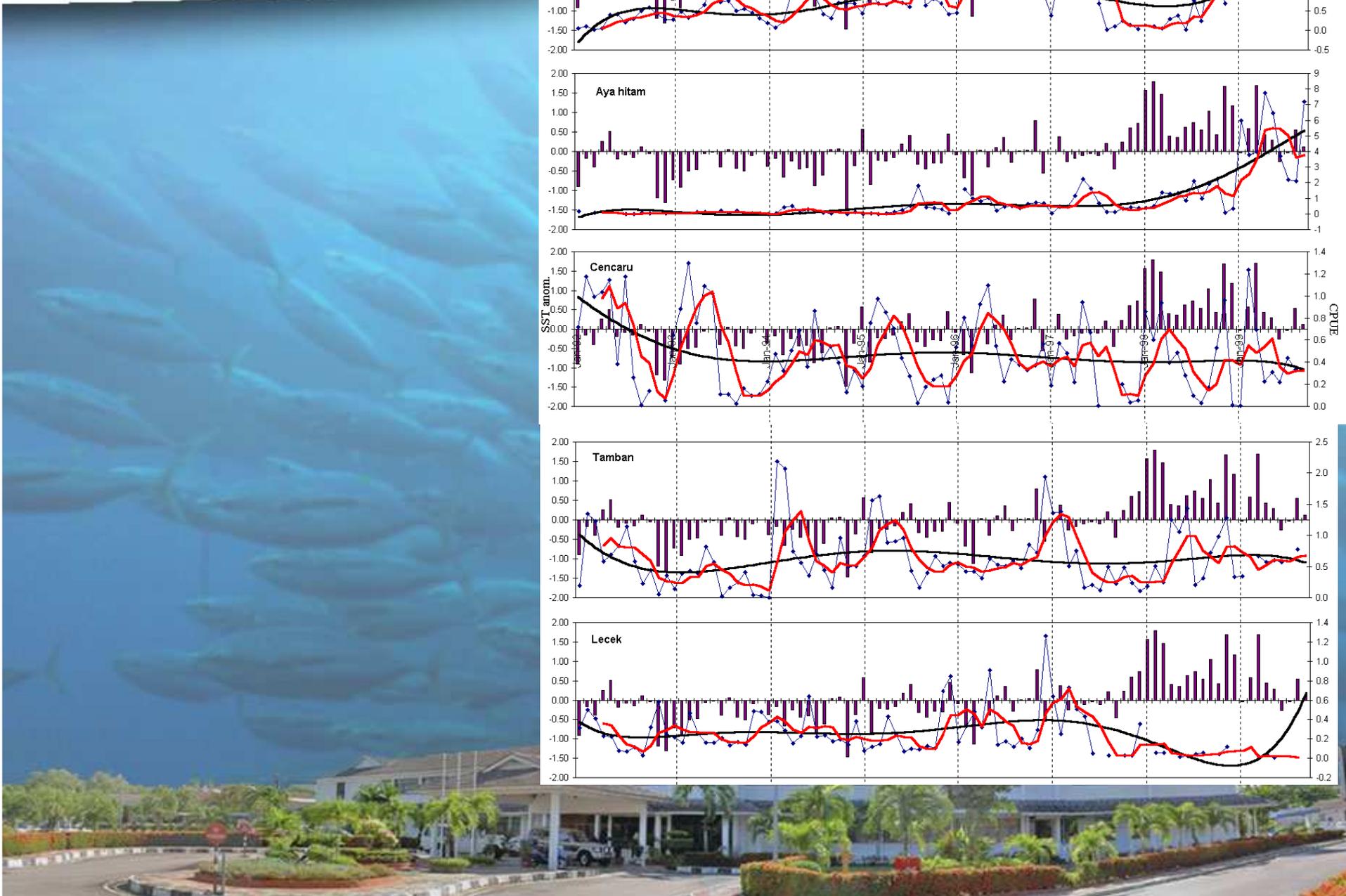
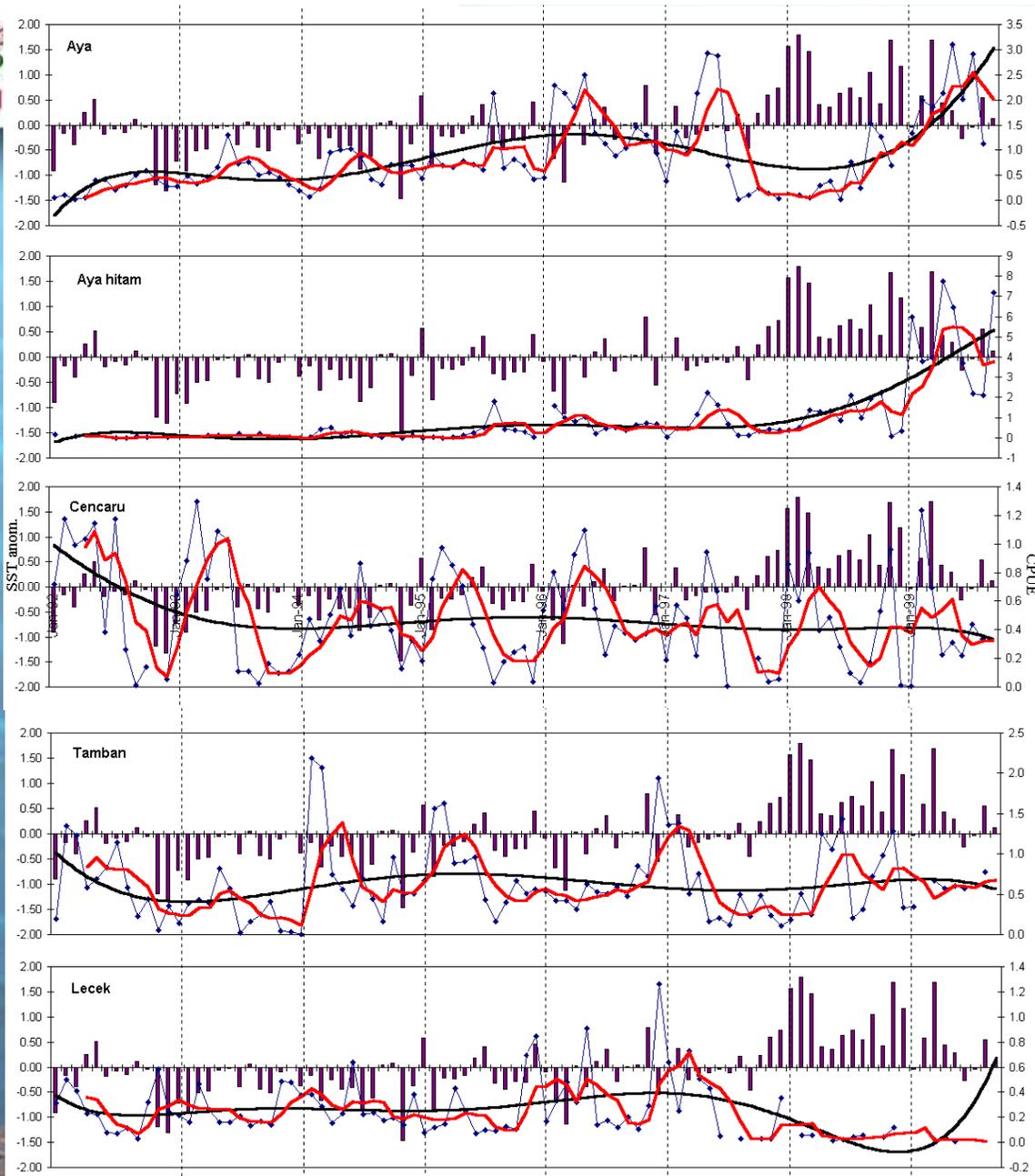
Reduced productivity of reef fisheries.





# El Nino impact to fish catch on the east coast of Peninsular Malaysia







## Effects of rising sea levels

Mean sea level is predicted to rise between 10 and 90 centimeters during this century.

→ This will likely damage or destroy many coastal ecosystems such as mangroves and salt marshes

→ Threat to countries such as Bangladesh, Guyana, and the Maldives, and to low-lying islands like Tuvalu, Tonga, and Kiribati, and most low lying coral islands in the Pacific and Indian Oceans that have economies tied to coastal and marine systems, in the form of fishing and tourism.





A rise in sea level would increase the depth of water above coral reefs (optimum being 2–30 m).

→ This would result in lower light penetration to support the photosynthetic algae living within the coral. If the water depth increases faster than the corals can grow, they could effectively “drown,” destroying habitat for fish upon which many artisanal fishers are dependent.





## Disease

In tropical areas, warmer waters may increase the susceptibility of fish to pathogens because they are already expending energy dealing with thermal stress.

Many pathogens are temperature-sensitive. For example, growth rates of marine bacteria and fungi are positively correlated with temperature.

→ More disease related fish mortalities are expected.





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## Impact of climate change to fish species





Predicted changes in various fish populations associated with warmed habitats, according to geographical region (Roessig et al., 2004)

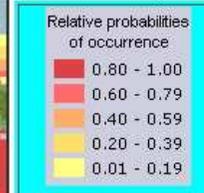
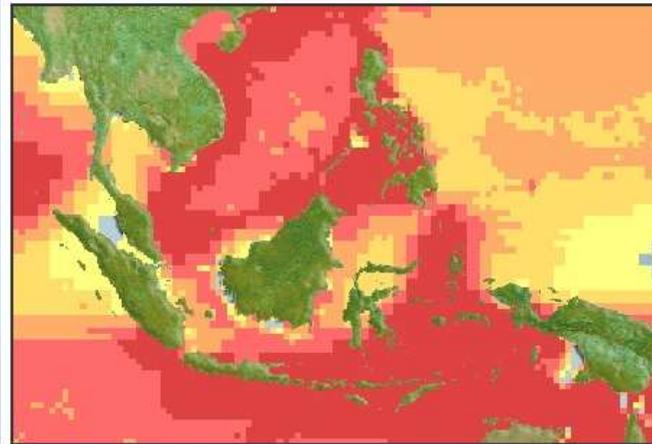
Region	Species	Prediction
Polar	North Sea cod, haddock, herring, and sardines	Possible shift in spawning times; alteration of bioenergetics; changes in transport of larvae
	Barents Sea cod and haddock	Changes in early life stages growth rates and recruitment levels
	Cod, haddock, plaice	Recruitment decreases off West Greenland with increasing temperature; changes in growth rates
Temperate	Pacific salmon ( <i>Oncorhynchus spp.</i> )	Distribution shifts northward; changes in size; decreased population
	Sockeye salmon ( <i>O. nerka</i> )	Distribution shifts towards the sub-Arctic
	Skipjack tuna	Spatial shifts with temperature
	Atlantic salmon	Distribution and survival changes
Tropical	Horse mackerel ( <i>Trachurus trachurus</i> L.)	Distribution changes in accordance to food shifts
	Atlantic tropical reef spp.: porgies, snappers, sea bass	Species shift into new areas and change in abundance
	Pacific reef spp.	Decreases in corallivore and coral nester abundance; increases in invertebrate feeders



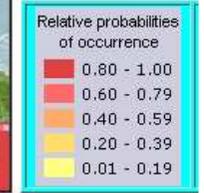
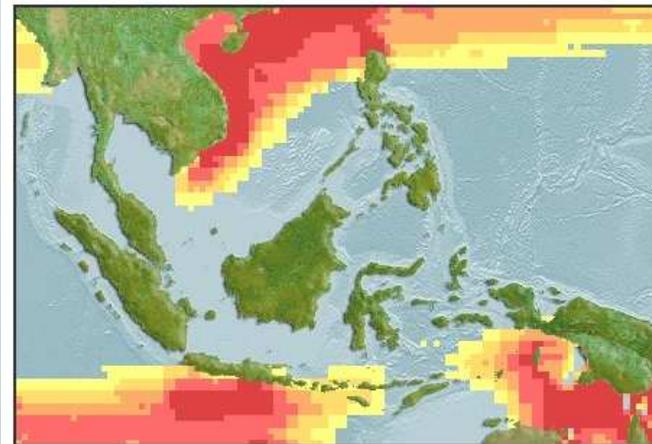
Climate change may alter the species distribution.

Maps showing occurrence of mackerel in the region at present and in 2050. (under IPCC SRES A1B scenario)

Rastrelliger kanagurta (ikan kembung)



Computer Generated Native Distribution Map (present)



Computer Generated Native Distribution Map (in year 2050)

Source: AquaMaps project (ACB-WFC-FRI); [www.aquamaps.org](http://www.aquamaps.org) - mapping tools that display changes in the SEA marine biodiversity due to climate change, using a biogeography modeling approach (AquaMaps) linked to existing information systems .





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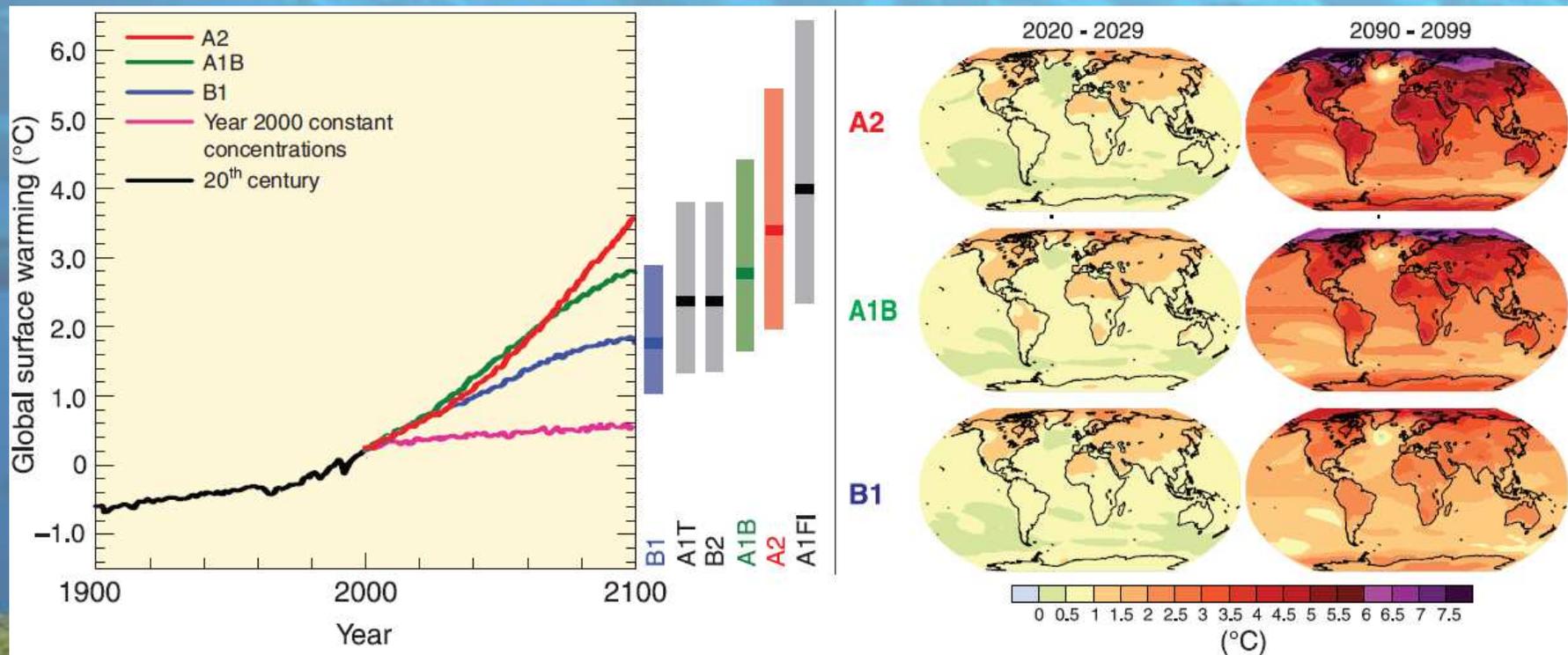
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# ADAPTATION AND MITIGATION





We can't stop the climate from being changed, as the production of CO<sub>2</sub> has been increasing, and the atmosphere has been warming....





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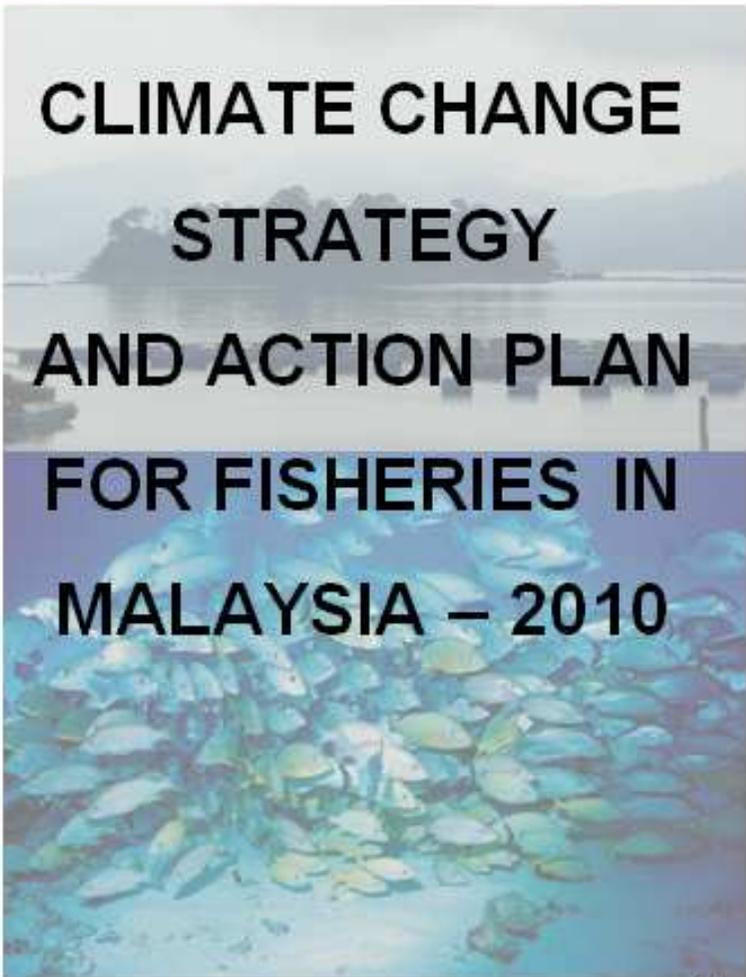
Our option....

“Mitigate and adapt.....”





21 April 2010 DRAFT OF CLIMATE CHANGE STRATEGY AND ACTION PLAN FOR FISHERIES IN MALAYSIA - 2010



21 April 2010 DRAFT OF CLIMATE CHANGE STRATEGY AND ACTION PLAN FOR FISHERIES IN MALAYSIA - 2010

1.0 INTRODUCTION

Malaysia is one of the moderate climate vulnerable countries in the world and will become even more serious as a result of climate change in future. Floods, tropical storm surges and droughts are likely to become more frequent and severe in the coming years. These changes will threaten the significant achievements Malaysia has made over the last 50 years in increasing incomes and reducing poverty. Over the last 50 years, the Government of Malaysia, with the support of other international organizations, has invested over \$100 billion to make the country less vulnerable to natural disasters. These investments include flood management schemes, improvement of agriculture irrigation channel, coastal erosion and the raising of roads and highways above flood level. In addition, the Government of Malaysia has developed state-of-the-art warning systems for tsunami, floods, storm surges and is expanding community-based disaster preparedness. Climate resilient varieties of rice and other crops have also been developed.



The challenge Malaysia now faces is to scale up these investments to create a suitable environment for the economic and social development of the country and to secure the well-being of our people, especially the poorest and most vulnerable. This includes... The



**DRAFT ONLY**



The Climate Change Action Plan is a 10-year programme (2010-2020) .  
Seven actions to be taken:

**1. Develop/strengthen fisheries-meteorology database**

- Compile data on fisheries activities and meteorology for areas under fisheries
- Develop temporal & spatial database and data management that can be accessed by stakeholders
- Provide real-time data for monitoring
- Dissemination of information to target groups and stakeholders
- Develop fisheries meteorological stations network with Met.





2. Develop climate change resilience in fisheries
  - thru community-level adaptation, livelihood diversification, better access to basic services and social protection
  
3. Research and knowledge management
  - Analysis on the linkages between climate phenomena and capture fisheries landings
  - Research on use of green technology in fishing to help reduce CO<sub>2</sub>.
  - Monitor landing of fish species (especially commercial sp.)
  - Monitor impact of climate change to ecosystem and marine biodiversity.





4. Capacity building and institutional strengthening
5. Disaster Management
6. Awareness Programme
7. Conservation on marine biodiversity





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Annex 1

**CLIMATE CHANGE STRATEGY AND ACTION PLAN FOR FISHERIES**

**Objektif 1 – Development of Fisheries – Meteorology Database**

No.	Strategies	Activities	Target	Responsibilities/ Actions
1.	Acquire fisheries/ meteorology data and Develop Temporal and Spatial Data	a) Compile data on fisheries activities and meteorology for areas under fisheries b) Develop temporal & spatial database and data management that can be accessed by stakeholders c) Acquire database server d) Provide real-time data for monitoring e) Dissemination of information to target groups and stakeholders	Establish of a National Fisheries Climate Change Centre (NFCCC) as One-stop Centre to provide Up-to-date and real time data, and GIS web base	DID DOE DOF FRI MACRES Marine Dept. MMD Stakeholders Universities
2.	Develop fisheries meteorological stations network	a) Weather monitoring stations b) Agencies-stakeholders national link c) System maintenance	Up-to-date and real time information on selected aquaculture species and areas	DOF MMD

**Objective 2 – Food Security, Social Protection and Health**

No.	Strategies	Activities	Target	Responsibilities/ Actions
1.	To increase national food fish production, BOT and production for ornamental fish	a) Maintaining climate supporting information for boosting aquaculture production and ornamental fish b) Reduce number of failure and risk for investors and operators c) Provide with more conducive environment d) Increasing new culture sites under control	Well plan production of enough fish with minimum risk level. Achieve DPN target and BOT.	DOF MMD Stakeholders

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**OBJECTIVE 1: Development of Fisheries – Meteorology Database**

No.	Milestone	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1.	Acquire fisheries/meteorology data and Develop Temporal and Spatial Data										
	a) Compile data on fisheries activities and meteorology for areas under fisheries										
	b) Develop temporal & spatial database and data management that can be accessed by stakeholders										
	c) Acquire database server										
	d) Provide real-time data for monitoring										
	e) Dissemination of information to target groups and stakeholders										
2.	Develop aquaculture meteorological stations network										
	a) Weather monitoring stations										
	b) Agencies-stakeholders national link										
	c) System maintenance										

**OBJECTIVE 2 – Food Security, Social Protection and Health**

No.	Milestone	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1.	To increase national food fish production, BOT and production for ornamental fish										
	a) Maintaining climate supporting information for boosting aquaculture production and ornamental fish										
	b) Reduce number of failure and risk for investors and operators										
	c) Provide with more conducive environment										
	d) Increasing new culture sites under control environment and safe										



## CONCLUSION

- Projections of future conditions show impacts on the distribution and abundance of fishes associated with climate change.
- Fisheries have an option i.e. “mitigate and adapt...”
- Coral bleaching has been a problem arising from global warming. It will give impact to fish production.
- DOF Malaysia has prepared the Plan of Action for climate change to address this issue in fisheries. (first draft).
- Exact situation of fisheries as a result of climate change still unknown.
- More research are needed.





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TERIMA KASIH  
Only God knows....

