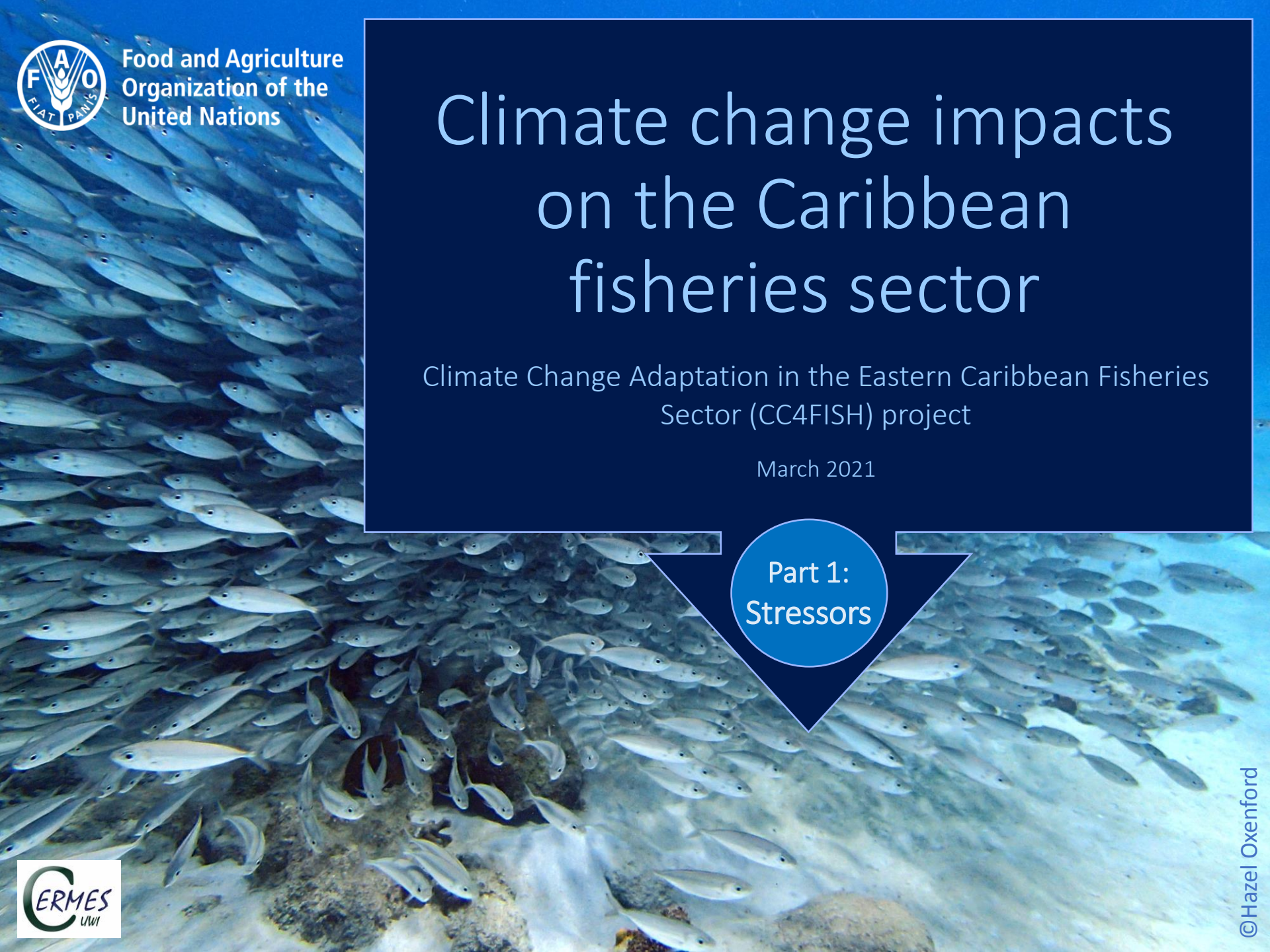
Food and Agriculture Organization of the United Nations

Climate change impacts on the Caribbean fisheries sector

Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (CC4FISH) project

March 2021

Part 1: Stressors



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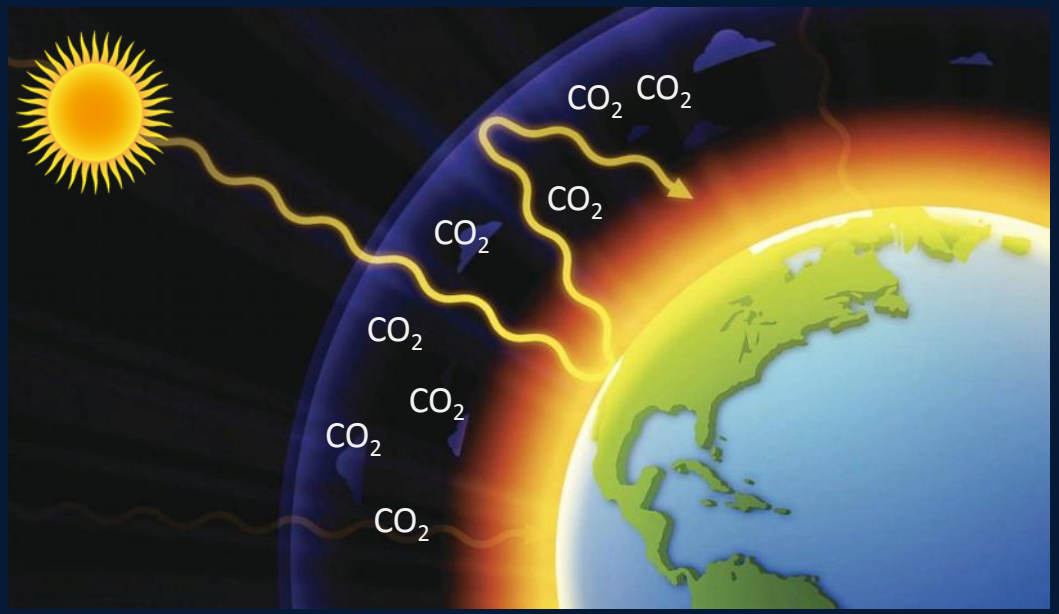
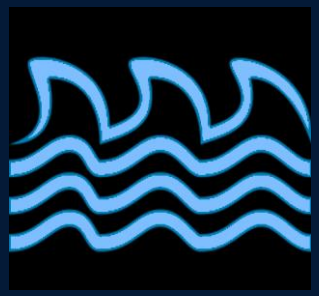
Why is climate changing?

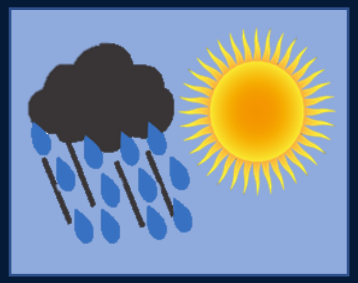


Adapted from https://thewellesleynews.com/

Release of carbon dioxide and other greenhouse gases traps the sun's heat in the earth's atmosphere

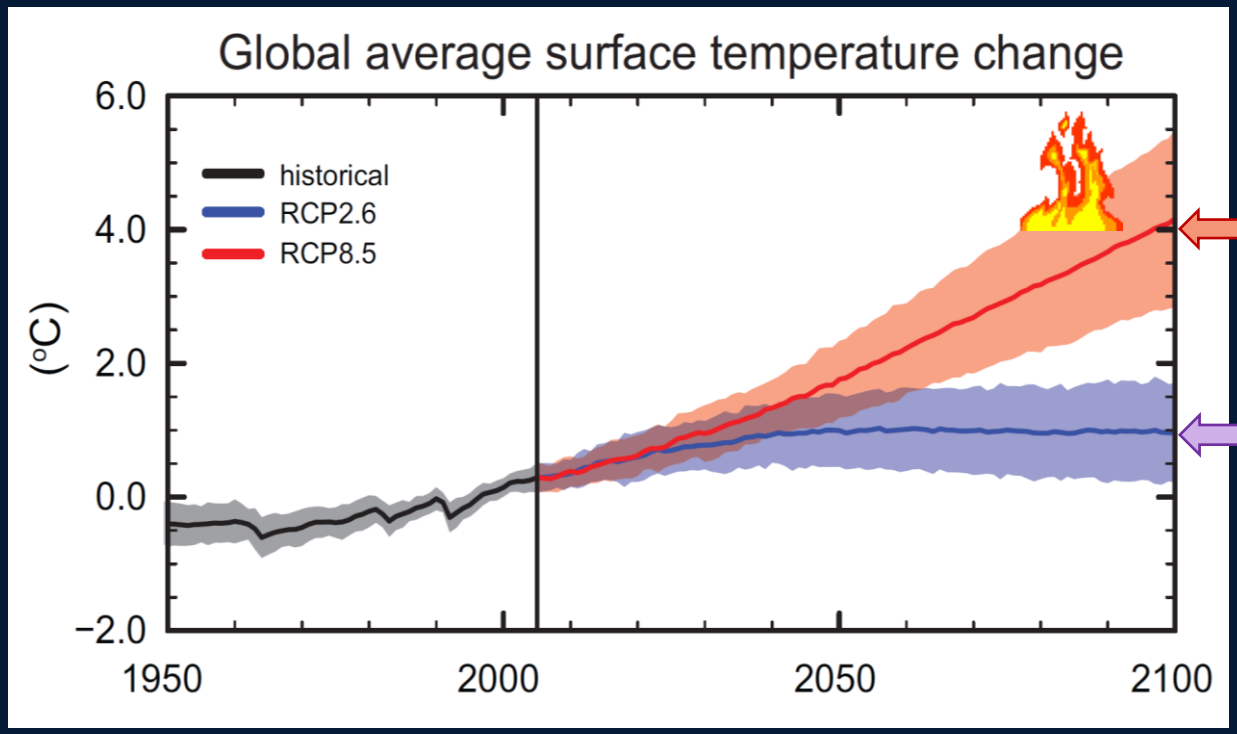
What are the main climate change stressors?





- Warmer seas
- Sea level rise
- Stronger hurricanes
- Less predictable sea conditions
- Changes to ocean currents
- Extreme weather
- Ocean acidification

Warmer seas …..



Source: IPCC AR5 (2013)

Global projections

"Business-as-usual" scenario

"Low emissions" scenario

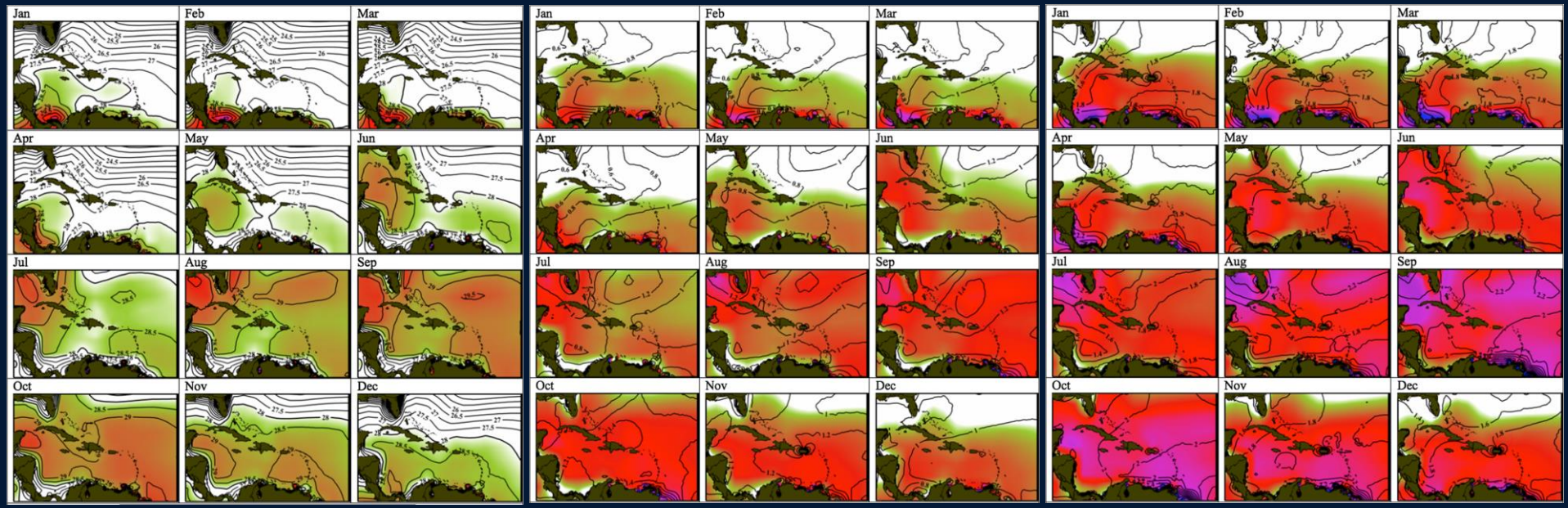
….caused by warmer air temperatures

Caribbean Sea Surface Temperatures

2000 - 2009

2050 - 2059

2090 - 2099

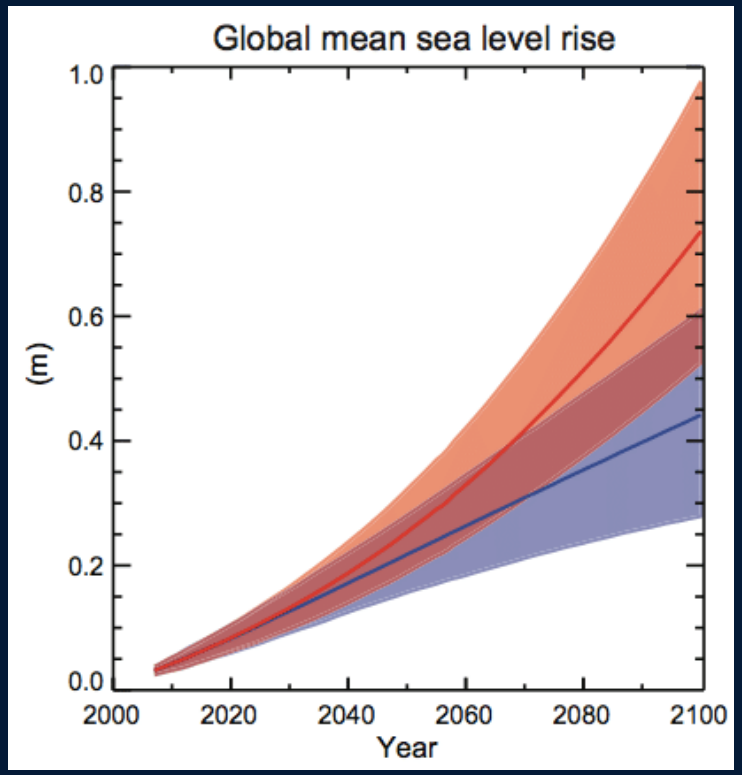


What we have seen

What to expect with business-as-usual

Source: Nurse and Charlery (2015)

Higher sea levels

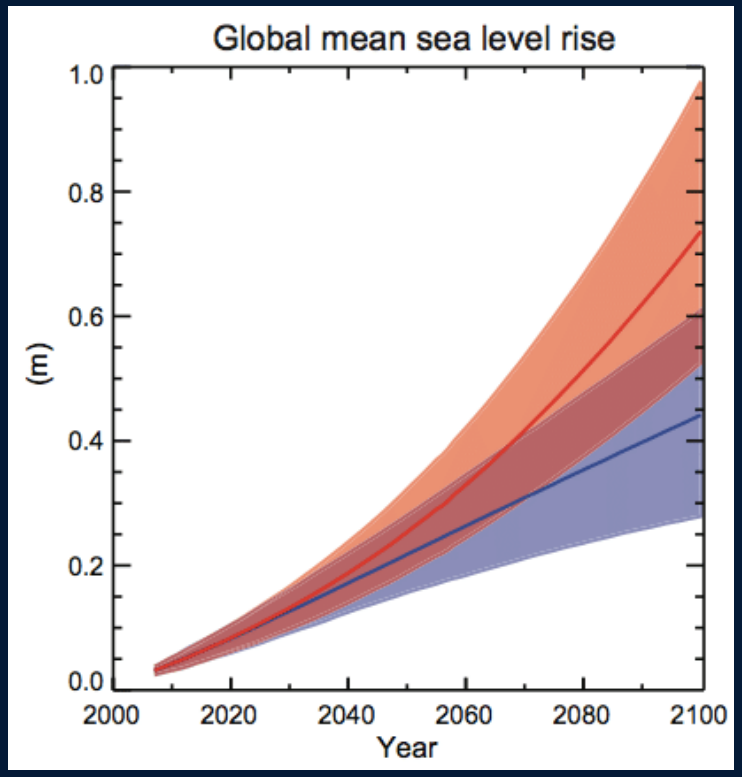


Source: IPCC AR5 (2013)

Global projections

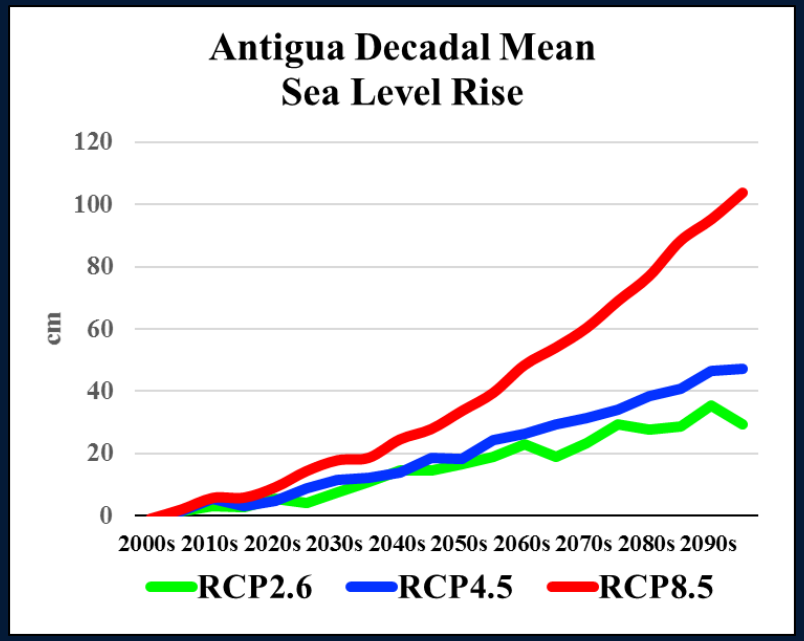
- "Business-as-usual" scenario
- "Low emissions" scenario

Higher sea levels



Source: IPCC AR5 (2013)

.... Caribbean is tracking global changes



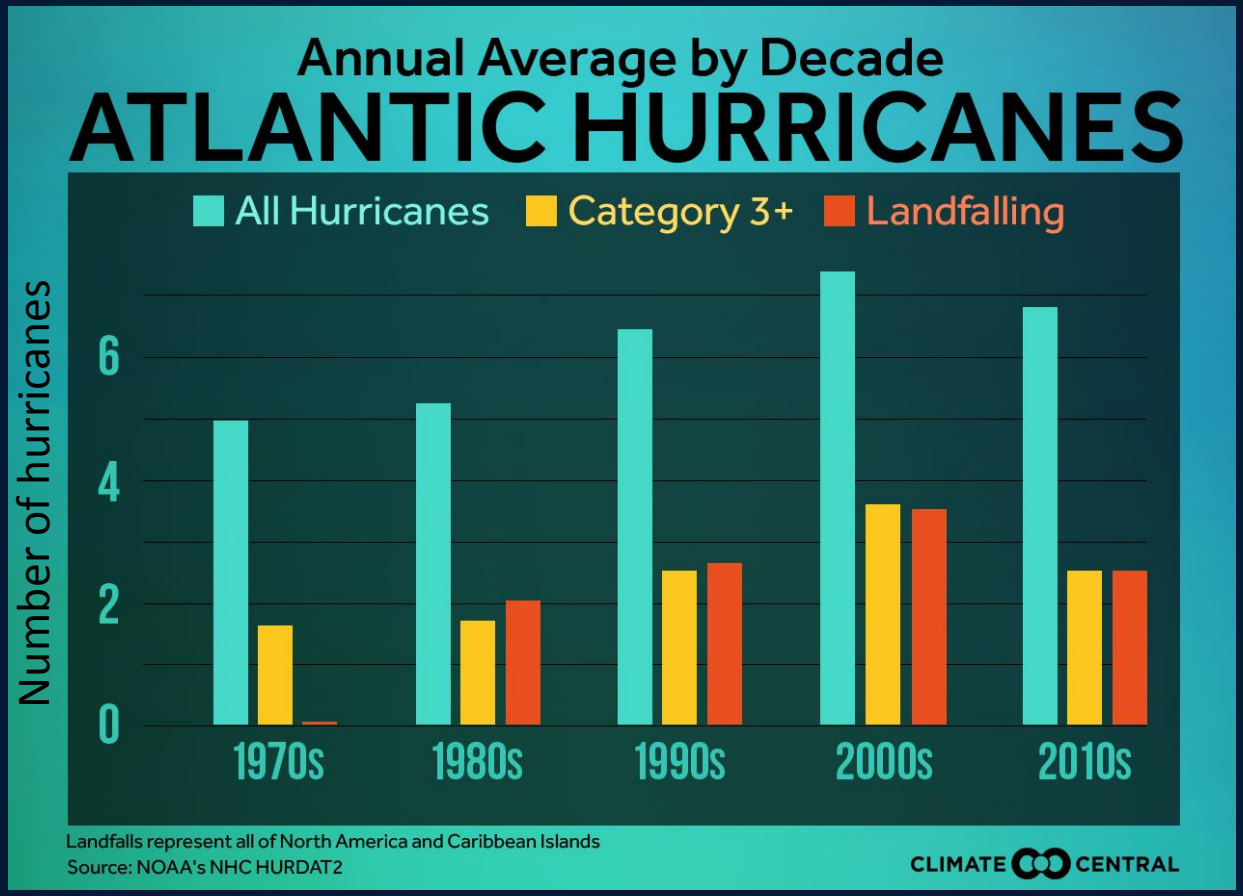
Source: Nurse and Charlery (2017)

Stronger hurricanes

1970 - 2019

What we have seen

NASA handout photo



What to expect

Projections are uncertain and vary widely, but ….

- likely to increase in intensity (more Category 4 & 5)
- very likely to have greater coastal inundation (flooding)
- very likely to have higher associated rainfall

Changing currents and sea conditions

What we have seen

Fishers are reporting:

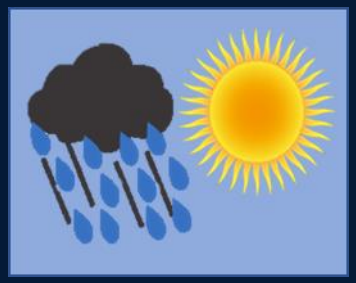
- increased storminess
- more dangerous waves
- unpredictable winds
- changes to ‘tides’ (currents)
- more green water
- Sargassum

Source: Kinch & Oxenford (2019)

What to expect

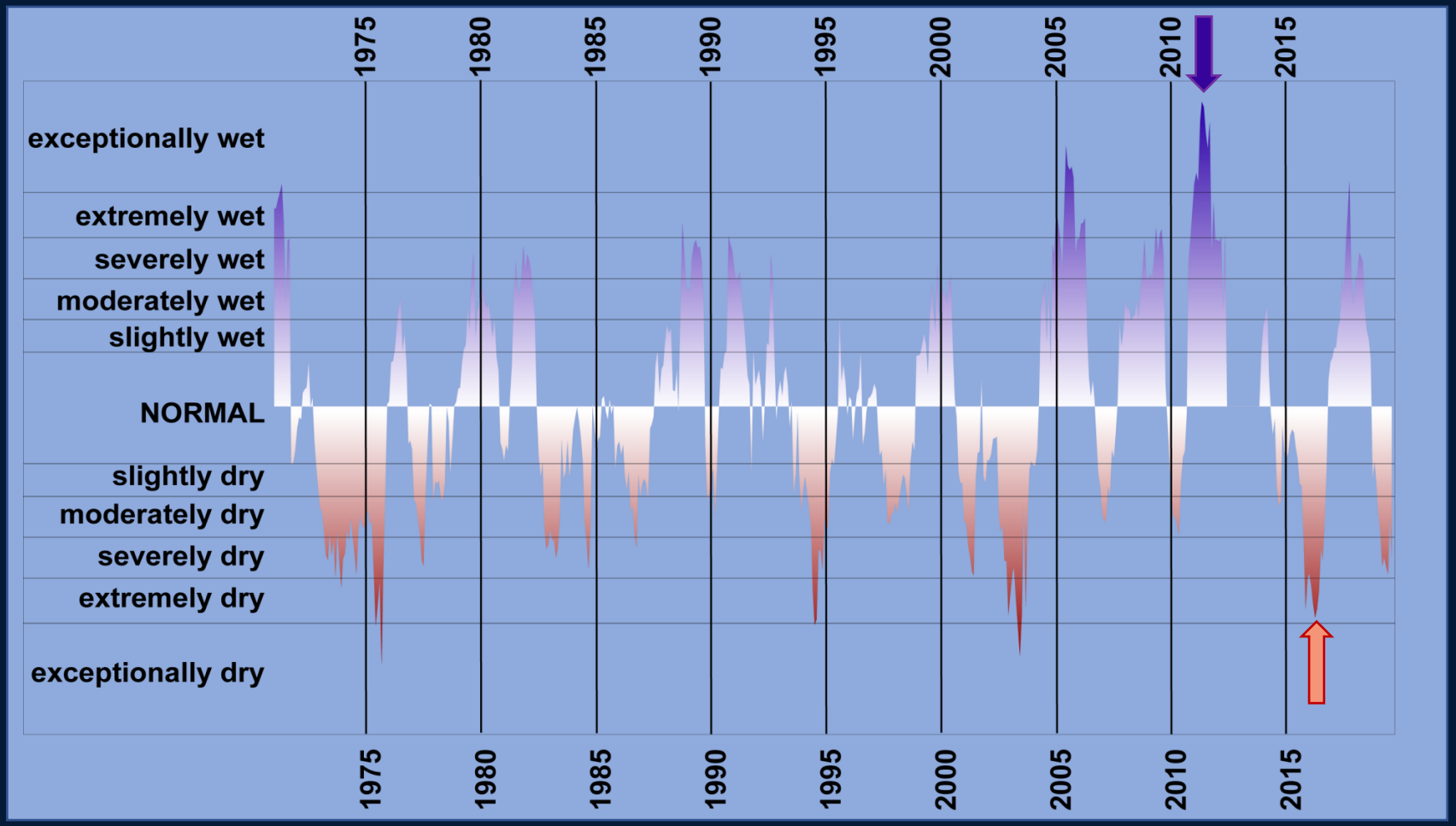
- wave heights lowering?
- green water for longer?
- continued sargassum

Source: Taylor et al. (2020)

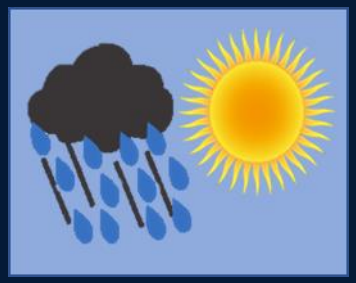


Extreme rainfall or drought

What we have seen in the Caribbean (1975-2016)

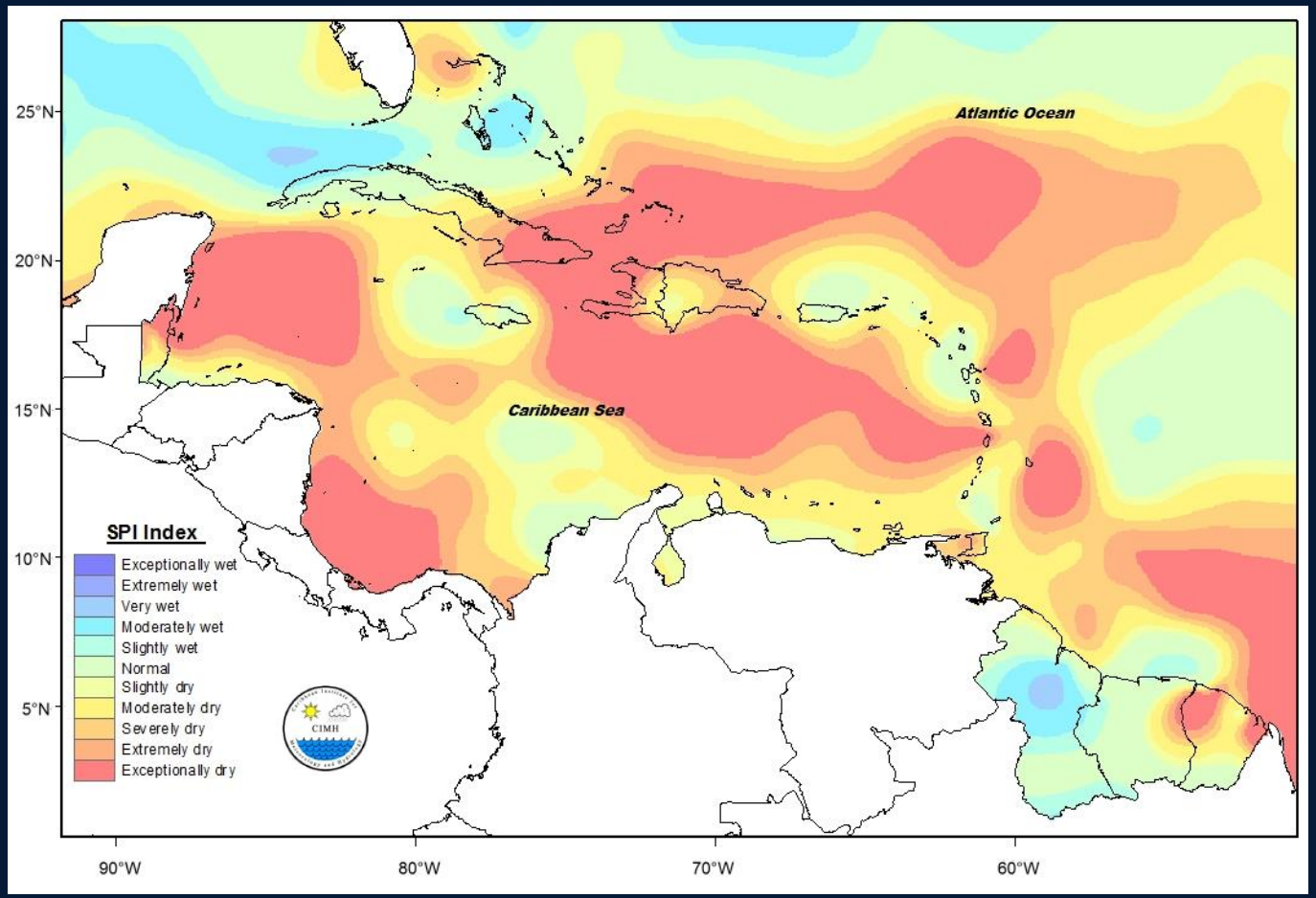


Source: Trotman (2019)

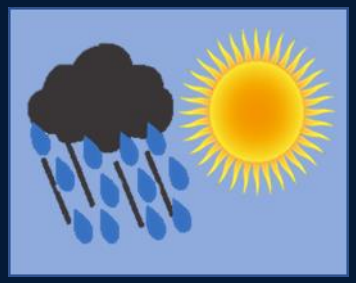


Extreme rainfall or drought

What we have seen recently (Feb 2019 – Jan 2020)



Source: https://rcc.cimh.edu.bb/spi-monitor-january-2020/



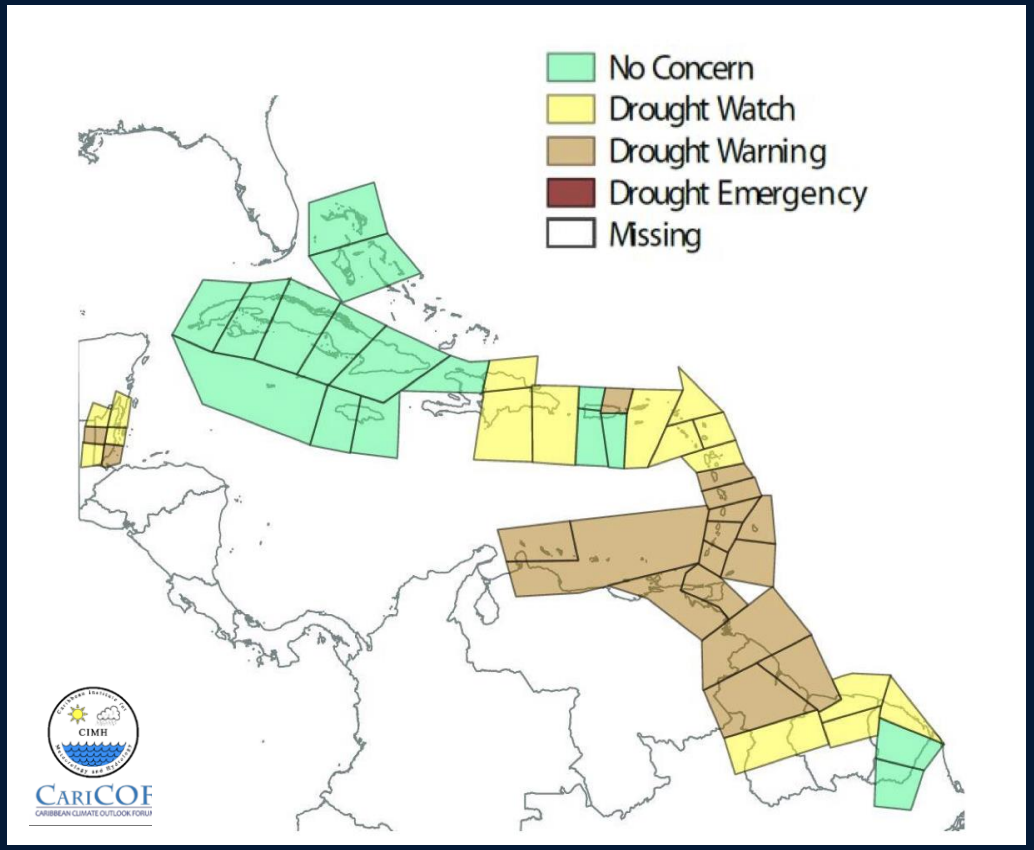
Extreme rainfall or drought

What to expect

Up to 2100, Caribbean islands can expect:

- more frequent droughts
- more severe droughts
- more heavy rainfall events

Short-term drought alert levels to end of May 2020

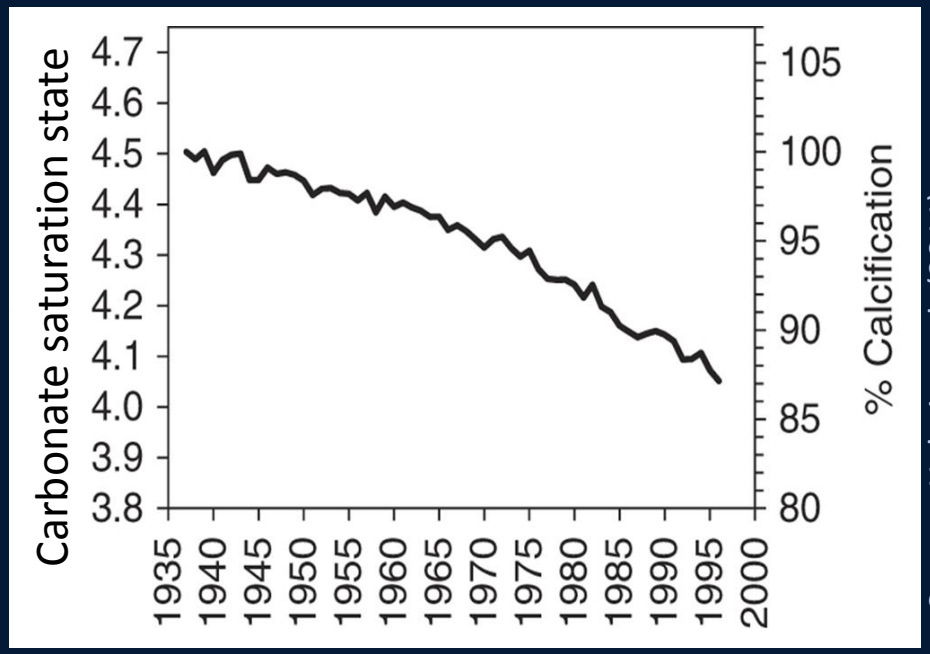


Source: http://rcc.cimh.edu.bb/spi-outlook/

Ocean acidification

More carbon dioxide dissolved in the sea

What we have seen in the Caribbean

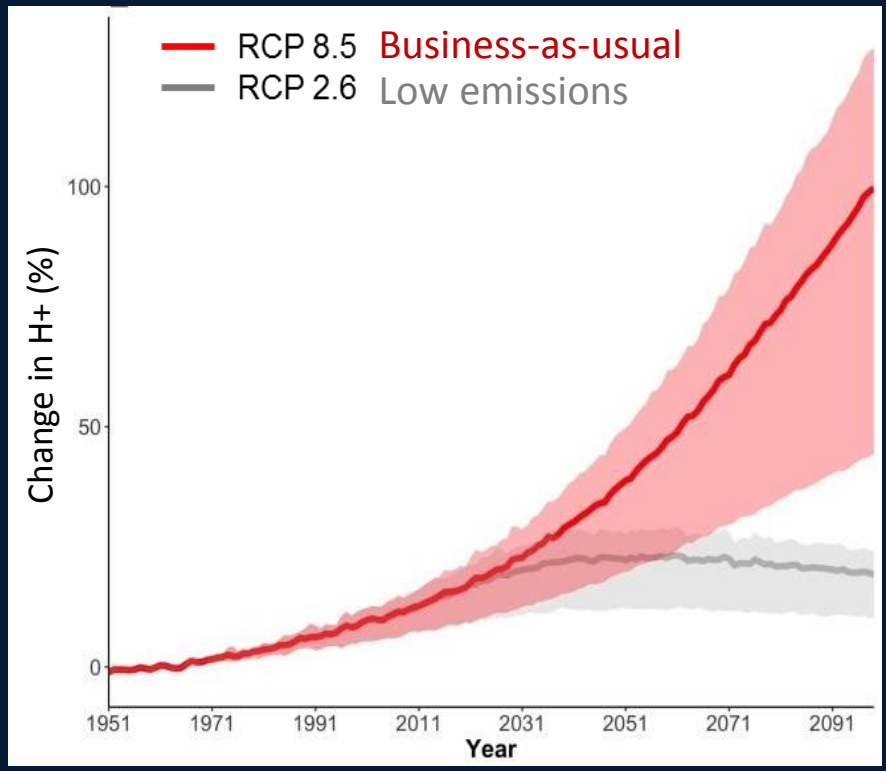


Source: Helmie et al. (2011)

….. less suitable for calcifying organisms

What to expect

Increasing sea surface acidity in the Caribbean



Source: CRFM (2019)

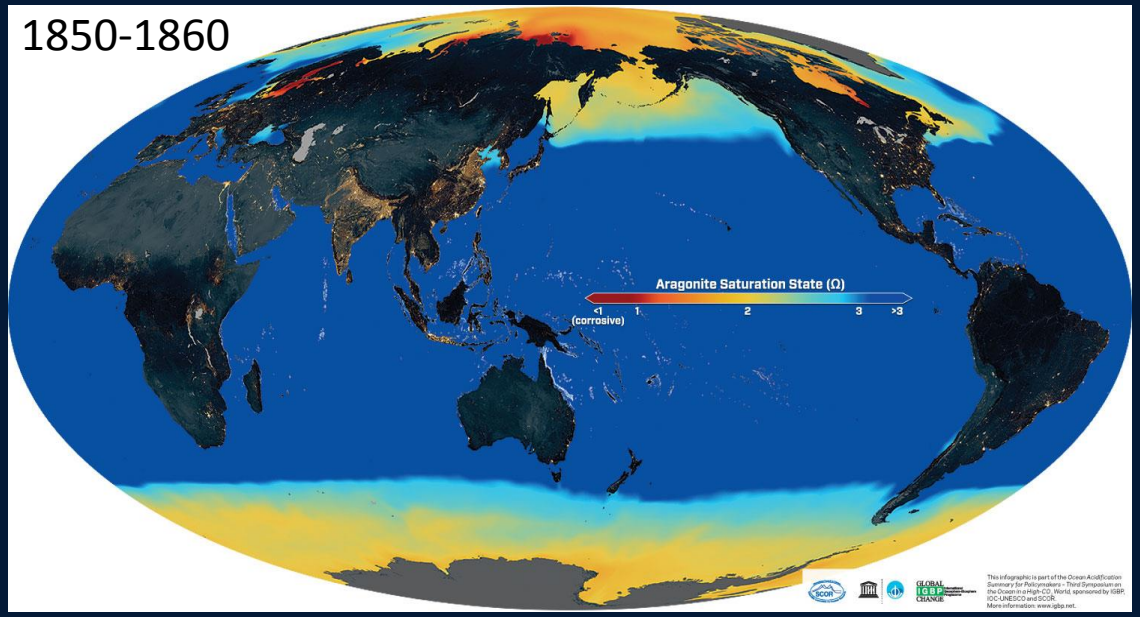
Ocean acidification

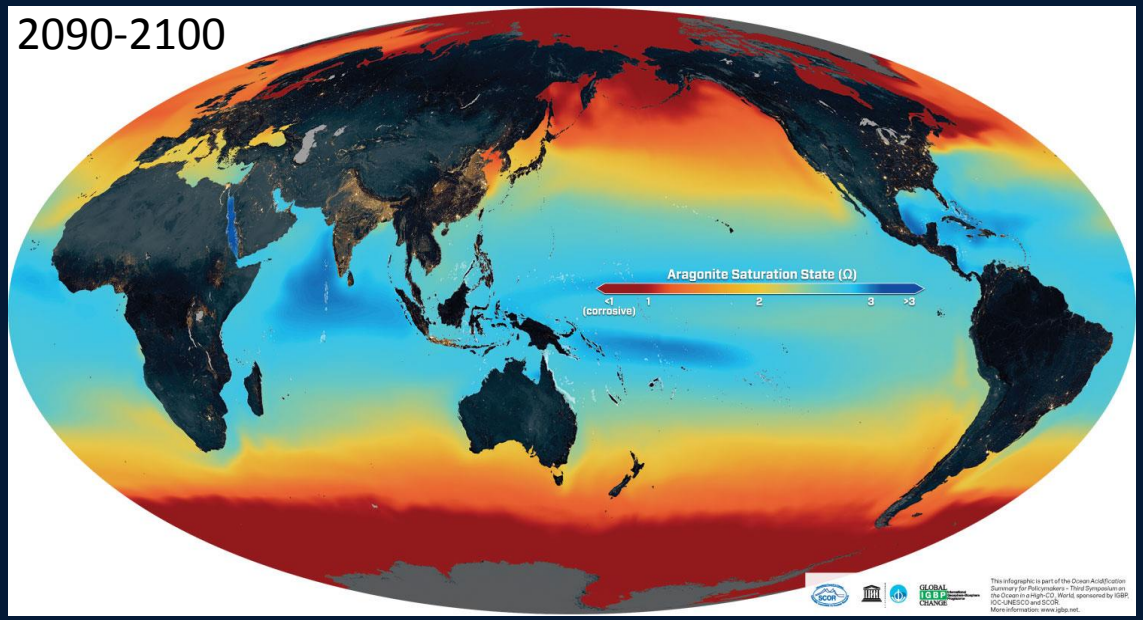
Decade of:
1850 - 1860

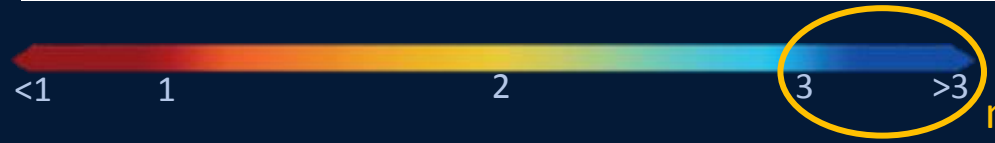
What to expect

....lower carbonate saturation state

Decade of:
2090 - 2100





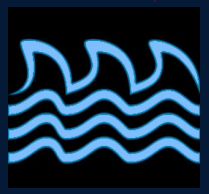


What to expect in the Caribbean by 2100

Warmer seas	+ 1.4 to 2.2 °C Smaller temperature range

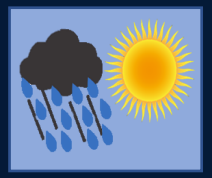
Sea level rise	+ 1 m

Stronger hurricanes	More Category 4 & 5 storms Max. wind speeds up by 11%?



Less predictable sea conditions	Slightly smaller waves? More green water?

Changes to currents	??



Extreme weather	More heavy rainfall events More periods of drought

Ocean acidification	32% lower carbonate saturation state of seawater

Source: Taylor et al. (2020)

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Part 2: Impacts

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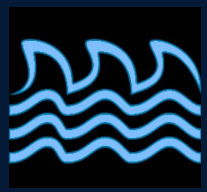
Impact pathways



Warmer seas

Sea level rise

Stronger hurricanes

Less predictable sea conditions

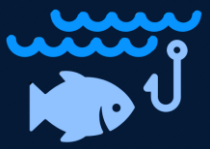
Changes to ocean currents

Extreme weather

Ocean acidification

Biological productivity

Capture fisheries



Aquaculture

Communities livelihoods

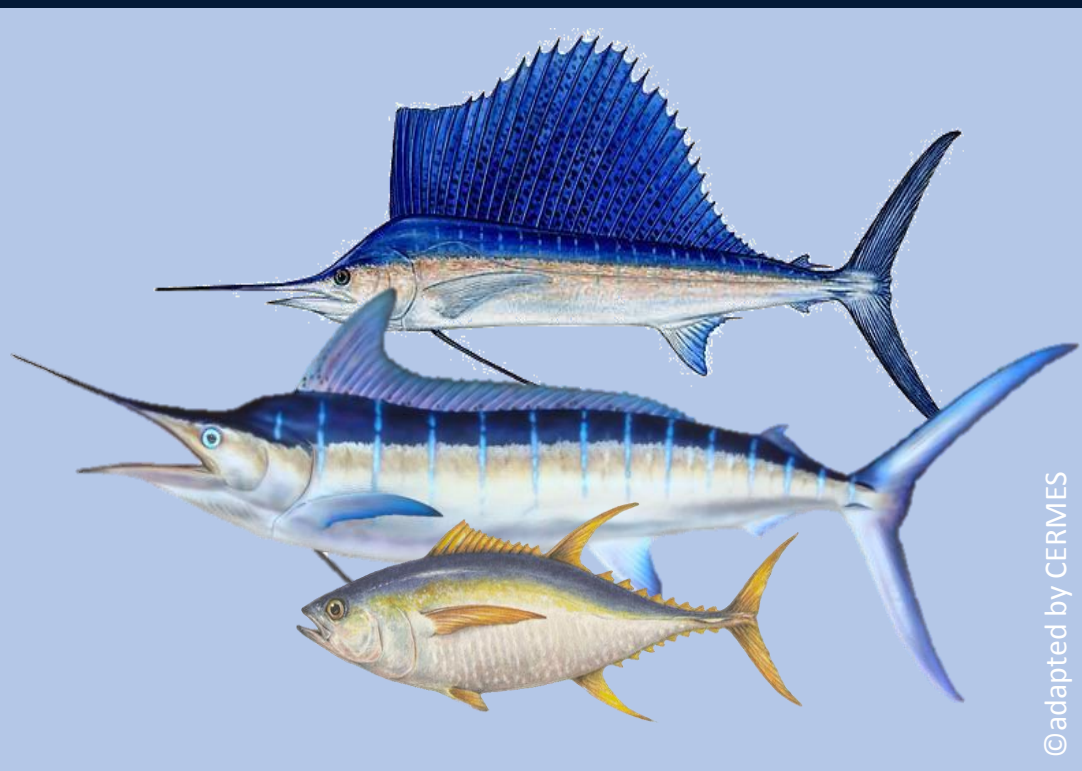
Governance

Wider society and economy

Less oxygen in water

Critically low oxygen means:

- fish kills
- expanding 'dead zones‘
- slower growth
- less living space for pelagic species like billfishes and tunas



Coral bleaching

Mass coral bleaching means:

- high coral mortality
- loss of reef integrity
- less living space for reef fishes and lobsters
- loss of coastal protection

Sargassum influx events

Mass strandings cause:

- drowning of turtles and marine mammals
- oxygen depletion and fish kills
- damage to beaches
- smothering and loss of critical fish habitats

Sargassum influx events

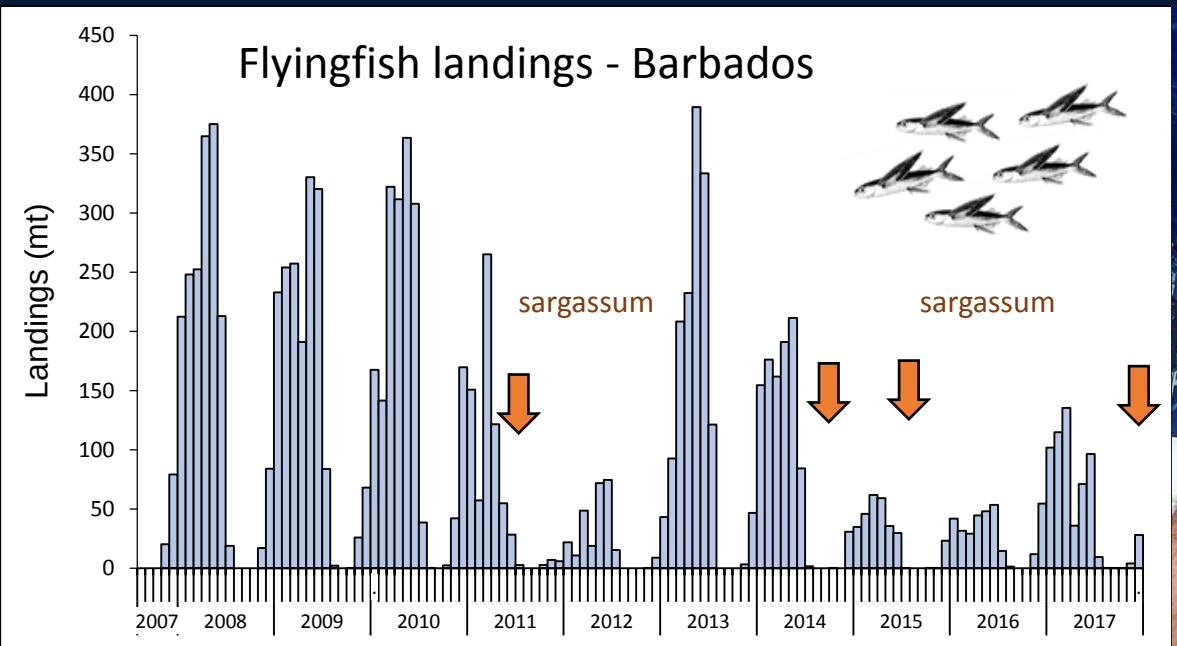
Mass strandings cause:

- clogging of harbours and bays
- impeded navigation
- damage to boat engines
- release of toxic hydrogen sulphide gas as weed rots
- bad smell affecting fish markets and health of fisherfolk
- Damage to tourism (loss of additional livelihood opportunities for fisherfolk)

Sargassum influx events

Large floating mats cause:

- hazard to navigation
- damage to fishing gear
- lost fishing time
- reduced flyingfish catches
- landing of smaller dolphinfish
- loss of income for fishers, vendors and processors
- loss of food security



Sargassum at sea

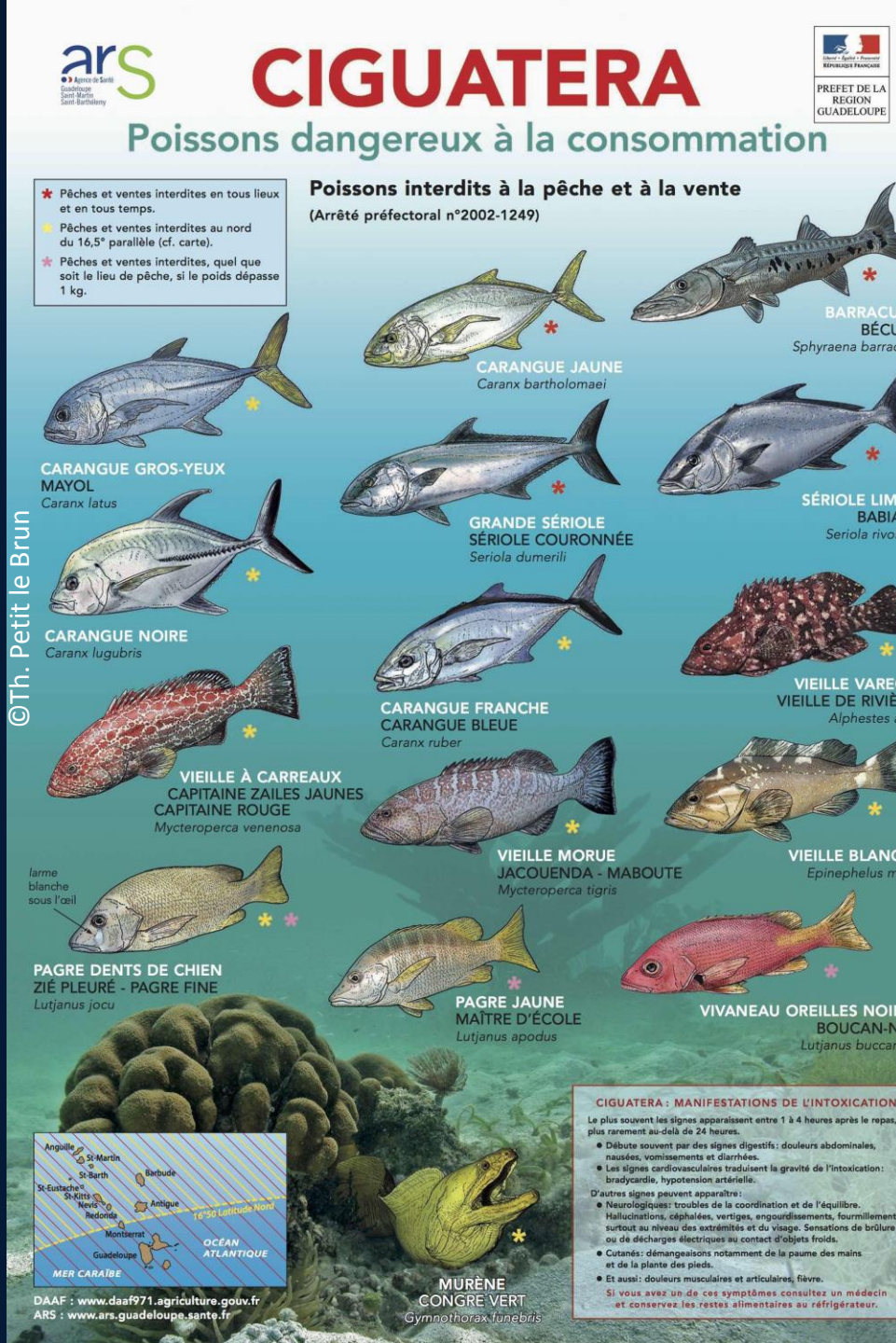
Could improve ocean productivity?

- higher biodiversity supported
- availability of new fishery species
- potential new income from harvesting and use of sargassum

Fish poisoning

Warmer temperatures:

- increase likelihood of fish spoiling
- increase occurrence of ciguatera poisoning
- marketing and human health impacts



Toxic algal blooms

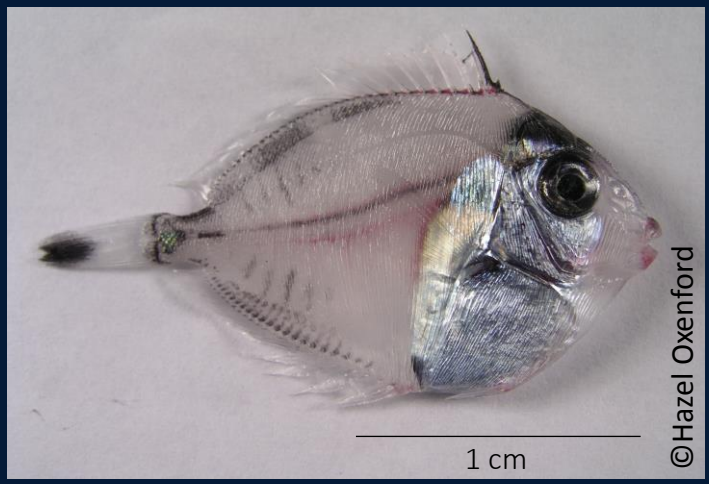
More frequent with warmer waters and high nutrient loads means:

- shellfish and fish kills
- human health hazard

Increased ocean acidity

Fewer carbonate ions, more hydrogen ions means:

- increased difficulty building shells
- coral reef framework may erode
- nerve damage to fish larvae
- low fish population replacement

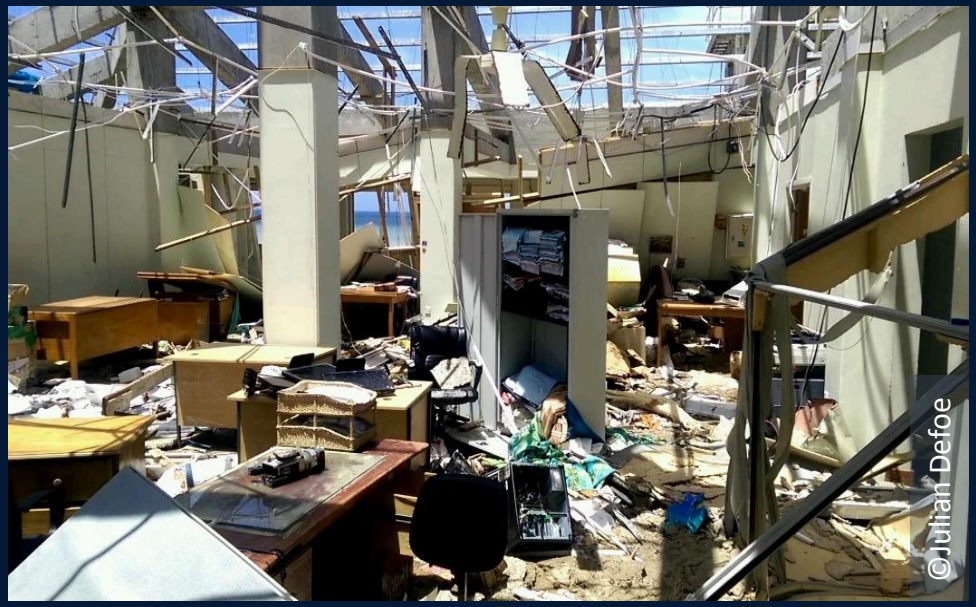


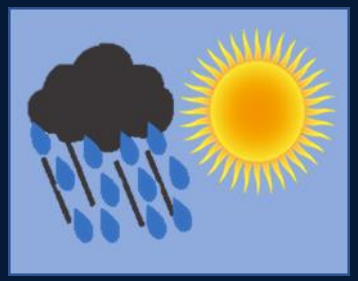
Sea level rise

- coastal erosion
- more flooding with storm surge
- damage to critical fish habitat (mangroves)
- destruction of coastal property and aquaculture ponds

Stronger hurricanes

- massive damage to fishery gear, boats and infrastructure
- loss of property and livelihood
- decreased safety of fisherfolk
- damage to critical fish habitat

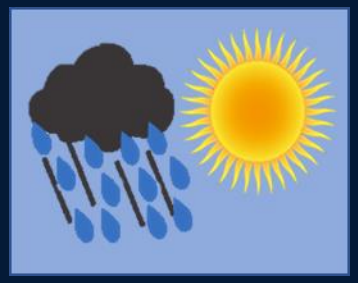




Extreme weather

Flooding:

- damages infrastructure
- disrupts fish supply and value chains



Extreme weather

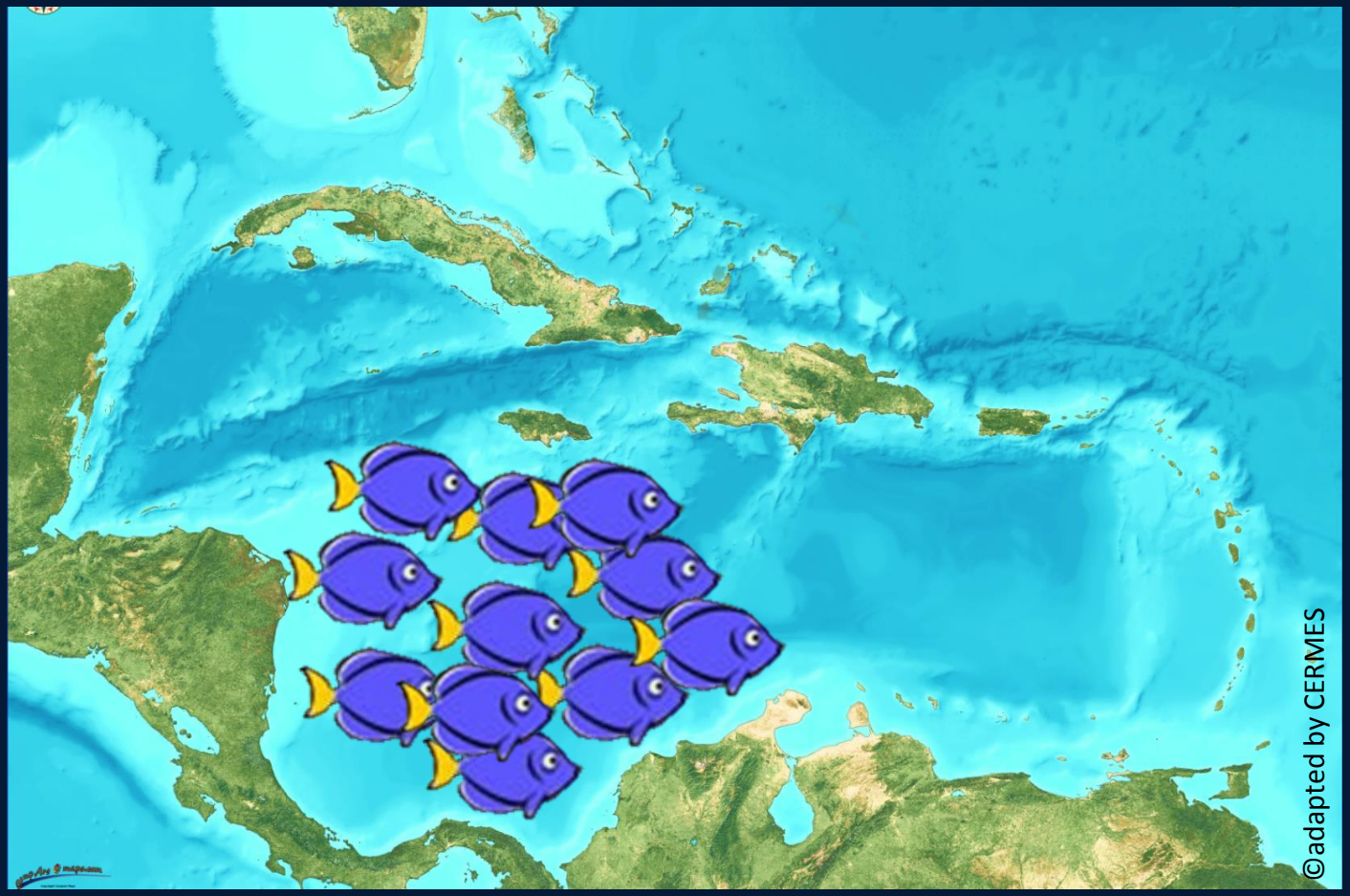
Drought limits water supply affecting:

- fish processing / value chain
- ice supply
- aquaculture water supply

Changes to fish populations

Warmer water means:

- reduced spawning success
- reduced stock replenishment



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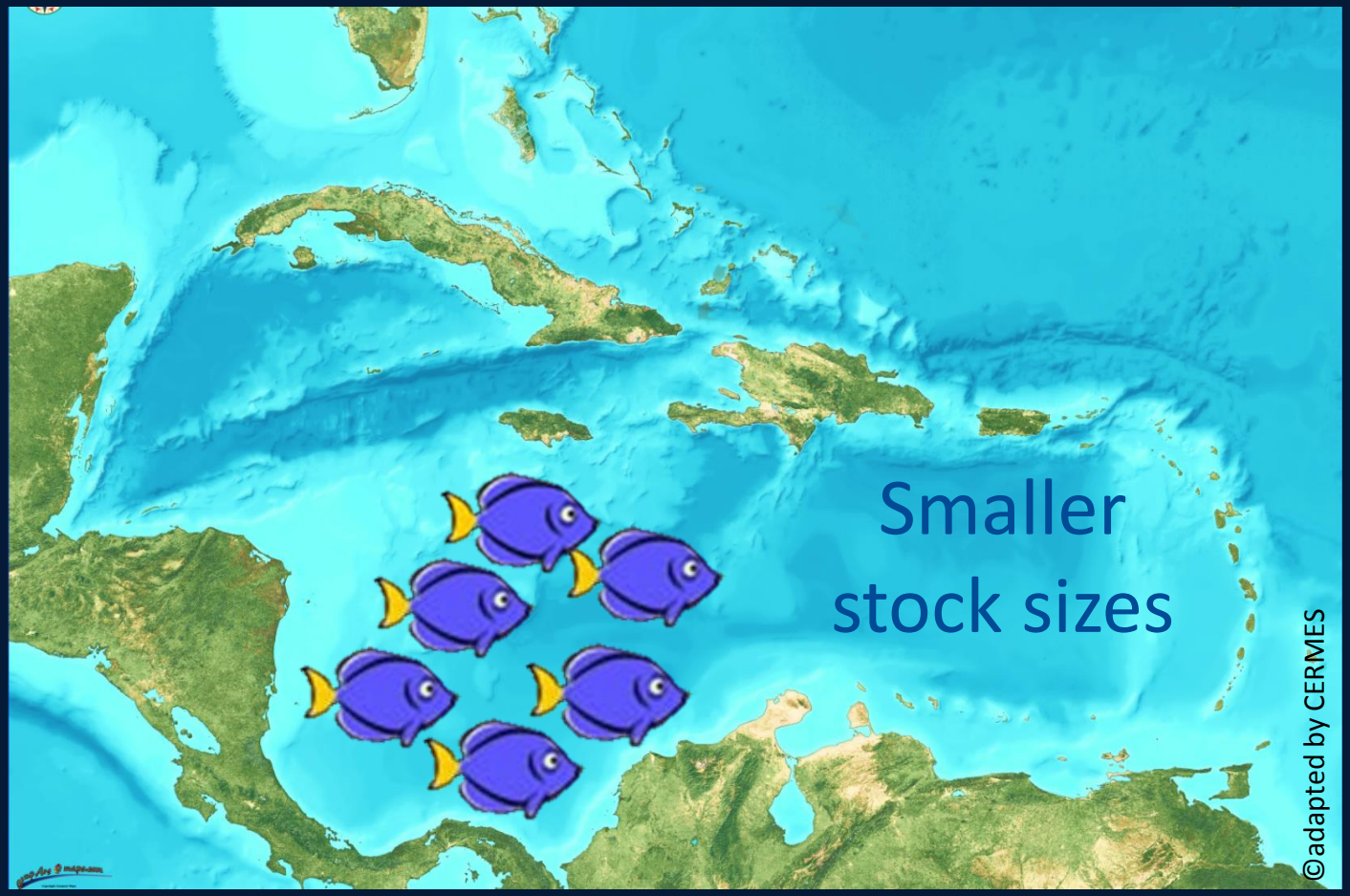
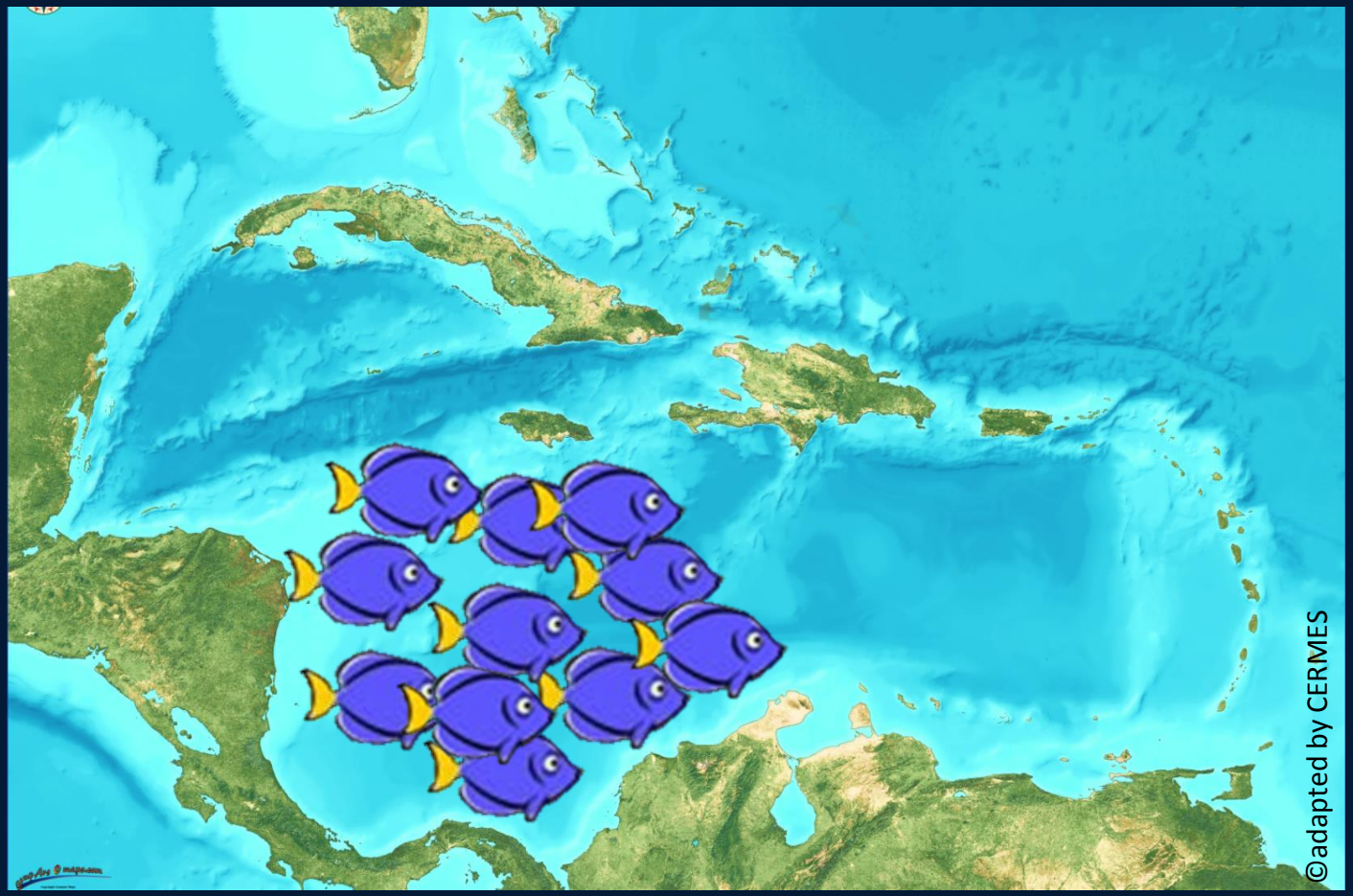


Changes to fish populations

Warmer water means:

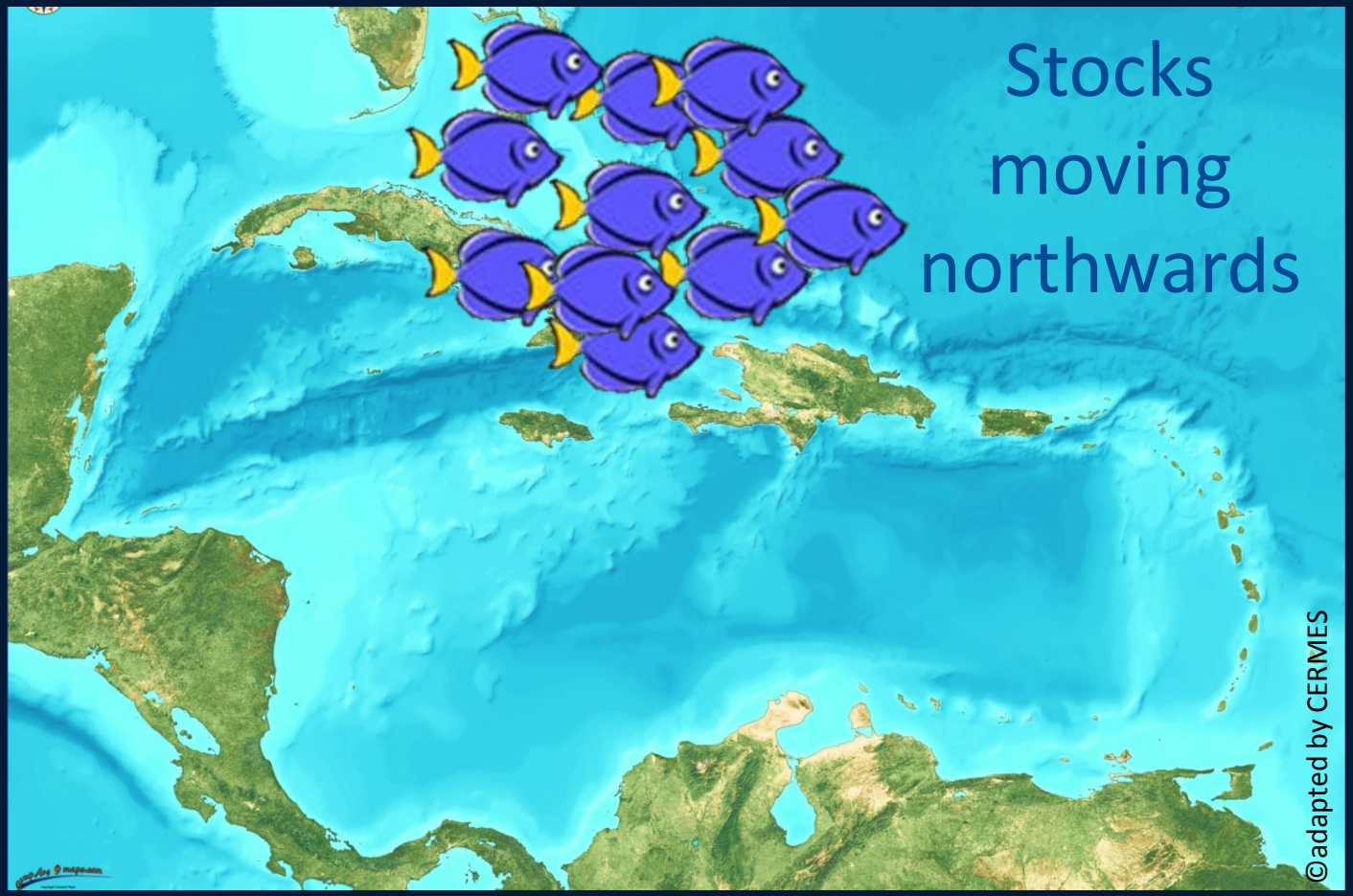
- changes in fish distributions



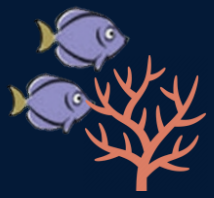
Changes to fish populations

Warmer water will mean:

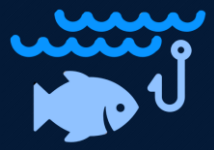
- changes in fish distributions



Impact pathways



Biological productivity



Capture fisheries

Aquaculture

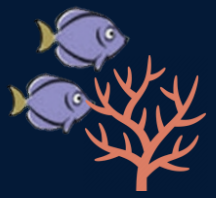
Communities livelihoods

Governance

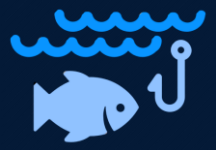
Wider society and economy

- disruption of marine food webs
- damage to critical habitats
- reduced growth and productivity of fish stocks
- change in distribution of fish stocks
- fish kills from low oxygen

Impact pathways



Biological productivity



Capture fisheries

Aquaculture

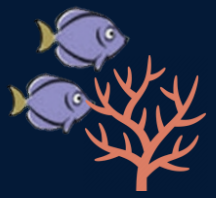
Communities livelihoods

Governance

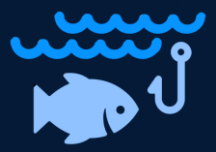
Wider society and economy

- disruption of marine food webs
- damage to critical habitats
- reduced growth and productivity of
- lower yields
- change in species caught
- reduced safety at sea
- more damage to infrastructure, gear and boats
- increased travel time, reduced days at sea and greater operational costs

Impact pathways



Biological productivity



Capture fisheries

Aquaculture

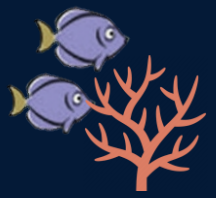
Communities livelihoods

Governance

Wider society and economy

- disruption of marine food webs
- damage to critical habitats
- reduced growth and productivity of
- lower yields
- change in species caught
- reduced safety at sea
- increase in disease incidences
- reduced freshwater supply
- more damage to infrastructure and equipment
- increased operational costs

Impact pathways



Biological productivity

Capture fisheries

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Communities livelihoods

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Wider society and economy

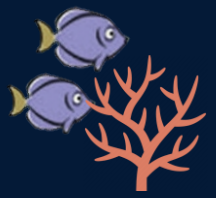
- disruption of marine food webs
- damage to critical habitats
- reduced growth and productivity of

- lower yields
- change in species caught
- reduced safety at sea

- increase in disease incidences
- reduced freshwater supply

- loss of income
- reduced wellbeing
- reduced health and safety
- loss of physical assets
- threat to cultural identity

Impact pathways



Biological productivity

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Capture fisheries

- lower yields
- change in species caught
- reduced safety at sea

Aquaculture

- increase in disease incidences
- reduced freshwater supply

Communities livelihoods

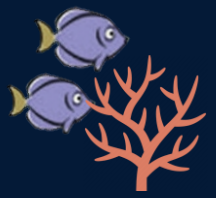
- loss of income
- reduced wellbeing
- reduced health and safety

Governance

- changes to appropriate geographical scales for governance (e.g. shared stock boundaries, Marine Protected Area (MPA) networks)
- increased importance of utilizing fisherfolk and scientific knowledge
- increased need for ecosystem-based management approach

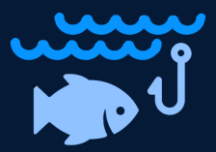
Wider society and economy

Impact pathways



Biological Productivity

- disruption of marine food webs
- damage to critical habitats
- reduced growth and productivity of



Capture fisheries

- lower yields
- change in species caught
- reduced safety at sea

Aquaculture

- increase in disease incidences
- reduced freshwater supply

Communities livelihoods

- loss of income
- reduced wellbeing

Governance

- change in shared stock boundaries

Wider society and economy

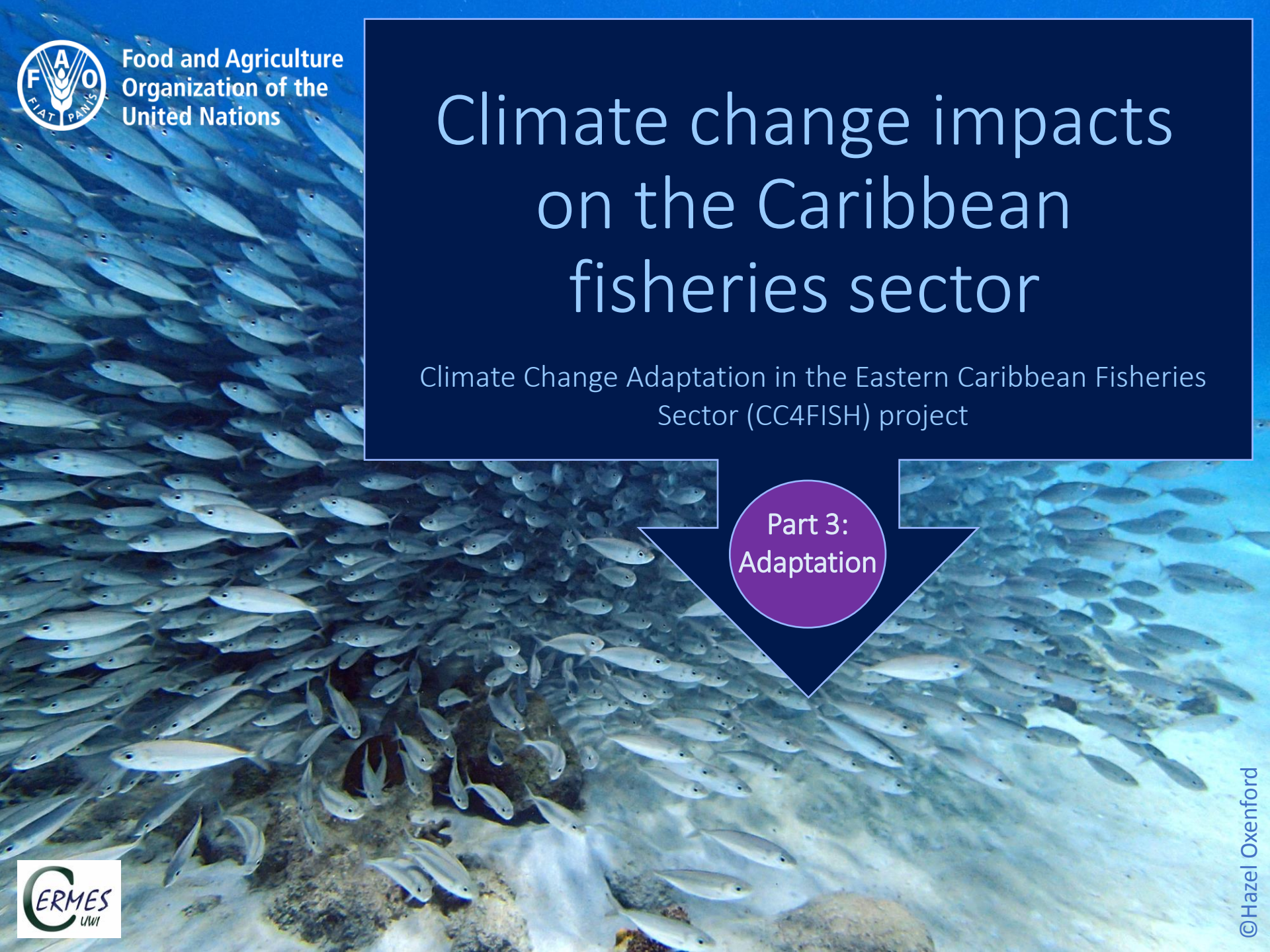
- increased poverty and reliance on social protection
- reduced food security and nutrition
- reduced revenue generation and foreign exchange earnings (exports)
- disruption of fish supply/value chain
- adaptation and mitigation costs

Food and Agriculture Organization of the United Nations

Climate change impacts on the Caribbean fisheries sector

Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (CC4FISH) project

Part 3: Adaptation



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Ongoing adaptation measures
Early warning

- Development of mobile apps for:
  - improved communication
  - early warning
  - vessel tracking
- Use of Very high frequency (VHF) radios and increased range of radio repeater systems

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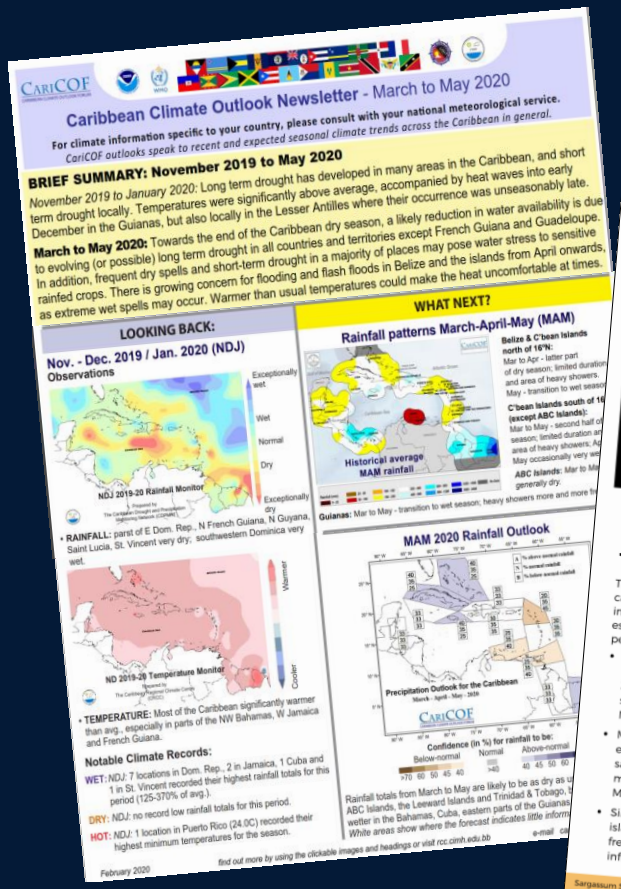
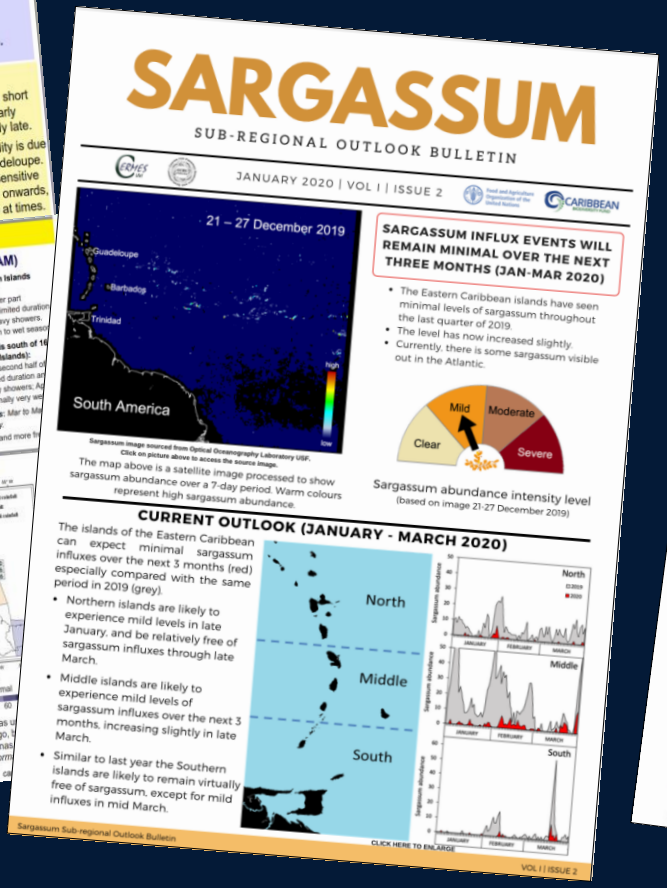
Ongoing adaptation measures

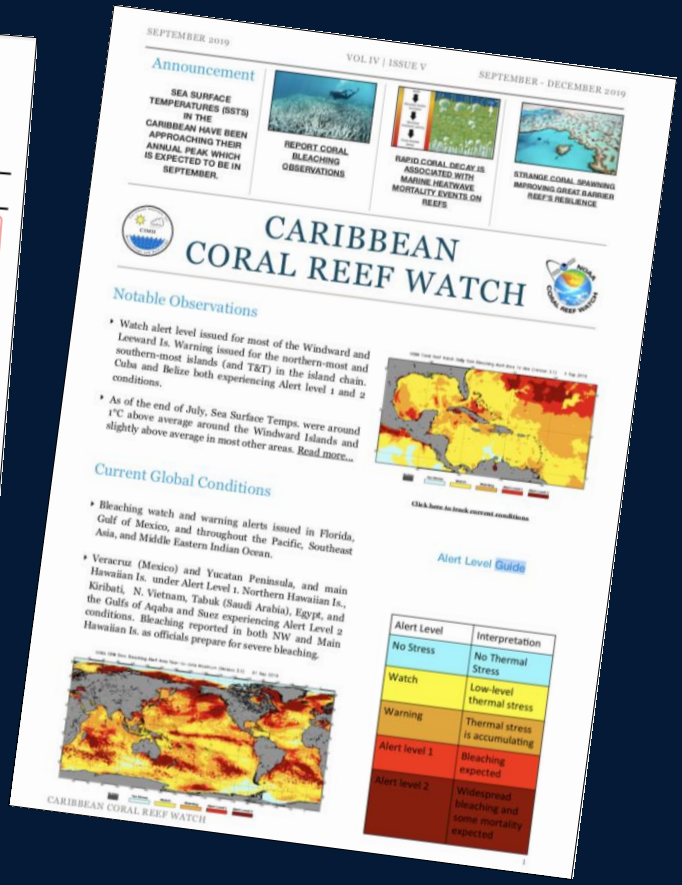
Forecasting

Better ocean and climate forecasting and communication that allow for:

- Emergency planning
- Timely informed decision making







Ongoing adaptation measures

Safety at sea

- Fisherfolk training and implementation of greater safety measures for small-scale fishing vessels
- Provision and appropriate use of safety equipment

Ongoing adaptation measures

Adding value and product traceability

- Fishery improvement programmes that:
  - support access to higher priced markets
  - improve sustainability of the fishery resource

Ongoing adaptation measures

Market diversification

- fisherfolk catching and marketing newly available or non-traditional species
- adding value in new and existing value chains

Ongoing adaptation measures

Climate-proof infrastructure

Improved facilities:

- prevent inundation by rising sea levels
- withstand coastal erosion and effects of more severe hurricanes
- use of renewable energy and water catchment systems

Ongoing adaptation measures

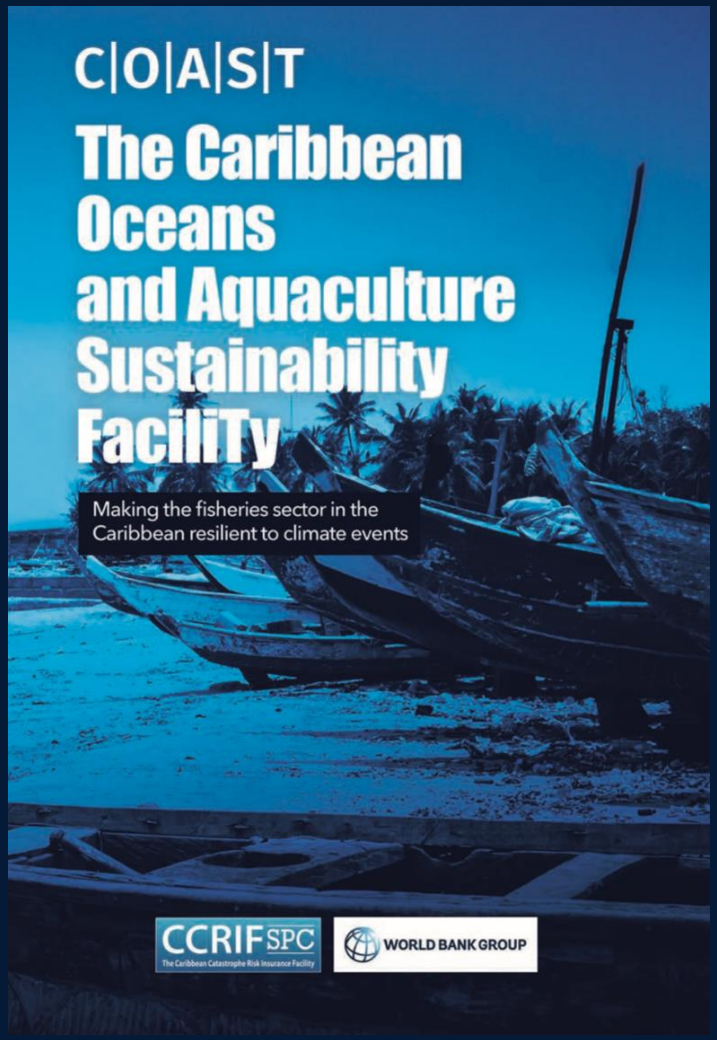
Energy efficiency

Use of renewable energy technology and improved building and boat designs to:

- improve fuel efficiency and reduce operating costs
- reduce carbon emissions by the fisheries sector

Ongoing adaptation measures

Insurance schemes



- improved access to affordable insurance for fisherfolk
- developing innovative parametric insurance for the fisheries sector

Ongoing adaptation measures

Capacity building

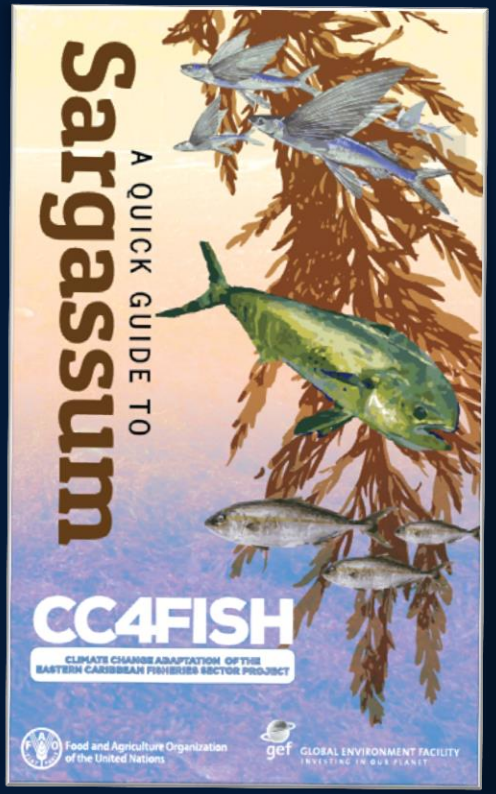
Improved resilience of fisherfolk and aquaculturists through knowledge sharing and training in:

- Business skills
- Product development
- Sea moss farming etc.

Ongoing adaptation measures

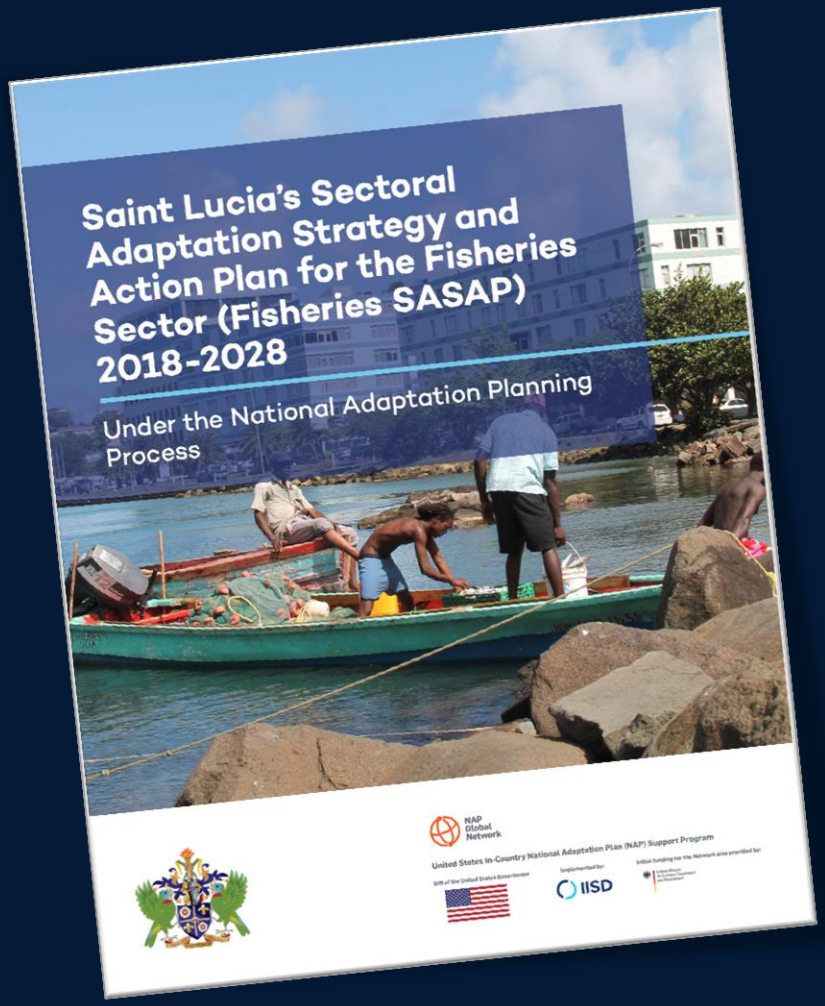
Building knowledge and awareness

Improving awareness and understanding of climate change vulnerabilities and adaption pathways through new communication products



Ongoing adaptation measures

Mainstreaming climate change



Revising policy formulation and fisheries management plans to integrate disaster risk management and climate change mitigation and adaptation

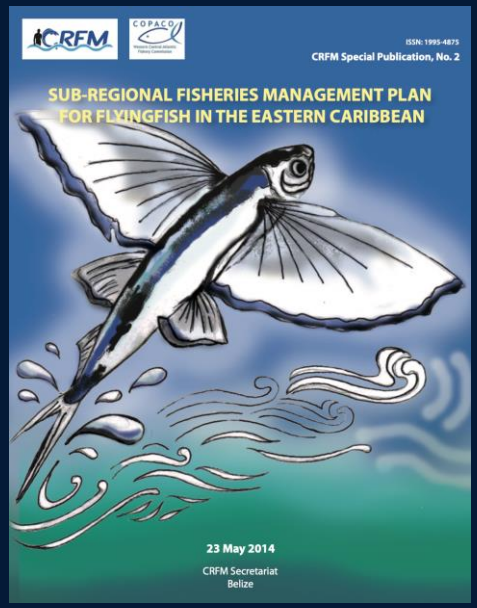
Integrating the fisheries sector into climate change policy formulation and management plans (e.g. Nationally Determined Contributions)

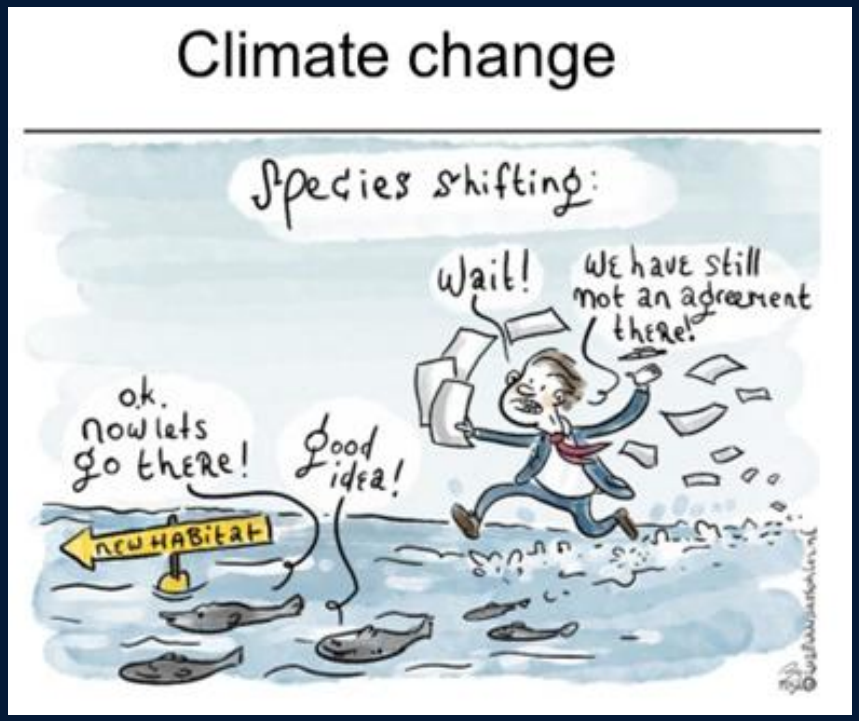
Supporting policy actions needed

Governance flexibility

National and regional level agreements and management arrangements should be responsive to rapid changes in fish resources such as:

- species shifts
- distribution
- productivity
- seasonality





Fisheries Ministers approve climate change protocol for CRFM Members States

Supporting policy actions needed

Stakeholder engagement

Improvements in engagement of fisherfolk resulting in:

- locally established coping strategies
- co-produced complementary adaptation strategies

Supporting policy actions needed

♀ Gender and youth ♂

Ensure adaptation measures:

- consider gender differences
- capitalize on specific skill sets of men, women and youth

Supporting policy actions needed

Sustainable livelihoods

Facilitate additional livelihood opportunities to improve:

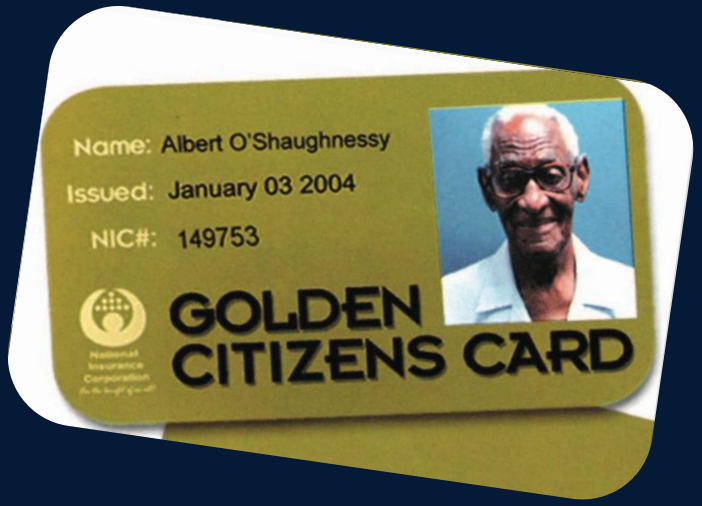
- fisherfolk incomes
- resilience to climate change

Supporting policy actions needed

Social protection

Eastern Caribbean fisherfolk

- 3% have vessel insurance
- 17% have healthcare insurance
- 20% have life insurance



National insurance schemes reformed to:

- include contributions from fisherfolk
- improve social safety net of fisherfolk
- third party fishing vessel liability insurance

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For the benefit of us all!

Supporting policy actions needed

Public-private partnerships

Improve engagement and support of the private sector to:

- leverage investment in the fisheries sector
- facilitate innovation
- decrease risks

Required citation:
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https://doi.org/10.4060/cb1695en

Thank you!

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Climate Change Adaptation of the Eastern Caribbean Fisheries Sector Project (CC4FISH)