



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

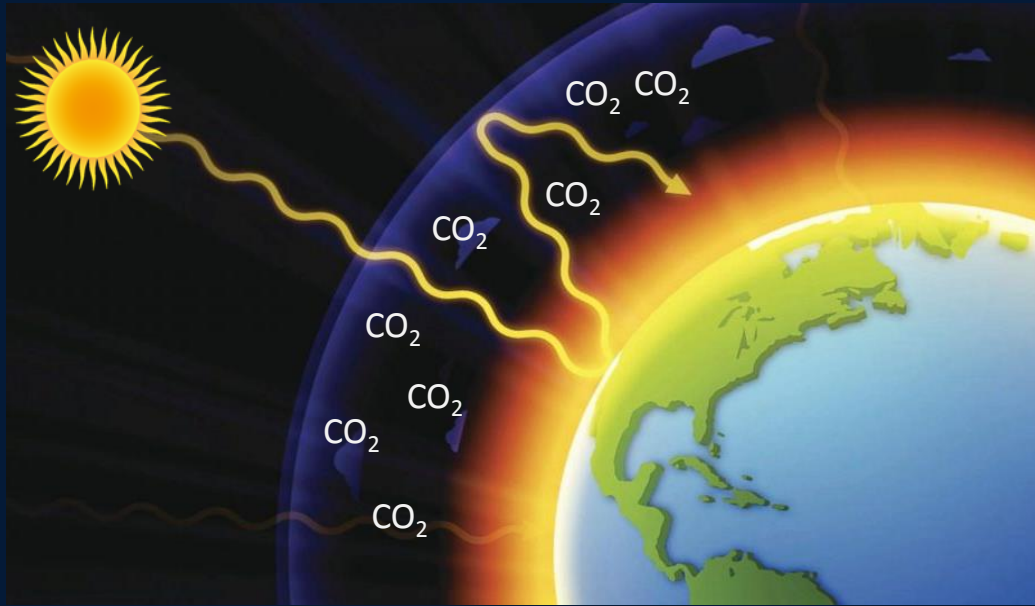
March 2021

Part 1:
Stressors

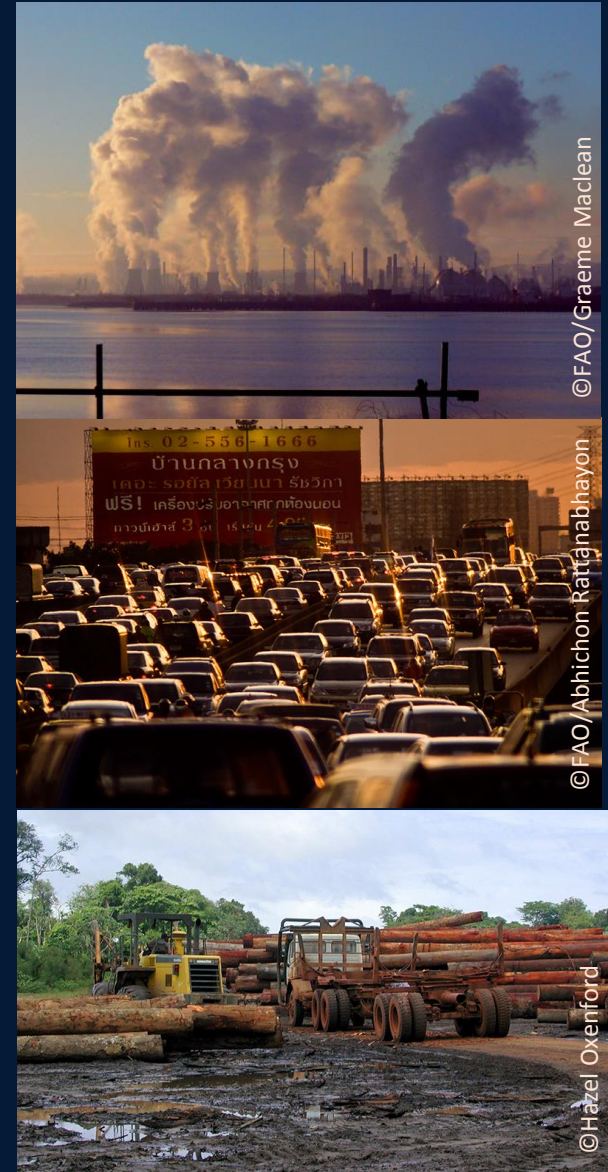


Why is climate changing?

Adapted from <https://thewellesleynews.com/>



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

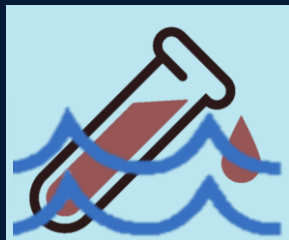
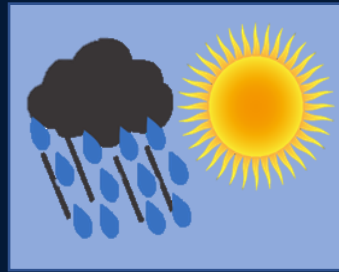
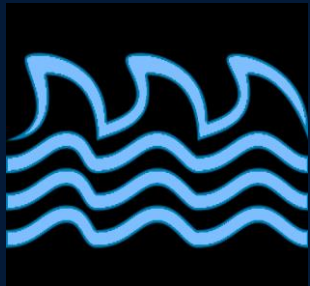


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What are the main climate change stressors?



Warmer seas

Sea level rise

Stronger
hurricanes

Less predictable
sea conditions

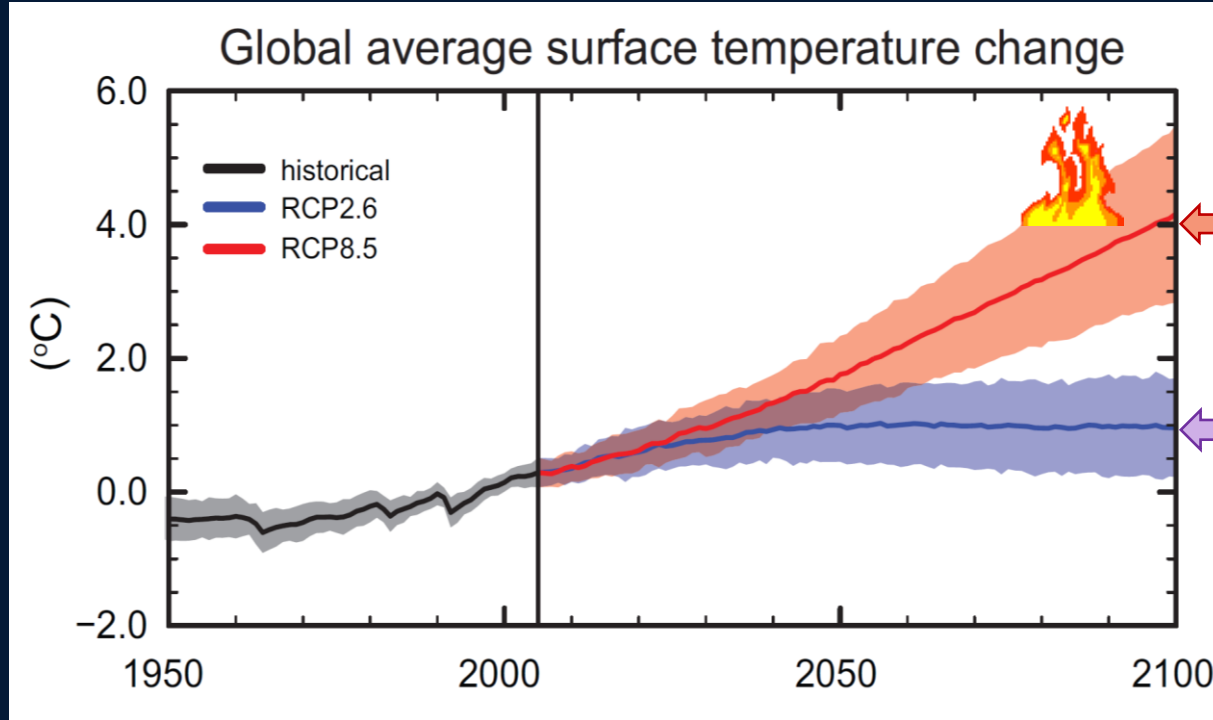
Changes to
ocean currents

Extreme
weather

Ocean
acidification



Warmer seas



Source: IPCC AR5 (2013)

Global projections

“Business-as-usual” scenario

“Low emissions” scenario

....caused by warmer air temperatures

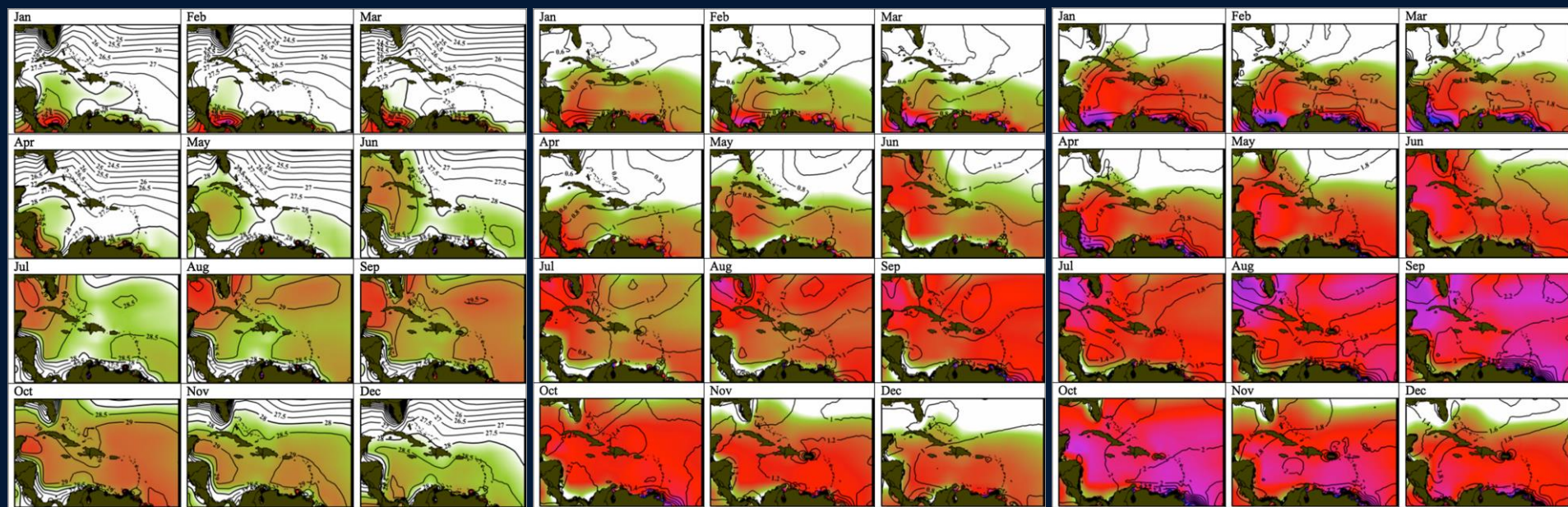
Caribbean Sea Surface Temperatures



2000 - 2009

2050 - 2059

2090 - 2099



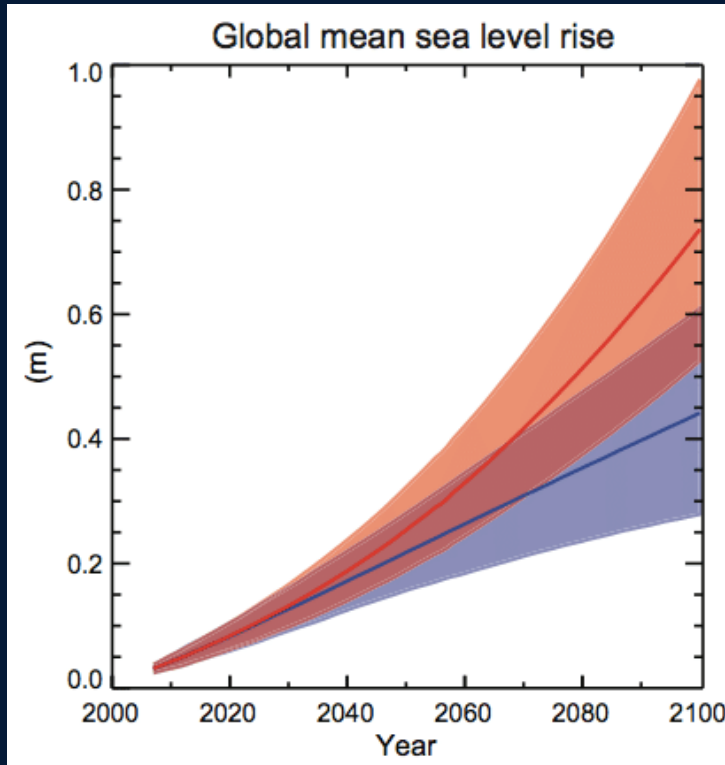
What we have seen

What to expect with business-as-usual

Higher sea levels



Source: IPCC AR5 (2013)



Global projections

← "Business-as-usual" scenario

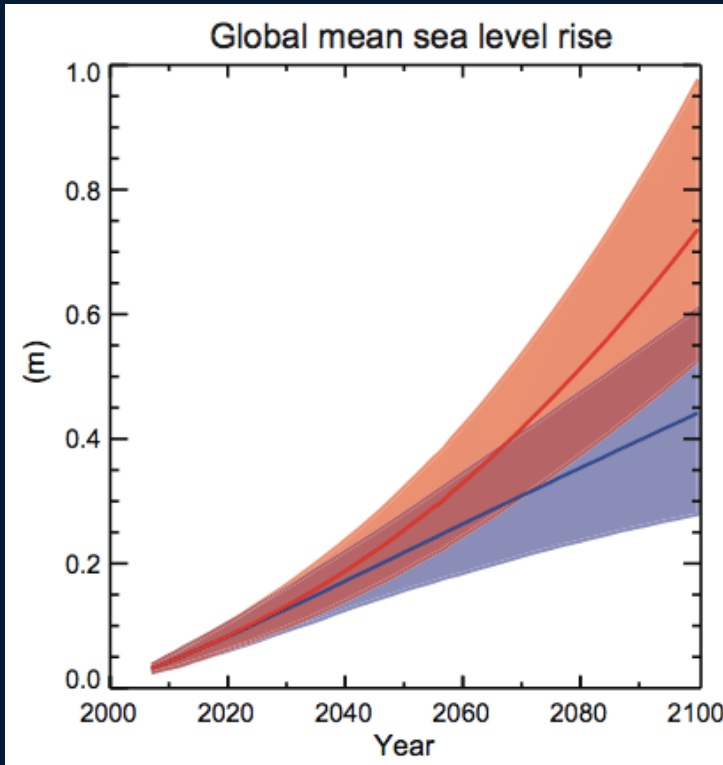
← "Low emissions" scenario



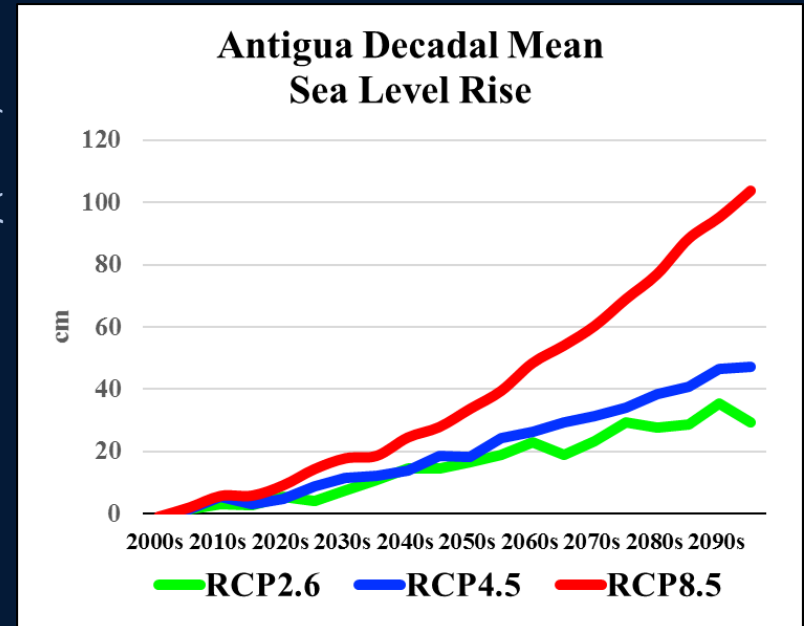
Higher sea levels

... Caribbean is tracking global changes

Source: IPCC AR5 (2013)



Source: Nurse and Charlery (2017)





Stronger hurricanes

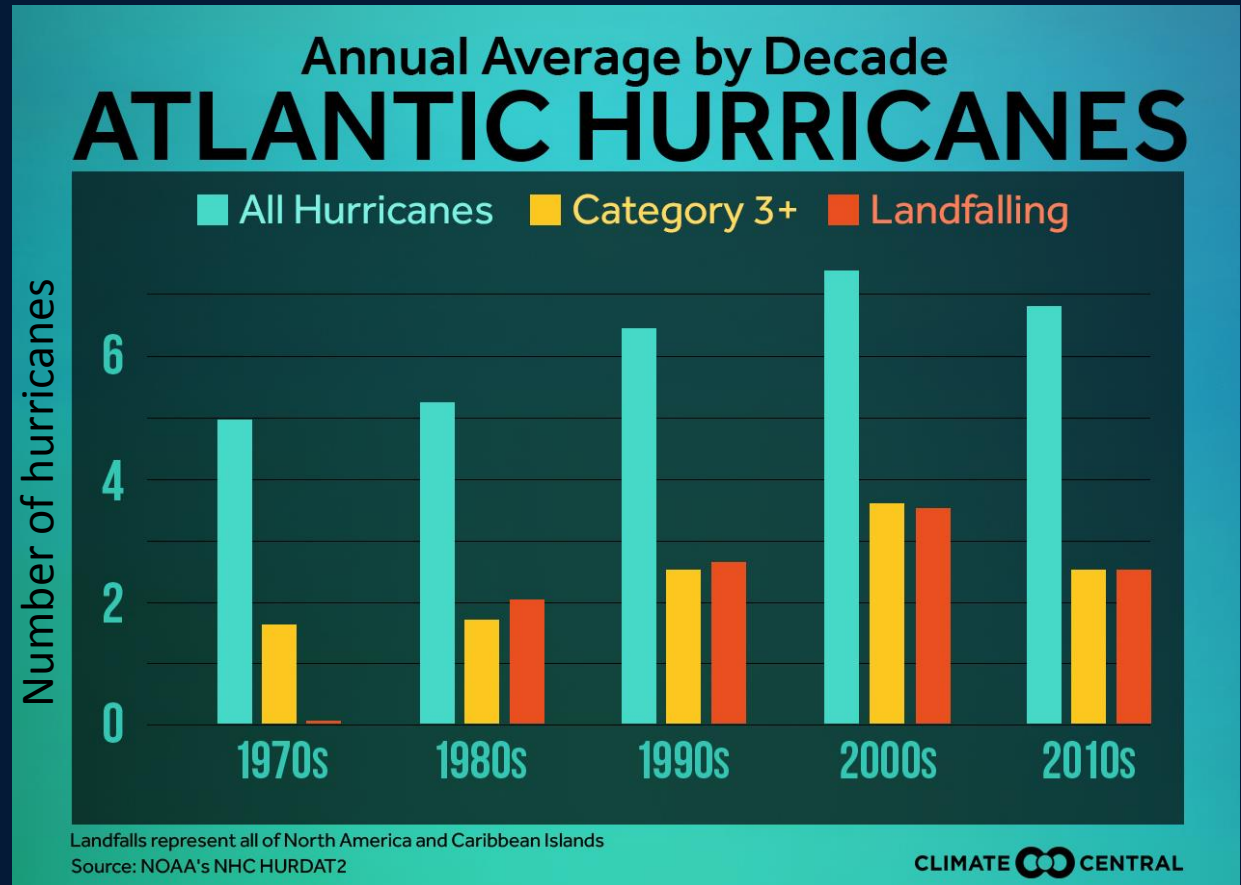
1970 - 2019

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

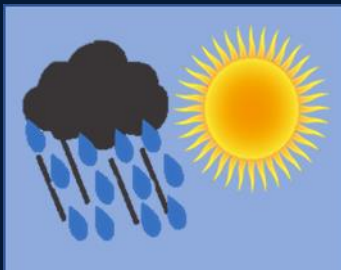


What to expect

Fishers are reporting:

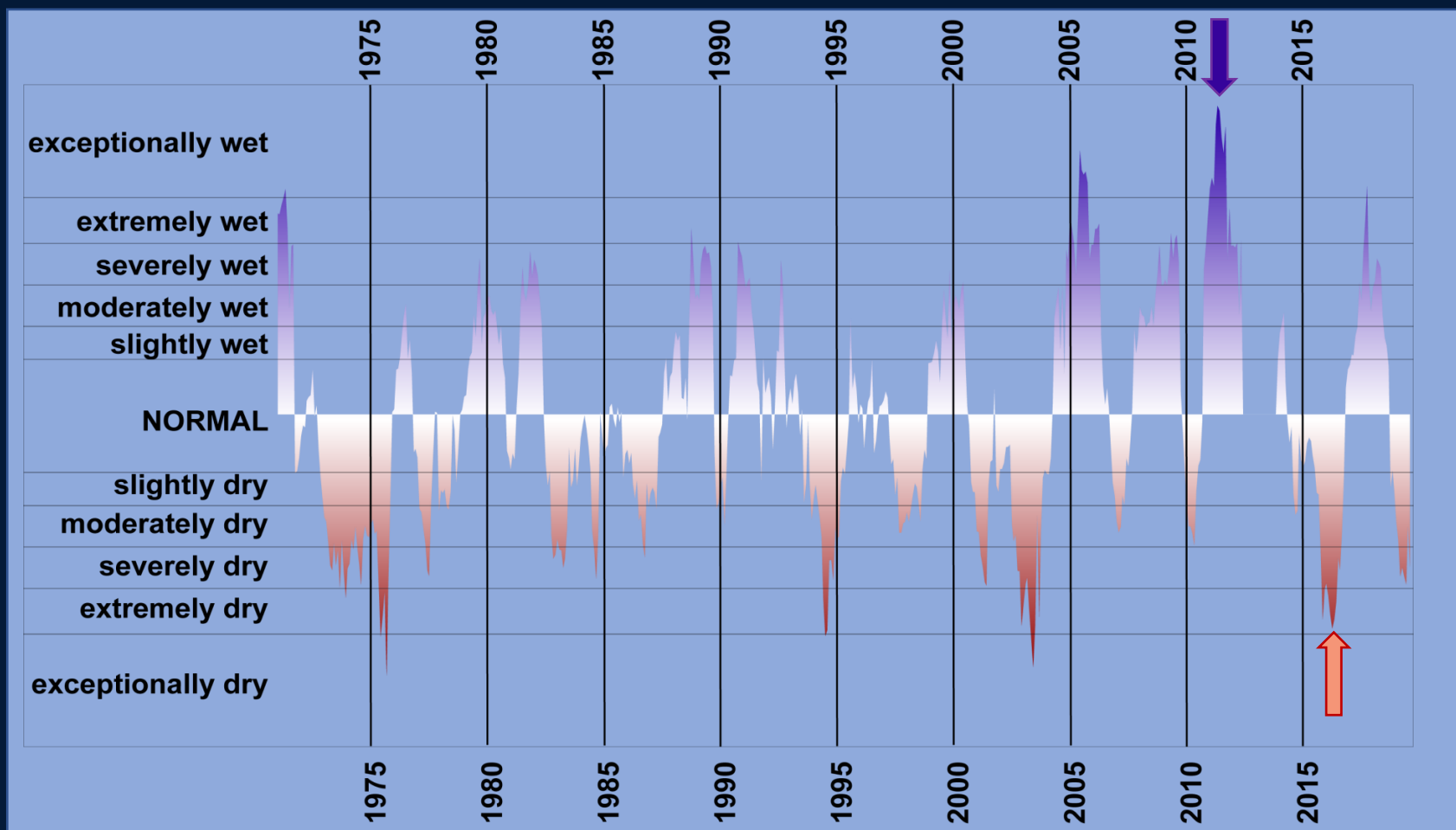
- increased storminess
- more dangerous waves
- unpredictable winds
- changes to 'tides' (currents)
- more green water
- Sargassum

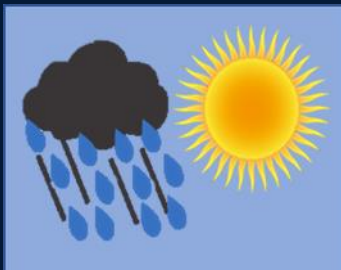
- wave heights lowering?
- green water for longer?
- continued sargassum



Extreme rainfall or drought

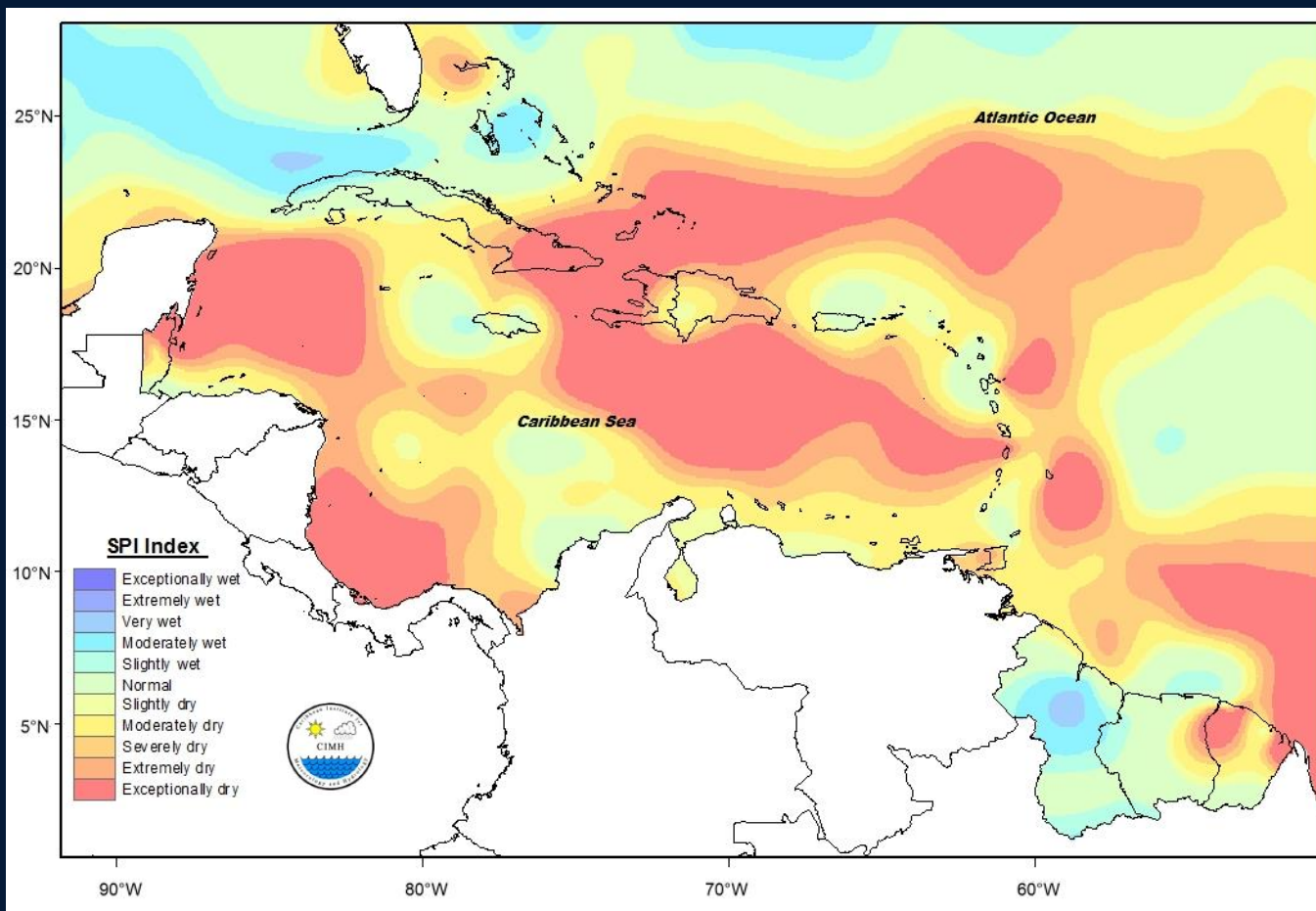
What we have seen in the Caribbean (1975-2016)



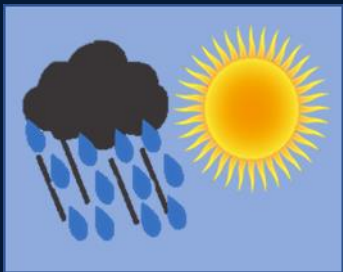


Extreme rainfall or drought

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



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



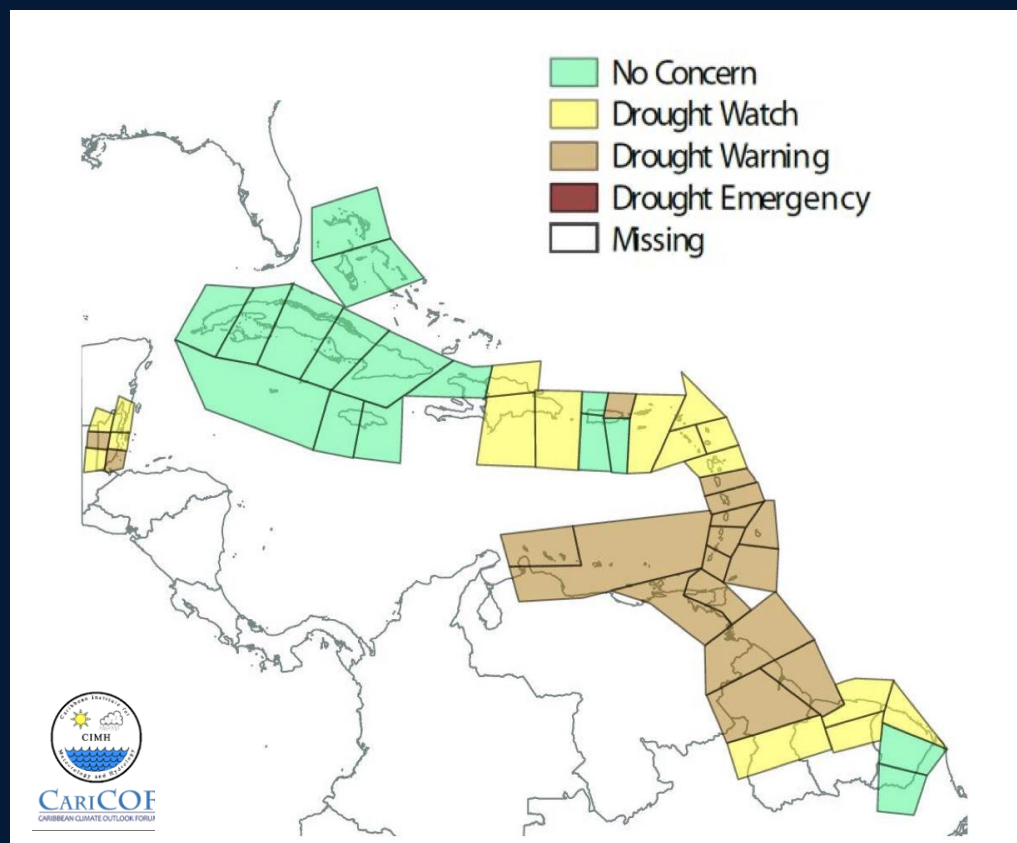
Extreme rainfall or drought

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

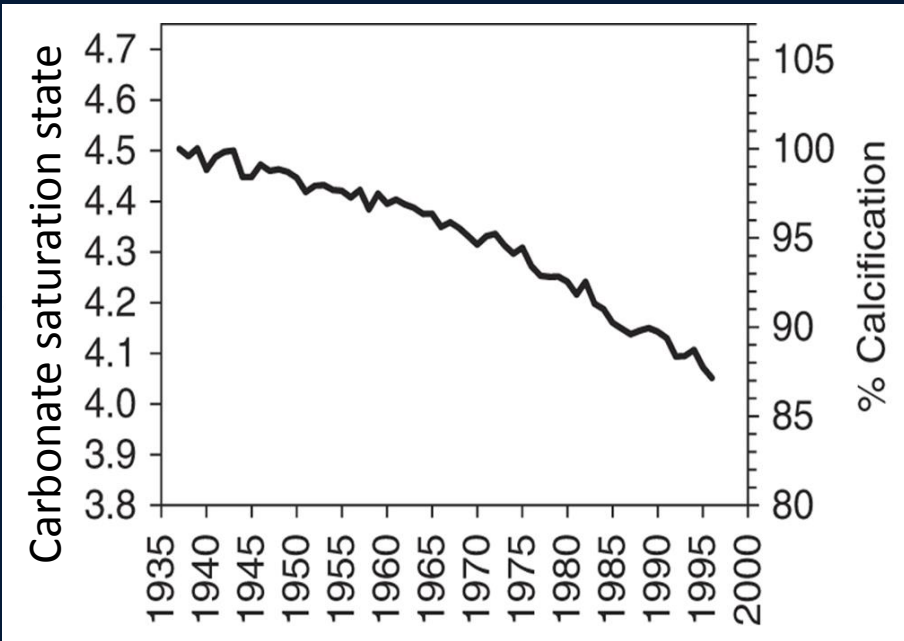




Ocean acidification

More carbon dioxide dissolved in the sea

What we have seen in the Caribbean

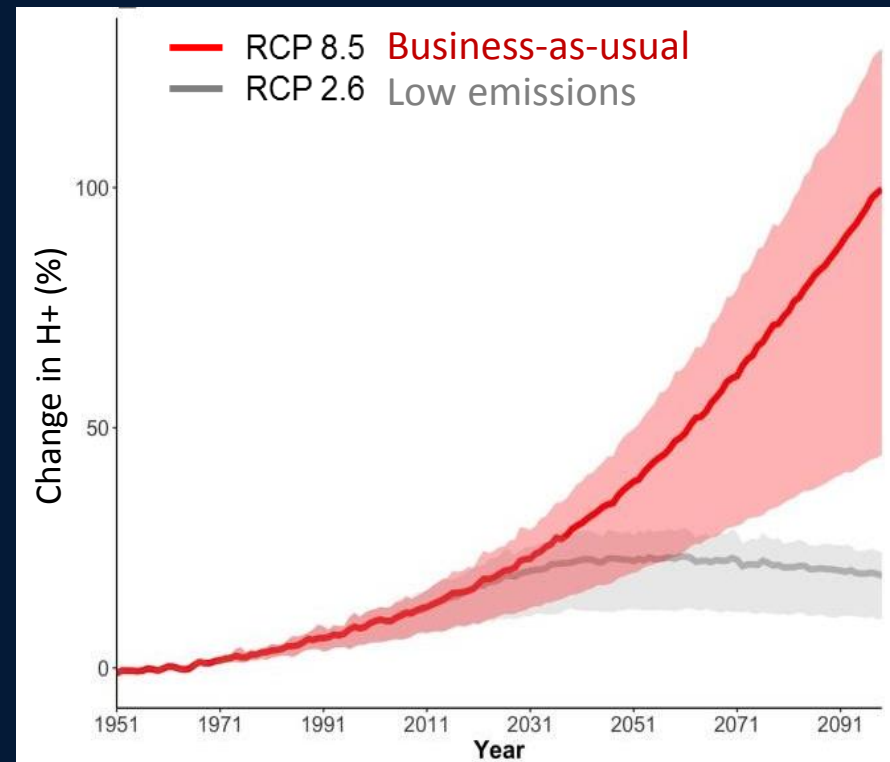


Source: Helmie et al. (2011)

..... less suitable for calcifying organisms

What to expect

Increasing sea surface acidity in the Caribbean

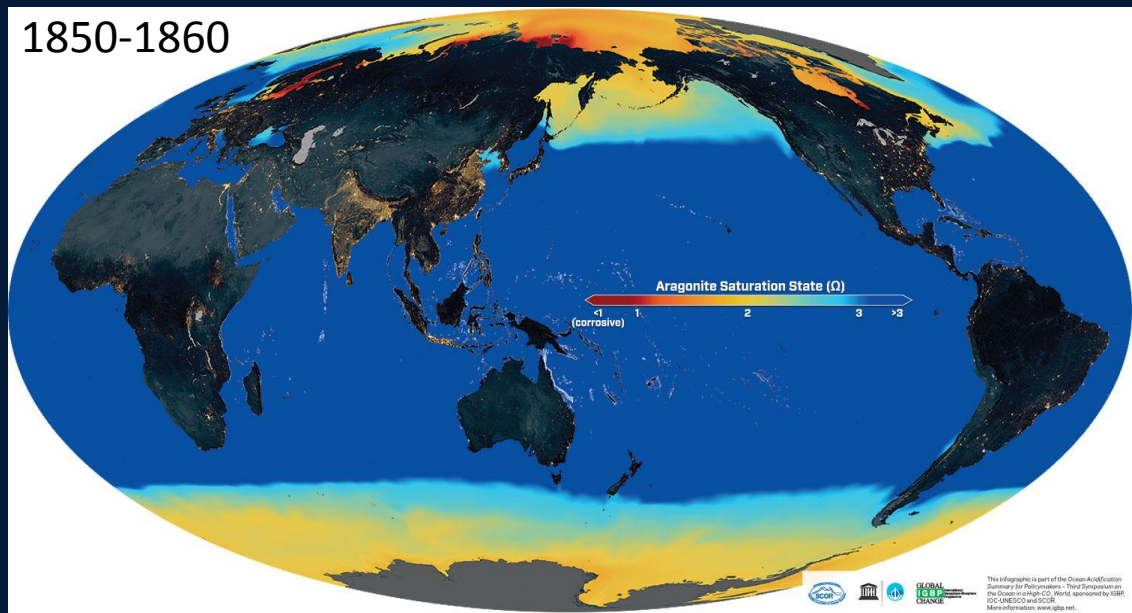


Source: CRFM (2019)



Ocean acidification

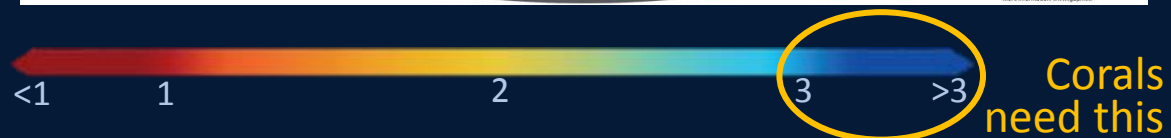
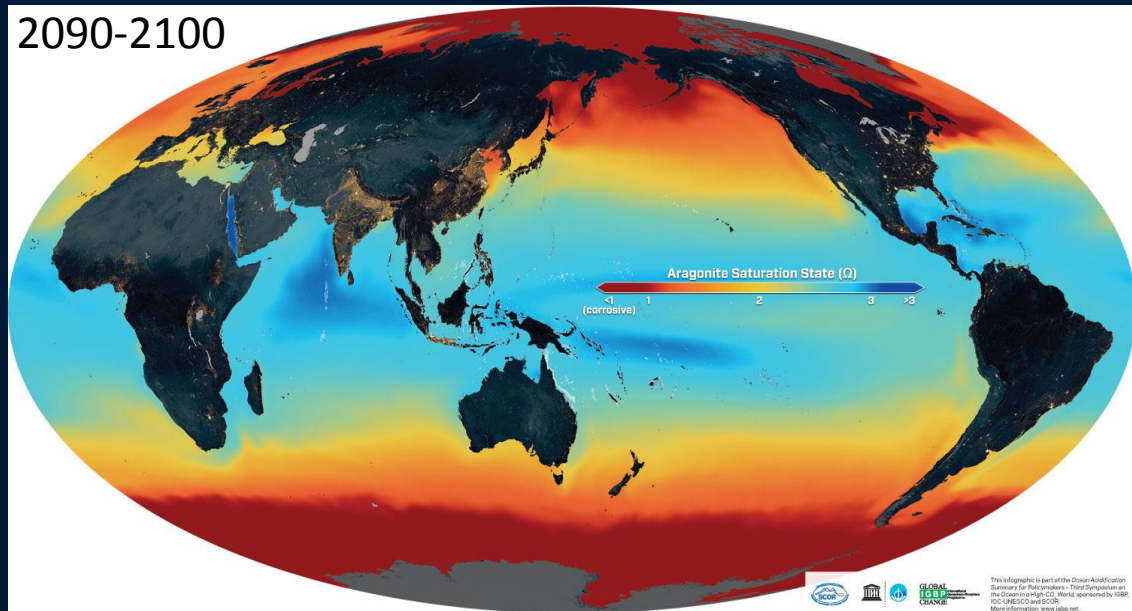
Decade of:
1850 - 1860



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



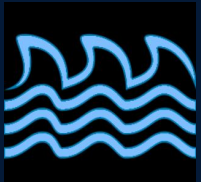
Sea level rise

+ 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



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Part 2:
Impacts





Warmer seas



Sea level rise



Stronger
hurricanes



Less predictable
sea conditions



Changes to
ocean currents



Extreme
weather



Ocean
acidification

Impact pathways



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



©FAO/Carla Daniel



©adapted by CERMES



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

coral bleaching.....



....coral death





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

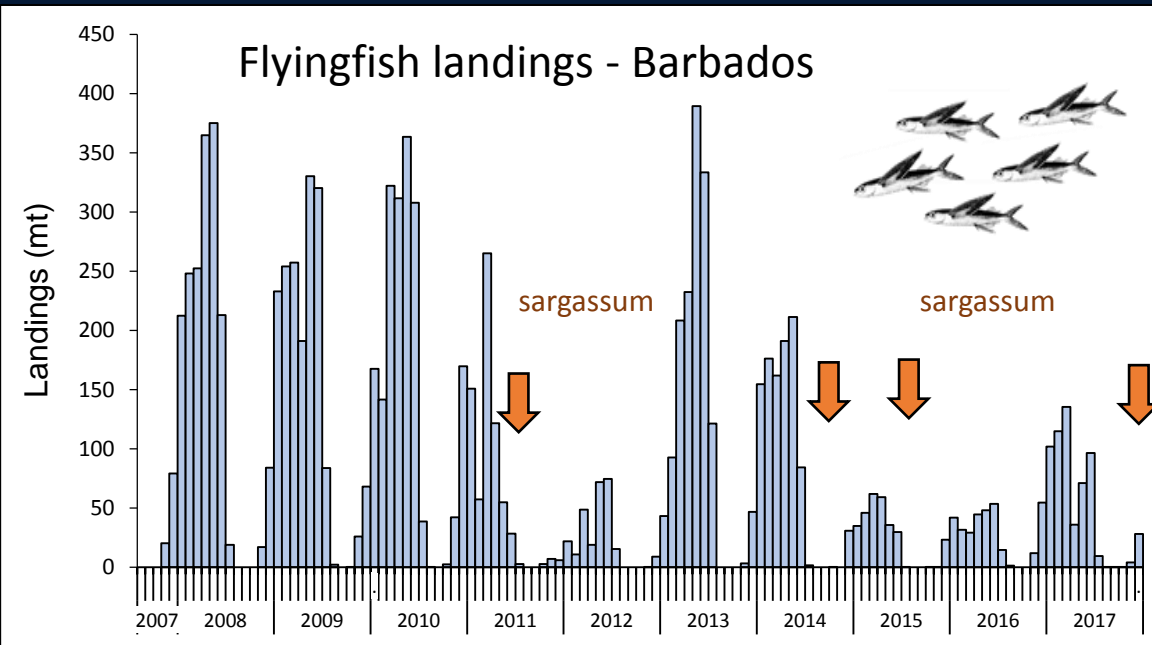




Sargassum influx events

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



©SeaFarmTable

©FAO/Hazel Oxenford



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:

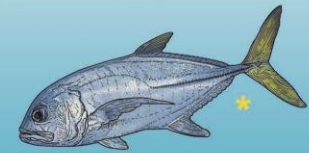
- increase likelihood of fish spoiling
- increase occurrence of ciguatera poisoning
- marketing and human health impacts



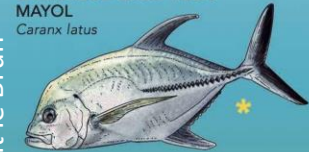
©Annabel Cox

- * Pêches et ventes interdites en tous lieux et en tous temps.
- Pêches et ventes interdites au nord du 16,5° parallèle (cf. carte).
- * Pêches et ventes interdites, quel que soit le lieu de pêche, si le poids dépasse 1 kg.

Poissons interdits à la pêche et à la vente (Arrêté préfectoral n°2002-1249)



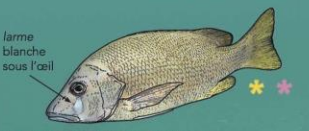
**CARANGUE GROS-YEUX
MAYOL**
Caranx latus



CARANGUE NOIRE
Caranx lugubris



**VIEILLE À CARREAUX
CAPITAINE ZAILLES JAUNES
CAPITAINE ROUGE**
Mycteroperca venenosa



**PAGRE DENTS DE CHIEN
ZIÉ PLEURÉ - PAGRE FINE**
Lutjanus jocu



CARANGUE JAUNE
Caranx bartholomaei



**GRANDE SÉRIOLE
SÉRIOLE COURONNÉE**
Seriola dumerilii



**CARANGUE FRANCHE
CARANGUE BLEUE**
Caranx ruber



**VIEILLE MORUE
JACOUENDA - MABOUTE**
Mycteroperca tigris



**PAGRE JAUNE
MAÎTRE D'ÉCOLE**
Lutjanus apodus



**BARRACUDA
BÉCU**
Sphyræna barracuda



**SÉRIOLE LIMBÉE
BABIA**
Seriola rivoliana



**VIEILLE VARE
VIEILLE DE RIVIÈRE**
Alpheutes



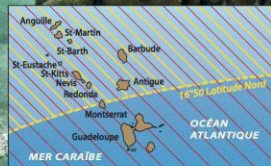
VIEILLE BLANCHE
Epinephelus



**VIVANEAU OREILLES NOIR
BOUCAN-NOIR**
Lutjanus buccanellus



**MURÈNE
CONGRÈ VERT**
Gymnothorax funebris



CIGUATERA : MANIFESTATIONS DE L'INTOXICATION

- Le plus souvent les signes apparaissent entre 1 à 4 heures après le repas, plus rarement au-delà de 24 heures.
- Débute souvent par des signes digestifs : douleurs abdominales, nausées, vomissements et diarrhées.
 - Les signes cardiovasculaires traduisent la gravité de l'intoxication : bradycardie, hypotension artérielle.
 - D'autres signes peuvent apparaître :
 - Neurologiques : troubles de la coordination et de l'équilibre, hallucinations, céphalées, vertiges, engourdissements, fourmillement surtout au niveau des extrémités et du visage. Sensations de brûlure ou de décharges électriques au contact d'objets froids.
 - Cutanés : démangeaisons notamment de la paume des mains et de la plante des pieds.
 - Et aussi : douleurs musculaires et articulaires, fièvre.
- Si vous avez un de ces symptômes consultez un médecin et conservez les restes alimentaires au réfrigérateur.



Toxic algal blooms

More frequent with warmer waters and high nutrient loads means:

- shellfish and fish kills
- human health hazard

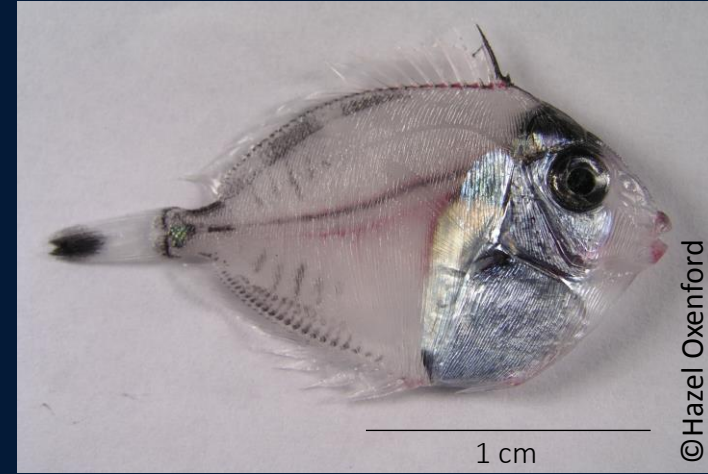




Increased ocean acidity

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



©Hazel Oxenford



©Hazel Oxenford



©Hazel Oxenford



©Hazel Oxenford



Sea level rise

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



©Hazel Oxenford



©Shelly-Ann Cox



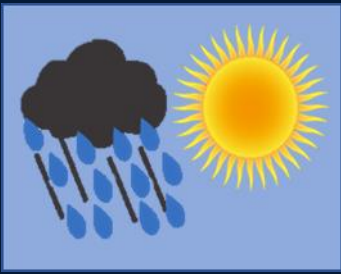
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Stronger hurricanes

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



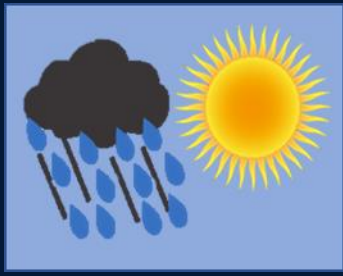


Extreme weather

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



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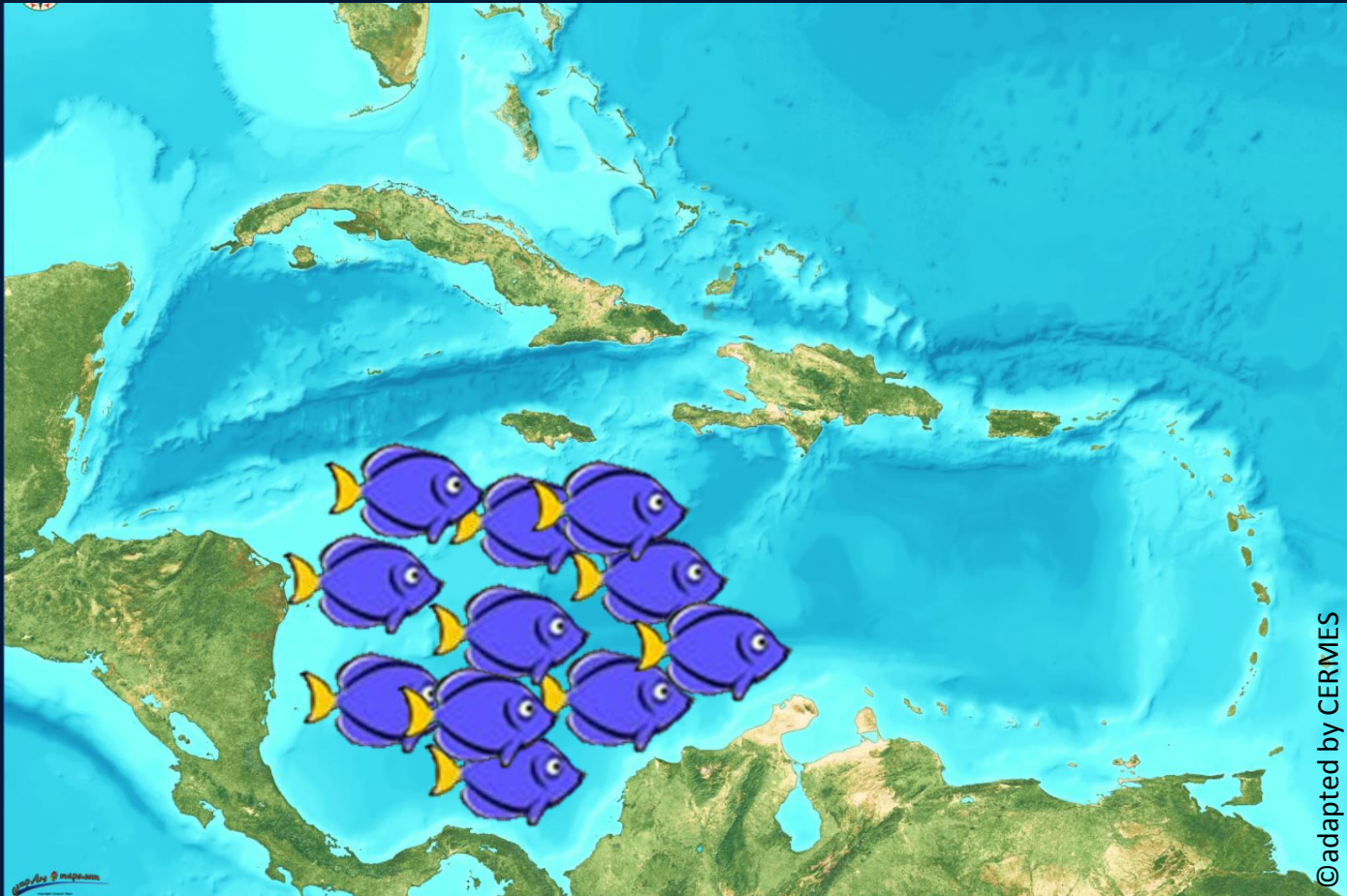


©FAO/Iris Monnereau

Changes to fish populations

Warmer water
means:

- reduced spawning success
- reduced stock replenishment



Changes to fish populations

Warmer water
means:

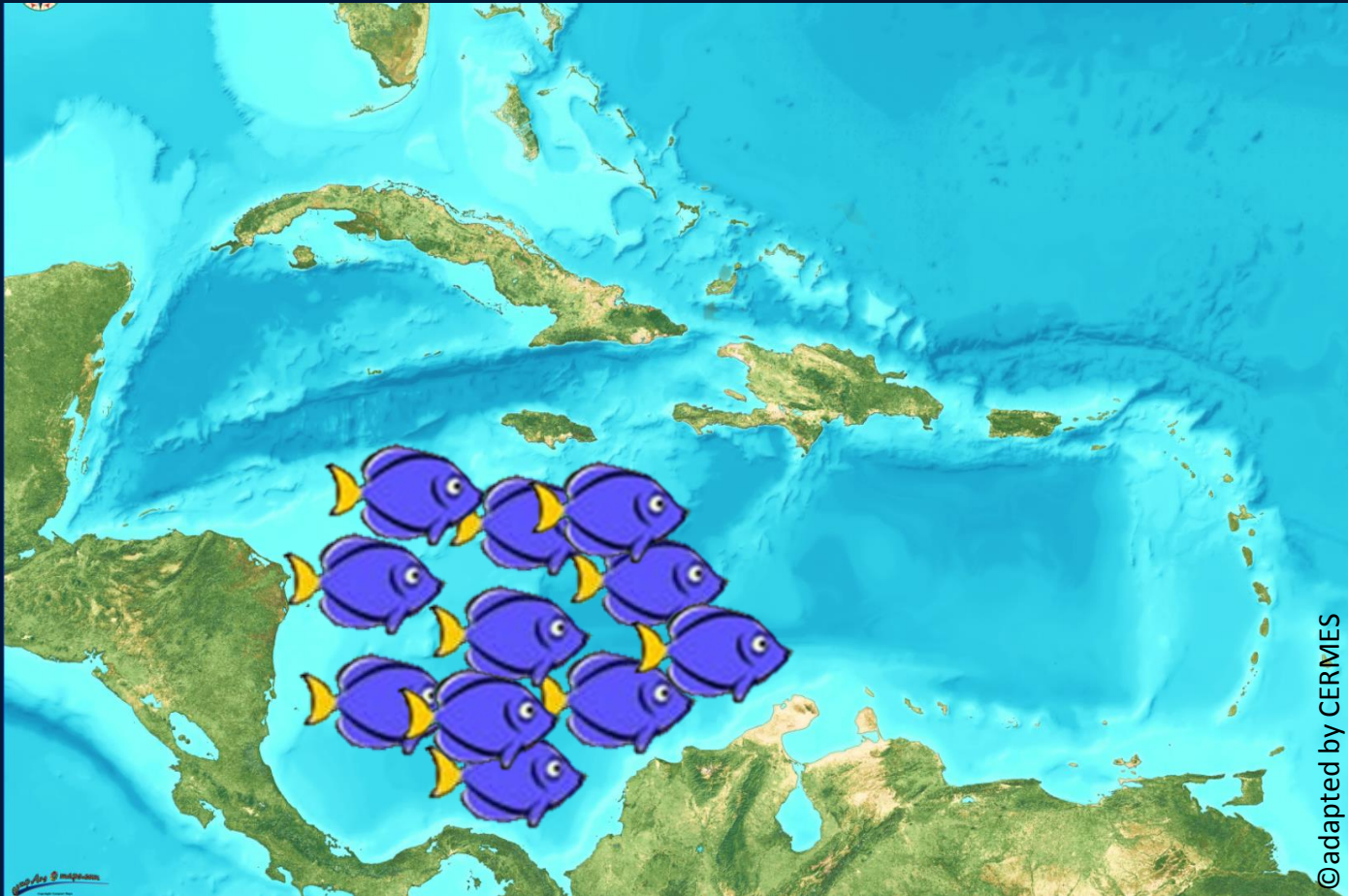
- reduced spawning success
- reduced stock replenishment



Changes to fish populations

Warmer water means:

- changes in fish distributions



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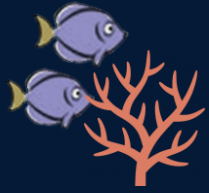
Changes to fish populations

Warmer water will mean:

- changes in fish distributions



Impact pathways



Biological
productivity



- 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



Capture fisheries



Aquaculture



Communities
livelihoods

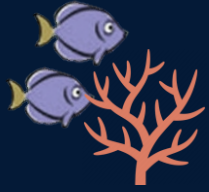


Governance



Wider society
and economy

Impact pathways



Biological
productivity



Capture fisheries



Aquaculture



Communities
livelihoods



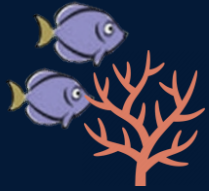
Governance



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

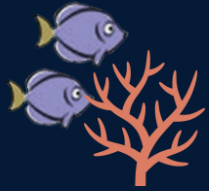


Wider society
and economy

- 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



Aquaculture



Communities
livelihoods



Governance



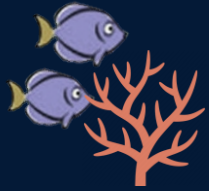
Wider society
and economy

- 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

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

Impact pathways



Biological
productivity



Capture fisheries



Aquaculture



Communities
livelihoods



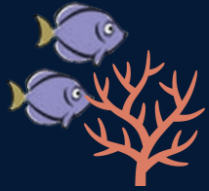
Governance



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

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
- loss of income
- reduced wellbeing
- change in shared stock boundaries
- 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



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Part 3:
Adaptation



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



Ongoing adaptation measures

Forecasting

Better ocean and climate forecasting and communication that allow for:

- Emergency planning
- Timely informed decision making

CARICOF Caribbean Climate Outlook Newsletter - March to May 2020

For climate information specific to your country, please consult with your national meteorological service. CARICOF outlooks speak to recent and expected seasonal climate trends across the Caribbean in general.

BRIEF SUMMARY: November 2019 to May 2020

November 2019 to January 2020: Long term drought has developed in many areas in the Caribbean, and short term drought locally. Temperatures were significantly above average, accompanied by heat waves into early December in the Guianas, but also locally in the Lesser Antilles where their occurrence was unseasonably late.

March to May 2020: Towards the end of the Caribbean dry season, a likely reduction in water availability is due to evolving (or possible) long term drought in a majority of places may pose water stress to sensitive. In addition, frequent dry spells and short-term drought in a majority of places may pose water stress to sensitive. There is growing concern for flooding and flash floods in Belize and the islands from April onwards, as extreme wet spells may occur. Warmer than usual temperatures could make the heat uncomfortable at times.

LOOKING BACK:

Nov. - Dec. 2019 / Jan. 2020 (NDJ)

Observations

NDJ 2019-20 Rainfall Monitor

• **RAINFALL:** part of E. Dom. Rep., N. French Guiana, N. Guyana, Saint Lucia, St. Vincent very dry; southwestern Dominica very wet.

ND 2019-20 Temperature Monitor

• **TEMPERATURE:** Most of the Caribbean significantly warmer than avg., especially in parts of the NW Bahamas, W. Jamaica and French Guiana.

Notable Climate Records:

WET-NDJ: 7 locations in Dom. Rep., 2 in Jamaica, 1 Cuba and 1 in St. Vincent recorded their highest rainfall totals for this period (129-370% of avg.).

DRY: NDJ: 1 location in Puerto Rico (24.0C) recorded their highest minimum temperatures for the season.

February 2020

find out more by using the clickable images and headlines or visit ccm.cmh.edu

SARGASSUM

SUB-REGIONAL OUTLOOK BULLETIN

JANUARY 2020 | VOL 1 | ISSUE 2

21 - 27 December 2019

SARGASSUM INFLUX EVENTS WILL REMAIN MINIMAL OVER THE NEXT THREE MONTHS (JAN-MAR 2020)

- The Eastern Caribbean islands have seen minimal levels of sargassum throughout the last quarter of 2019.
- The level has now increased slightly.
- Currently, there is some sargassum visible out in the Atlantic.

Sargassum abundance intensity level (based on image 21-27 December 2019)

CURRENT OUTLOOK (JANUARY - MARCH 2020)

The islands of the Eastern Caribbean can expect minimal sargassum influxes over the next 3 months (red) especially compared with the same period in 2019 (grey).

- Northern islands are likely to experience mild levels in late January, and be relatively free of sargassum influxes through late March.
- Middle islands are likely to experience mild levels of sargassum influxes over the next 3 months, increasing slightly in late March.
- Similar to last year the Southern islands are likely to remain virtually free of sargassum, except for mild influxes in mid March.

North, Middle, South

CLICK HERE TO ENLARGE

VOL 1 | ISSUE 2

SEPTEMBER 2019

VOL IV | ISSUE V

SEPTEMBER - DECEMBER 2019

CARIBBEAN CORAL REEF WATCH

Announcement

SEA SURFACE TEMPERATURES (SST) IN THE CARIBBEAN HAVE BEEN APPROACHING THEIR ANNUAL PEAK WHICH IS EXPECTED TO BE IN SEPTEMBER.

REPORT CORAL BLEACHING OBSERVATIONS

RAPID CORAL BLEACHING IS ASSOCIATED WITH MARINE HEATWAVE MORTALITY EVENTS ON REEFS

STRANGE CORAL BEHAVIOR IMPROVING GREAT BARRIER REEF'S RESILIENCE

Notable Observations

- Watch alert level issued for most of the Windward and Leeward Is. Warning issued for the northern-most and southern-most islands (and T&T) in the island chain. Cuba and Belize both experiencing Alert level 1 and 2 conditions.
- As of the end of July, Sea Surface Temps, were around 1°C above average around the Windward Islands and slightly above average in most other areas. Read more...

Current Global Conditions

- Bleaching watch and warning alerts issued in Florida, Gulf of Mexico, and throughout the Pacific, Southeast Asia, and Middle Eastern Indian Ocean.
- Veracruz (Mexico) and Yucatan Peninsula, and main Hawaiian Is. under Alert Level 1. Northern Hawaiian Is., Kiribati, N. Vietnam, Tabuk (Saudi Arabia), Egypt, and conditions. Bleaching reported in both NW and Main Hawaiian Is. as officials prepare for severe bleaching.

Alert Level Guide

Alert Level	Interpretation
No Stress	No Thermal Stress
Watch	Low-level thermal stress
Warning	Thermal stress is accumulating
Alert level 1	Bleaching expected
Alert level 2	Widespread bleaching and some mortality expected

CLICK HERE TO ENLARGE

CARIBBEAN CORAL REEF WATCH

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



Amber fish filling the breach

THE AMBER FISH keeps coming in droves.

Catches have been so plentiful that president of the Barbados National Union of Fisherfolk Organisations, Vernel Nicholls, credits it with keeping the fish markets open at a time when most fisherfolk would be at home until flying fish season started.

Nicholls called for research on the fish, seemingly brought in with the sargassum



FISH VENDOR Jemma Harris of the Bridgetown Fisheries Complex, showing the amber fish, which is gaining popularity in place of flying fish.

(Picture by Lennox Devanish.)

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



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Ongoing adaptation measures

Energy efficiency

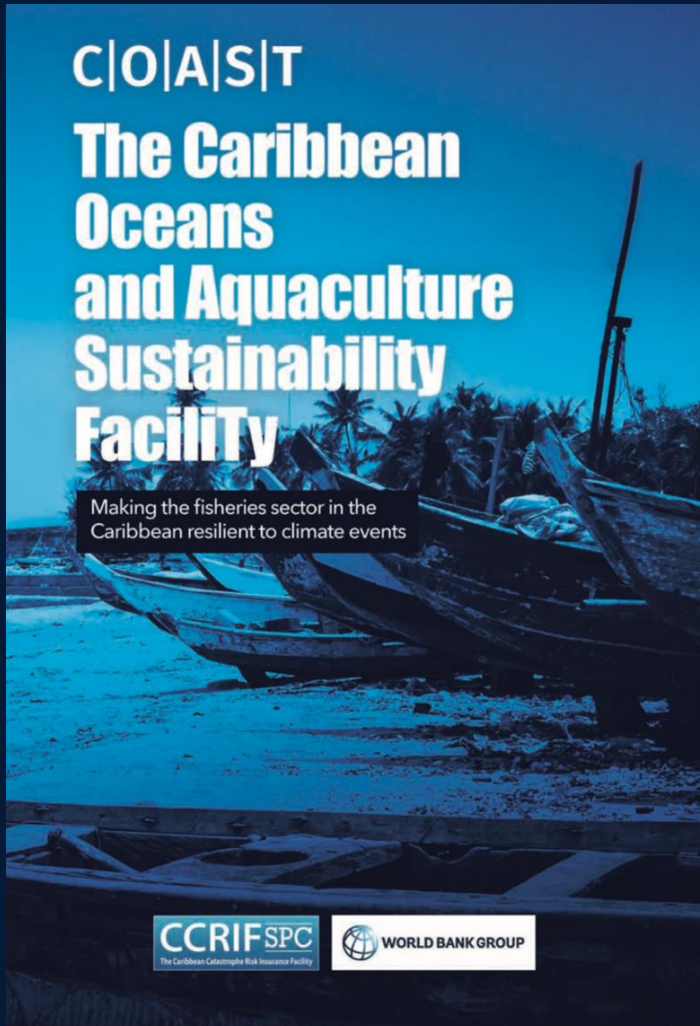
Use of renewable energy technology and improved building and boat designs to:

- 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:

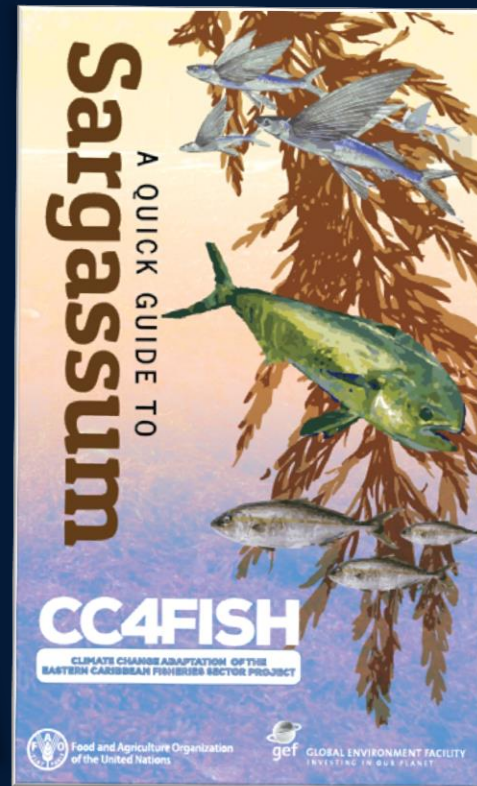
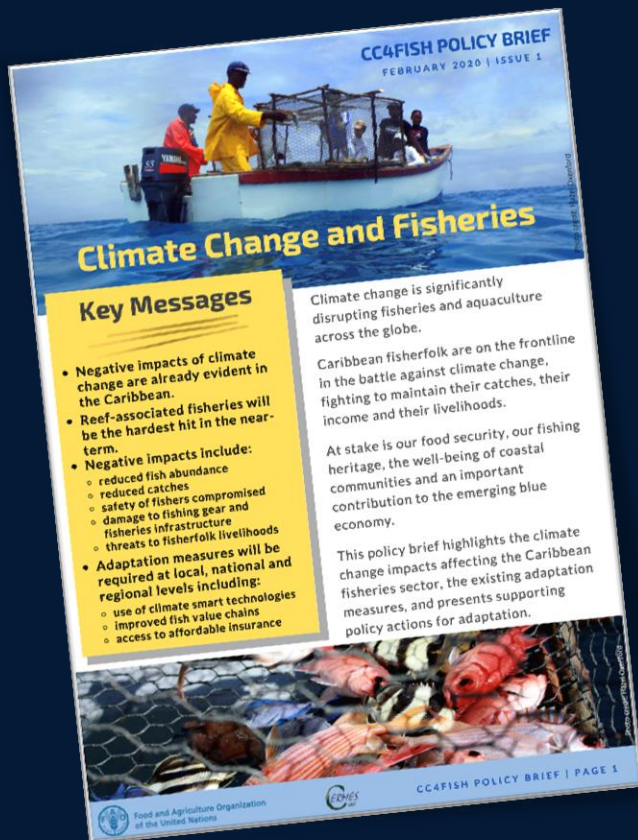
- Business skills
- Product development
- Sea moss farming etc.



Ongoing adaptation measures

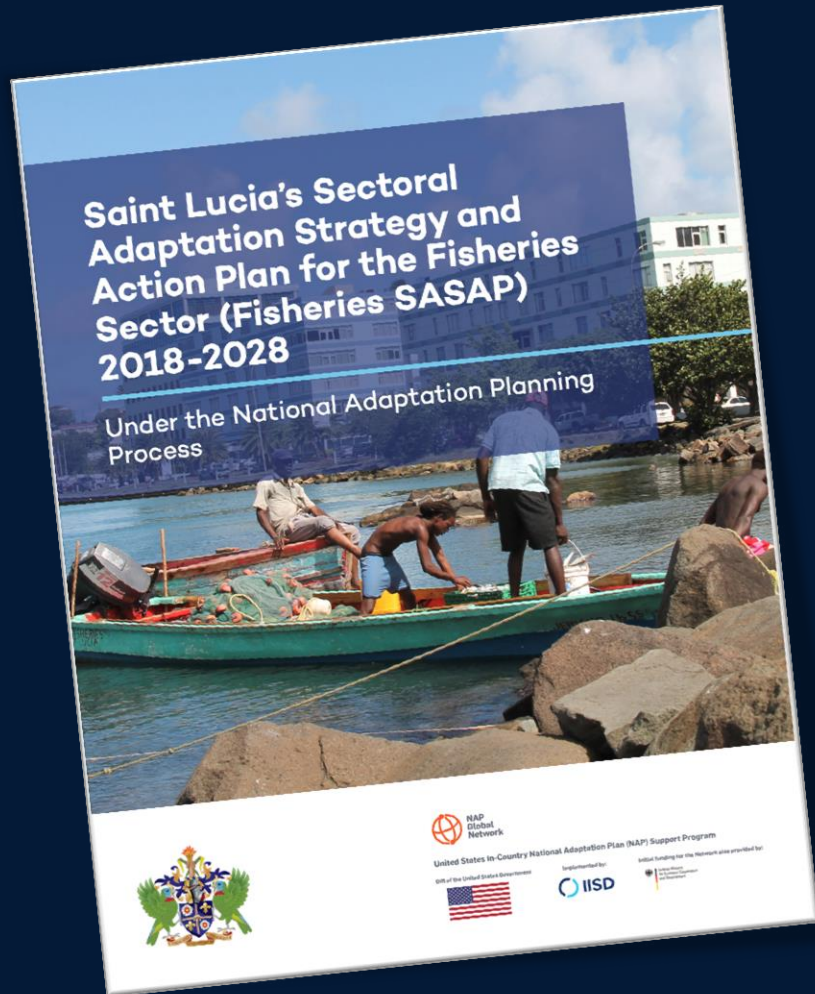
Building knowledge and awareness

Improving awareness and understanding of climate change vulnerabilities and adaptation 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

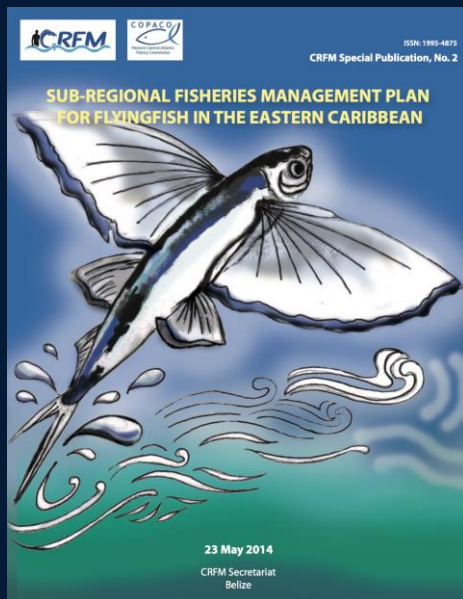
Integrating the fisheries sector into climate change policy formulation and management plans (e.g. Nationally Determined Contributions)

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



©Maria Pena

Supporting policy actions needed

Sustainable livelihoods

Facilitate additional livelihood opportunities to improve:

- fisherfolk incomes
- resilience to climate change

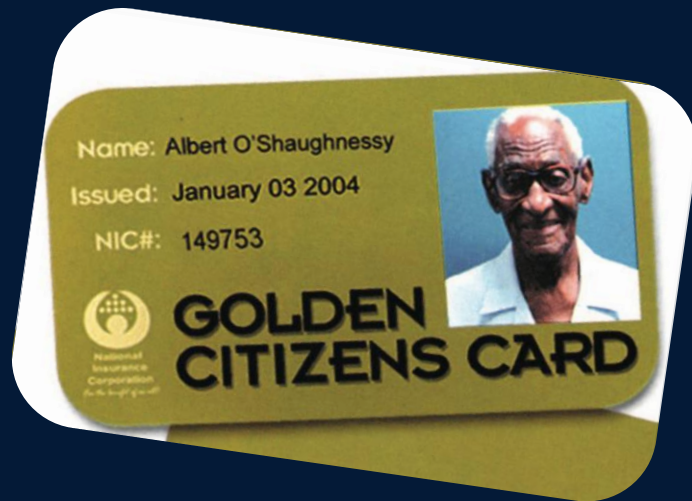


Supporting policy actions needed

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

Required citation:

Cox, S.-A., Oxenford, H.A. and Monnereau, I. 2020. *Climate change impacts on the Caribbean fisheries sector*. Bridgetown, FAO and UWI CERMES.

<https://doi.org/10.4060/cb1695en>

Thank you!

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