Impact of Climate Change on fisheries and food security in small-scale fisheries

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Mundus maris

Sciences and Arts for Sustainability asbl

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Climate change – a reminder

Life probably started in the ocean – a story of fits and starts.

We know that even small changes in climate and productivity in the past have led to far-reaching changes in the ocean environment, mass extinctions of flora and fauna.

This occurred e.g. after the rise of the Isthmus of Panama, which separated the Pacific and the Caribbean between four and three million years ago.

It can happen again, this time as a result of what we do and in ways which will be different, because our human impacts have no precedent in history.

Just recently, the correction of an error in land elevation data surprised even scientists for the implication on sealevel rise of much larger coastal areas than anticipated so far.

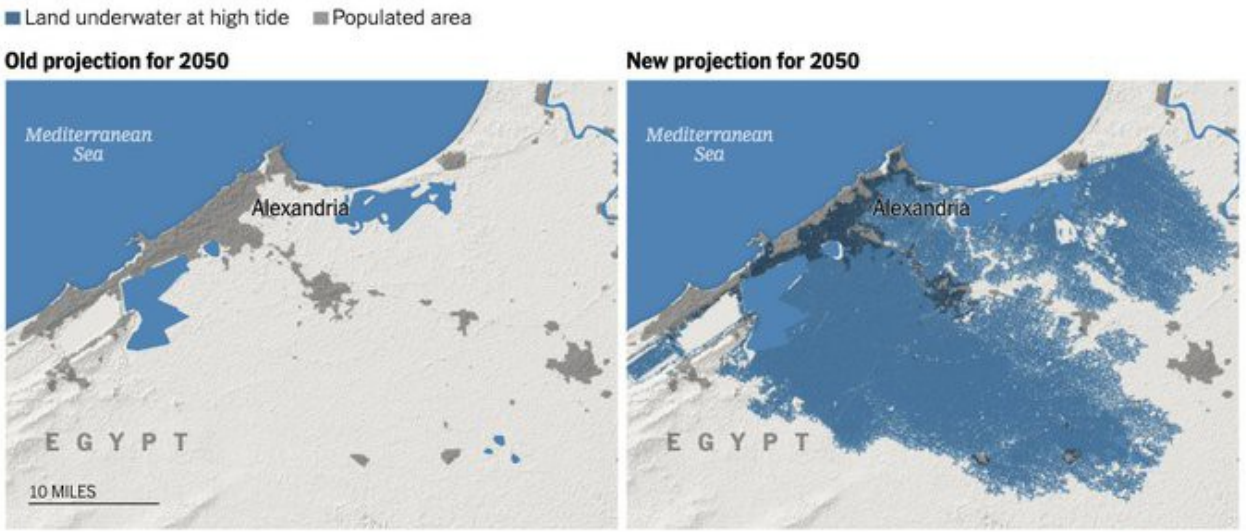
Climate change – key areas

Let's explore the major effects

- Sea level rise
- Poleward migration of marine life
- Less oxygen in the water
- Acidification
- Negative dynamics of mercury and other contaminants in the food web
- Reinforcement of the effects of overfishing and eutrophication on marine food webs

Climate change – sea level rise (1)

Factors: GHG emissions → warming (thermic expansion) + stability of ice sheets + correction of coastal elevation measurements and numbers of people living there

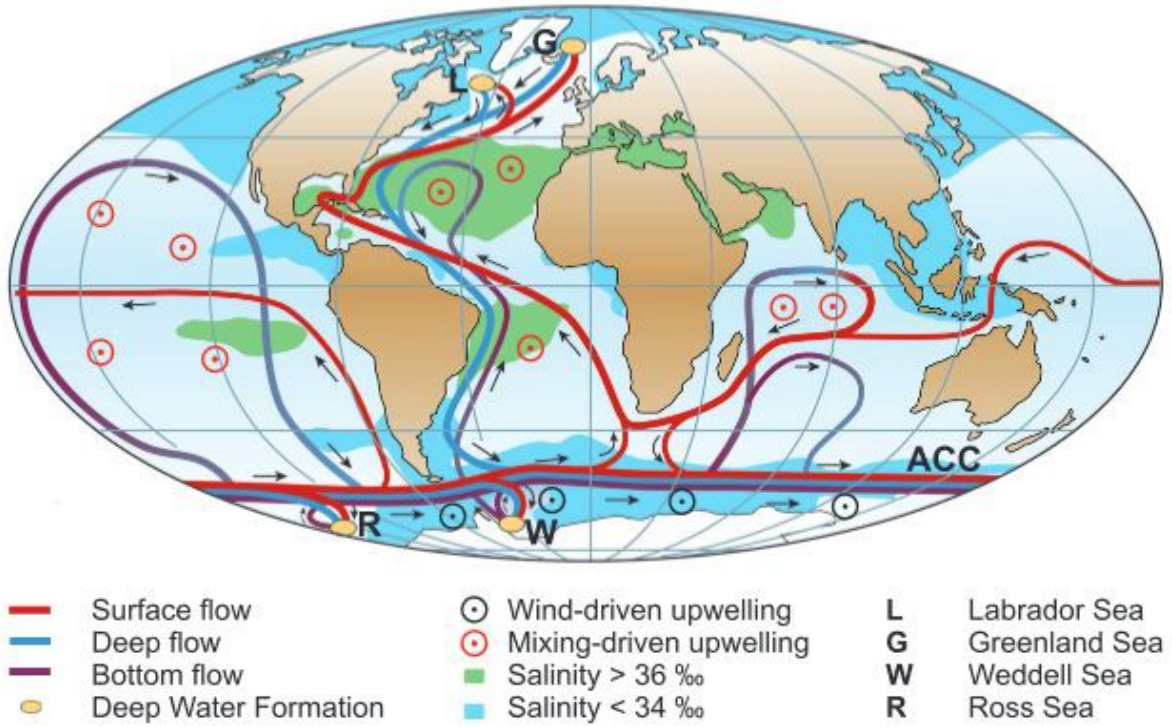


150 million people are now living on land that will be below high tide by 2050 (hopefully, if warming is held to 2°C). Numbers double to 300 million people flooded out by 2050 if warming continues at current rates. Effects on Nigeria...

Source: https://www.rollingstone.com/politics/politics-news/sea-level-rise-climate-central-study-906178/?fbclid=IwAR3vdN7FTIKoSSEU6oAMsA2uQ0RldFHLqbCWMDW69tbkrF2nCjkNLFNqXJ0

Climate change – sea level rise (2)

Factors: Instability of ice sheets, particularly Antarctica, impact on ocean circulation of melting ice – human sea defences may or not be sufficient



Schematic thermohaline ocean circulation measurably slowing, weaker ocean climate stabilisation (Source: Rahmstorf, 2006)

Climate change – poleward migrations

Factors: Marine organisms (fish, invertebrates, plants) have temperature preferences their metabolism is adapted to and will therefore move polewards (or deeper if they can) as waters keep warming

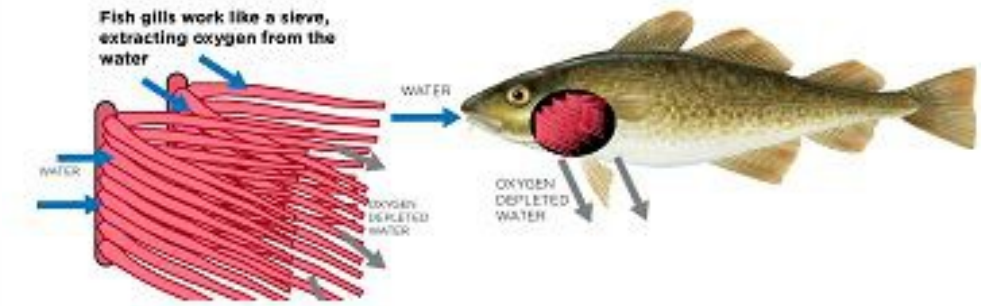
- Current rates of migration are approx. 800 m/year (Cheung pers.comm.)
- Species can adapt, but not all can adapt fast enough and higher extinction rates are predicted
- Species meeting continental barriers may be doomed or must be able to adapt
- Shifts in ecosystem composition are likely as interactions between organisms at different trophic levels are expected to change

Climate change – less oxygen (1)

Factors: Warming waters holds lower levels of dissolved oxygen

Effects: Fish and other gill-breathing organisms will grow to smaller sizes because they need to expend more energy for breathing (gas exchange through gills) and body weight grows in third dimension, but surface of gills only in second: Gill-Oxygen Limitation Theory, known as GOLT

Higher temperature speeds up metabolism, O_2 demand up!



Source http://www.seaaroundus.org/theory-explains-biological-reasons-that-force-fish-to-move-poleward-as-climate-change-heats-up-the-ocean/?fbclid=IwAR32Q6q-G-TjTic4k4rdwEOs1gDptg9Go1f7094h1fYi8CBDggExbgz4ueE

Climate change – less oxygen (2)

Factors: Warming waters can hold lower levels of dissolved oxygen

Effects: fish and other gill-breathing organisms will grow to smaller sizes and generate **lower catches**

Fish make up 17 percent of the global population's intake of animal protein, and as much as 70 percent for people living in some coastal and island countries, according to the Food and Agriculture Organization (FAO) of the UN.

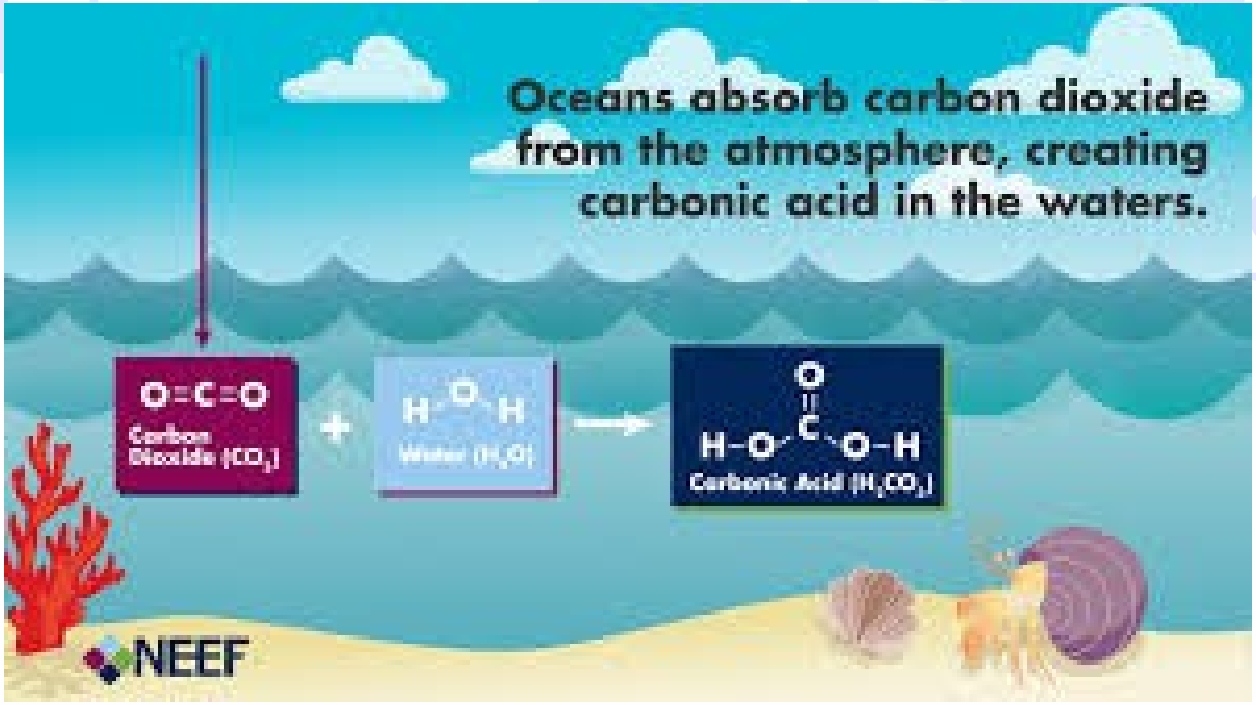
Wide-spread overfishing and its destabilising effect on marine ecosystems is exacerbated through climate change.

Global catches already shrink since the mid-90s.

Climate change – acidification (1)

Factors: Ocean acidification is the ongoing decrease in the pH of the Earth's oceans, caused by the uptake of carbon dioxide (CO. 2) from the atmosphere.

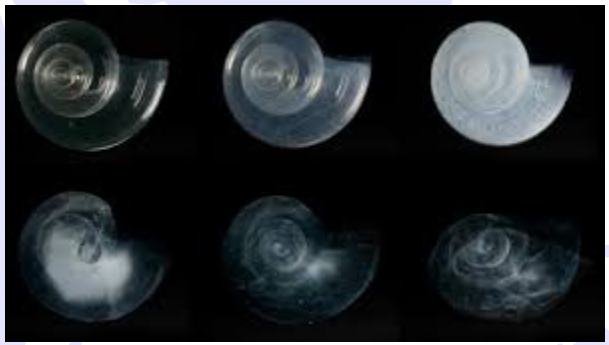
Seawater is slightly basic (meaning pH >7). Ocean acidification involves a shift towards pH-neutral conditions, eventually a transition to acidic conditions (pH <7).



Climate change – acidification (2)

Factors: Lowered pH of seawater

Effects: Especially organisms with calcareous skeletons – corals, bivalves but also planktonic algae which produce half the oxygen we breathe – need to spend more energy to keep their bodies together and grow.

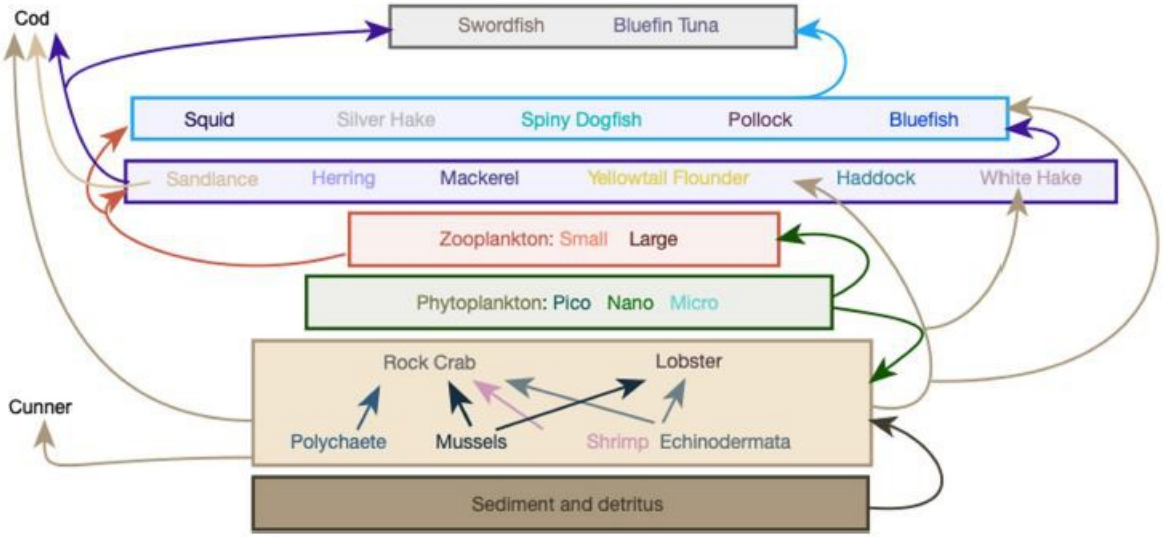


Progressive degradation of exposed shells.

Climate change – methylmercury

Factors: Climate change and overfishing increase neurotoxicant in marine predators

Effects: Even though release of mercury into the atmosphere is been reduced thanks to stricter regulations, climate warming, overfishing and associated changes in marine ecosystems seem to increase mercury loads in predators.



Extended Data Fig. 2 | Feeding relationships in the Gulf of Maine marine food web. Trophic interactions for the Gulf of Maine food web that are included in our MeHg bioaccumulation model.

Schartup, A.T. et al. 2019. *Nature*, https://doi.org/10.1038/s41586-019-1468-9

Climate change – connected effects

Factors: Climate change and eutrophication (from agricultural run-off, insufficiently treated urban waste waters etc.) create more and more dead zones and exacerbate the impact of overfishing

Effects: Reduced production from healthy wild stocks – there are not enough fish in the water to produce MSY

Directing large quantities of small pelagic fish into reduction to fishmeal and oils as feed to carnivores instead of direct human consumption threatens food availability to low income, vulnerable populations

Such populations are overproportionately depending on natural resources for food, labour and other services.

Food security definition

Food security, as defined by the United Nations' Committee on World Food Security, means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.

Resource declines affect business conditions of women in SSF selectively

Resource rarefaction makes upfront finance needs of fishing trips much higher, now well beyond financial means of women

No access to affordable credit

No shock absorbers through social policies (health, education new skills...)

Access to catches is reduced as 75% of industrial catches in Guinea are by Chinese vessels

Most profits then accrue outside the local and national economy as happens in some neighbouring countries.

Pictured a case in Conakry – Ms. Sarr and her group.

How to meet the challenge?

Foremost: Governments and industry must work a lot harder to implement the Paris Climate Agreement

Capacity strengthening of men and women in SSF for collective learning and practice that could open

- new perspectives
- new opportunities for women and men
- new, more robust solutions
- new and safer livelihoods
- sustainable lives for all – people and nature, won't work without gender equity and pulling in all talents.

Guiding principles of SSF Academy

Open platform for co-production of knowledge

Respectful multi-stakeholder platform (celebrate diversity)

Suspend judgement – accept participants as they are

Listen, seek solutions together

Promote local leadership, TRUST

Empower, build capacities

Address immediate needs
to enable venturing out to
more ambitious objectives

Create experiential meeting of global SDGs (and SSF Guidelines) with local constraints and opportunities.

SSF academy how to…

Social empowerment: making your plan of concrete next steps of what you want to achieve in steps of three months, during one year on the road to your larger ambitions

Support learning and doing on this journey

Men and women together …

For better integrated and mutually supportive value chains

<== Before

After ==>

What to do as researchers?

Support National SSF Action plans and favourable policies for implementation of SSF Guidelines and SDG14 globally through good science and promoting sustainable practice

Help improve quantitative and qualitative info, ask gender-aware questions for supporting better policy & practice

Make proactive use of existing global, regional, national db beyond disciplines to add value, feed in your results to enable richer interpretations, focus on enabling robust solutions (dynamic process, not *ad hoc*)

Collaborate internationally to promote climate adaptation and mitigation as well as equitable policies to make SSF part of viable futures of healthy wild food production from the ocean, including by expanding the SSF Academy

Strengthen internatonal scientific cooperation

Thanks for your attention

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open to cooperation

More info on

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