

# Fishes & Carbon, Fishing & Climate

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Fish-carbon Briefing

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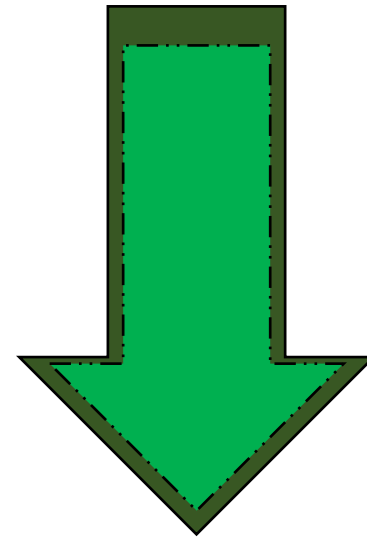
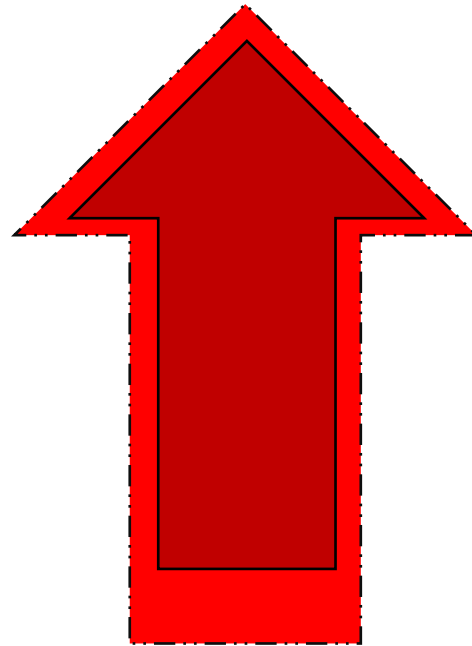
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# Carbon sources and sinks

Emissions of carbon dioxide and other greenhouse gases from fossil sources are increasing and driving climatic changes<sup>1</sup>



At the same time, the capacity of natural processes that result in long term storage of carbon have been reduced by loss of wild animals<sup>2</sup>

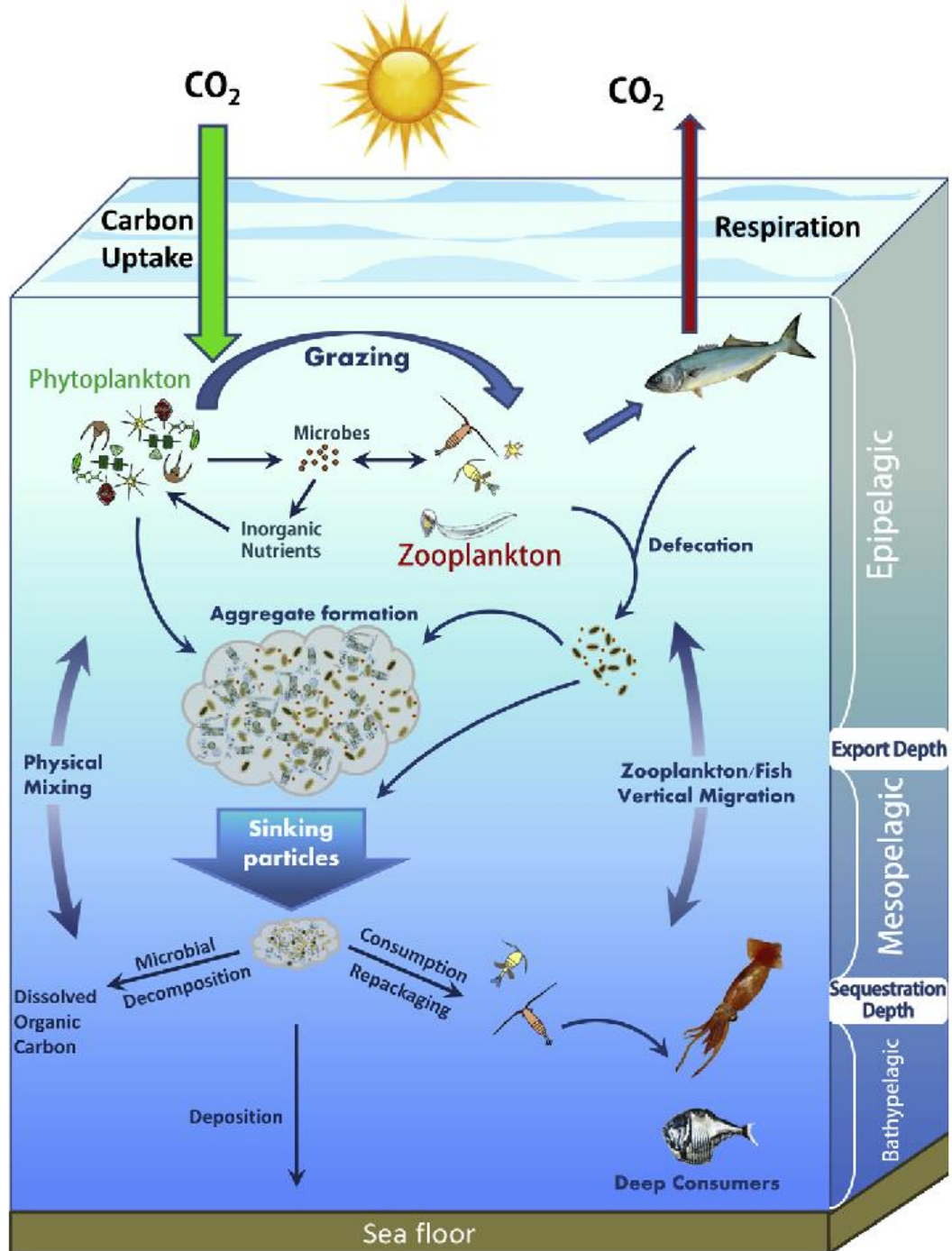


Image from Turner (2015)

Quick overview of the ocean carbon sink:

Physical pump: driven by heat, salinity, concentrations of atmospheric gases

Biological pump (image): driven by photosynthesis, has various potential outcomes

# What is fish carbon?

## 1. Fish bodies:

- Store carbon temporarily, populations represent a carbon store
- Carcasses can be a carbon sink

## 2. Fish faeces:

- Rapid-sinking
- Reach deep water/sediment

## 3. Fish migrate:

- Cross important depth thresholds
- Deliver carbon in faeces, “breath”, bodies

Fishes contribute  
16% (+/-13%) to  
ocean carbon flux<sup>3</sup>  
(sinking processes)





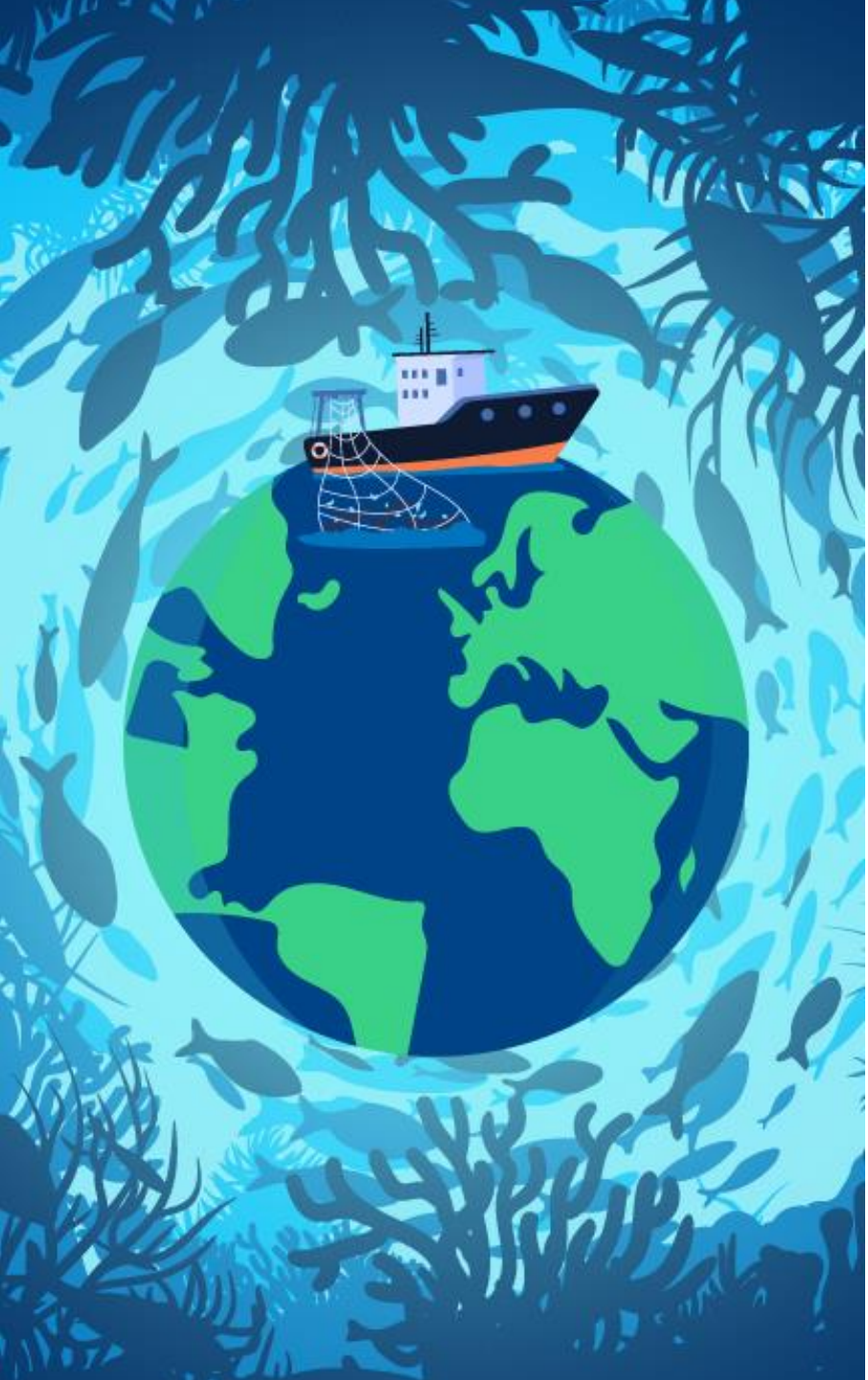
# How does fishing affect the ocean carbon sink?

## 1. Removes bodies

Thus reduces

- Carbon stored in populations (bodies)
- Carbon sinking through faecal pellets
- Carbon sinking through carcasses

Carbon sinking in fish faecal pellets reduced by 30% due to fishing<sup>4</sup>



# How does fishing affect the ocean carbon sink?

## 2. Affects food webs

- Lower trophic levels respond
- “Trophic cascades”





A

## Kelp forest state



- Local populations of coastal predators in healthy state
- High functional redundancy
- Urchin abundance controlled by predators
- Kelp domination

1950



## Ecosystem overfishing



- Driven by absent regulations, technological development and new market opportunities
- Lowered functional redundancy resulting in grazer bloom

1980



## Barren ground state



- Loss of ecosystem function: loss of urchin predation, loss of kelp forests, formation of urchin barrens



Norderhaug *et al.* 2020





# How does fishing affect the ocean carbon sink?

## 3. Fishing methods: trawling

- Destructive to benthic ecosystems
- Release carbon from sediment<sup>5</sup>
- High emissions from using this gear<sup>6</sup>

**Vox**

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## The surprise catch of seafood trawling: Massive greenhouse gas emissions

A new study shows that one industrial fishing method emits as much carbon dioxide annually as the aviation industry.

By Lili Pike | [lili.pike@voxmedia.com](mailto:lili.pike@voxmedia.com) | Mar 18, 2021, 7:30am EDT





# Summary

- Fishes are important for ocean carbon sink
- Fishing has impacts on ocean carbon sink
- Fisheries management is an opportunity to support climate and biodiversity goals

# References

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Images/Figures from:

*Turner, Jefferson T. (2015). "Zooplankton fecal pellets, marine snow, phytodetritus and the ocean's biological pump." Progress in Oceanography 130 : 205-248.*

*Norderhaug KM, et al. (2020). Depletion of coastal predatory fish sub-stocks coincided with the largest sea urchin grazing event observed in the NE Atlantic. Ambio. 2021 Jan;50(1):163-173. doi: 10.1007/s13280-020-01362-4*

Graphic credit: OurFish



# Go raibh maith agat

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