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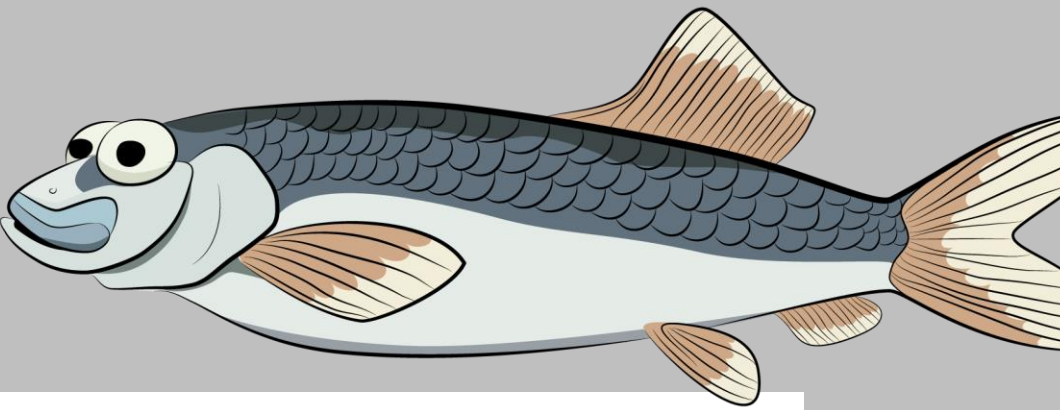
FRIENDS OF THE EARTH GERMANY



FISH: SECRET HEROES IN THE CLIMATE CRISIS

BUND „OCEAN & CLIMATE“ FACT CHECK SERIES – PART 2

Hardly any other group of animals is as numerous and diverse in our oceans as fish. However, it is not only their diversity that is often underestimated, but also their key function in the carbon cycle of the ocean. Fish are carbon engineers that help to reduce the amount of CO_2 in the atmosphere and to preserve it as carbon on the seafloor. They are strong allies in the fight against the climate crisis.

But their numbers are dwindling due to onging overfishing. At the same time, the climate crisis is making their home warmer and more acidic. Many fish species are therefore leaving their original habitats and migrate to cooler waters. The climate crisis is also completely upsetting the natural rhythms that have determined fish reproduction and growth for thousands of years. This has consequences, for the ocean, for the fish, and for us humans.

Numbers & Facts

- ✓ Fish are composed of 10-15 percent carbon. They accumulate it in their bodies in the course of their lives and thus contribute to carbon sequestration and storage.
- ✓ Fish make up about 16 percent of the total carbon that is transported from the sea surface to the deep sea. This happens both passively (faeces and other excretions) and actively (through movement).
- ✓ Currently, 40 percent of the fish populations in the North and Baltic Seas are overfished. As a result, there are fewer and smaller fish.
- ✓ The North Sea is almost 1.5°C warmer today than it was 50 years ago. Some fish species have already migrated so far into colder areas that they are hardly found in the south of their original range.

How fish and whales store blue carbon

The world's ocean is a huge storehouse for carbon. Seagrass beds, mangrove and kelp forests, and salt marshes in particular have storage capacities that are up to four times greater than those of tropical rainforests[1]. They are some of the world's most efficient absorbers of CO_2 as well as long-term carbon sinks. However, not only soils and plants, but also marine animals contribute to the sequestration and storage of "blue carbon"[2] in a variety of ways:

1. All animals are partly composed of carbon. The larger and older an animal is, the more carbon is stored in its body. Therefore, large and long-lived fish, such as tuna and sharks, play a particularly important role in storing blue carbon. This also applies to whales: the blue whale, the largest animal on our planet, stores an average 33 tonnes of CO_2 during its lifetime.

2. In addition to the size of fish, their mass is also crucial. Small fish that form huge shoals provide a highway for ocean carbon storage by transporting large amounts of CO_2 into deeper water layers. Krill, too, have true storage superpowers: scientists estimate that in the Antarctic alone the small swimming crustaceans contribute to the storage of about 12 billion tonnes of carbon annually.

3. When fish and whales die, they sink to the bottom of the ocean, where the carbon in their bodies serves as food for other organisms. What remains decays and is eventually stored in the seabed. It works similarly for the carbon in the excreta of fish and whales: microorganisms feed on it and thus store it further up the food chain. Iron and other nutrients in the faeces additionally fertilise the ocean, increasing CO_2 capture through stimulating phytoplankton growth.

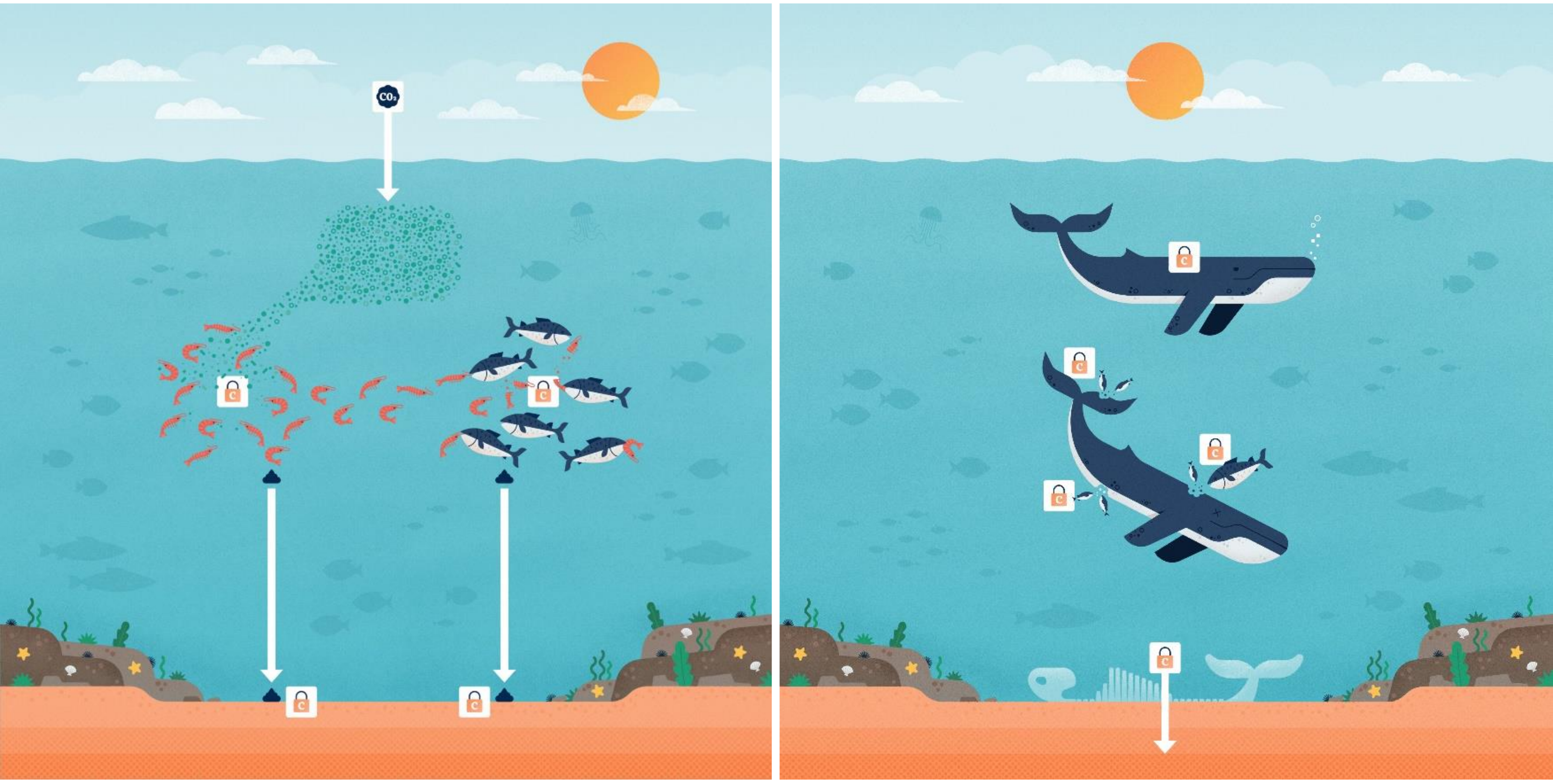
4. Like humans on land, fish exhale CO_2 under water. If the fish are at great depths, the carbon dioxide cannot rise back to the sea surface and enter the atmosphere. This is because the cold water at depth does not mix with the warmer water at the sea surface. It creates an unsurmountable barrier for dissolved CO_2, which remains trapped at depth.

5. Predatory fish protect carbon reservoirs, such as seagrass beds and algal forests, by preying on herbivores. This way they keep the complex ecosystem in balance. When the predators disappear, more and more herbivores are left to uncontrollably graze and destroy marine meadows and forests.

Research into how exactly and to what extent fish store carbon in the ocean is still in its infancy. It is already clear, however, that they reduce the amount of CO_2 in the atmosphere and contribute to long-term storage of blue carbon. Healthy and growing fish populations are therefore not only in the interest of species and nature conservation as well as food security, but are also a crucial element of climate protection.

Climate impacts: when fish shrink or move away

The climate crisis has already dramatically changed marine life. The seawater is becoming warmer and more acidic. This is not without consequences for the fish. Unlike barnacles or corals that have become stuck, fish can move if they no longer like it



LEFT – *The phytoplankton absorbs CO_2 from the atmosphere and converts it into carbon (through photosynthesis). Along the food chain, this carbon then accumulates in fish. The excreta of fish also contain carbon, which sinks to the seabed and can be permanently stored there.* RIGHT – *When fish and whales die, they sink to the seabed, where the carbon in their bodies provides nutrients to other organisms and is eventually sequestered in the sediment. Infographics: James Round / China Dialogue* somewhere. And that is exactly what many fish species do: worldwide, marine animals migrate towards the poles at a rate of about 70 kilometres per decade. This has led, for example, to plaice and cod hardly being found any longer in the south of their original habitat in the North Sea. Instead, fishermen are increasingly catching species originating from more southerly areas, such as sea bass and squid. However, not only the fish, but also the microscopically small plankton are evading the rising temperatures. The distribution of plankton in the North Sea has shifted by more than 200 kilometres per decade towards the North Pole in the last 40 years alone.

Warm water, small fish. Scientists estimate that with each degree Celsius increase, the average size of fish will in turn decrease by 20 to 30 percent. Since warm water can absorb less oxygen than cold water, more and more fish species are experiencing respiratory distress. In response, they grow smaller. At the same time, the warmer environment increases the metabolism of the fish and they need more food. This combination of smaller fish and an increased requirement for food does not go well together and leads to the interruption of entire food chains and starving fish.

In the Baltic Sea, another climatic consequence has been visible for some years. The originally perfectly coordinated rhythm of plankton growth and the hatching of fish larvae is no longer in tact. Because winters are getting warmer, fish are spawning earlier and earlier. The growth of plankton, on the other hand, is not determined by temperature but by light and therefore takes place at the usual time. When the small fish larvae hatch now, there is no plankton yet and they starve to death. Due to this shift, the entire offspring of the herring in the German Baltic Sea has died more and more frequenctly in recent years. This is a serious blow to the population, which has been ruthlessly overfished for years.

[1] Carbon storage by different ecosystems in comparison (per hectare per year). Tropical rainforests: 0.74 t; mangrove forests: 1.74 t; seagrass beds: 1.38 t; salt marshes: 2.18 t; kelp forests: 3.03 t.

[2] Carbon stored in marine ecosystems is called „blue carbon".

The BUND demands

- Catch quotas for fisheries must under no circumstances exceed the scientific advice. The precautionary principle must apply to those fish populations for which there is insufficient data.
- For fish species that suffer particularly from the climate crisis (e.g. herring and cod), an additional "climate buffer" must be factored in when allocating catch quotas to prevent a collapse of the population.
- Fish also need places to retreat. That is why at least 50 percent of the protected areas in the North and Baltic Sea must be closed to fishing and other human activities.

Selected literature

Atwood et al. (2015). Predators help protect carbon stocks in blue carbon ecosystems. Nature Climate Change 5, DOI: 10.1038/NCLIMATE2763

Mariani et al. (2020). Let more big fish sink: Fisheries prevent blue carbon sequestration – half in unprofitable areas. Science Advances 6(44), DOI: 10.1126/sciadv.abb4848

Pauly & Cheung (2017). Sound physiological knowledge and principles in modelling shrinking of fishes under climate change. Global Change Biology, 24(1), DOI: 10.1111/gcb.13831

Saba et al. (2021). Toward a better understanding of fish-based contribution to ocean carbon flux. Limnology and Oceanography 9999, 1-26, DOI: 10.1002/lno.11709

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