

Rebuilding a depleted key predator species

Enhancing Ecosystem Resilience and Empowering Communities

Community ocean literacy



CHALLENGE

Depleted predator populations

Unsustainable fisheries



Loss of kelp habitats

Sea urchin overgrazing

Trophic Imbalance

INTERVENTION

Restoring a keystone predator



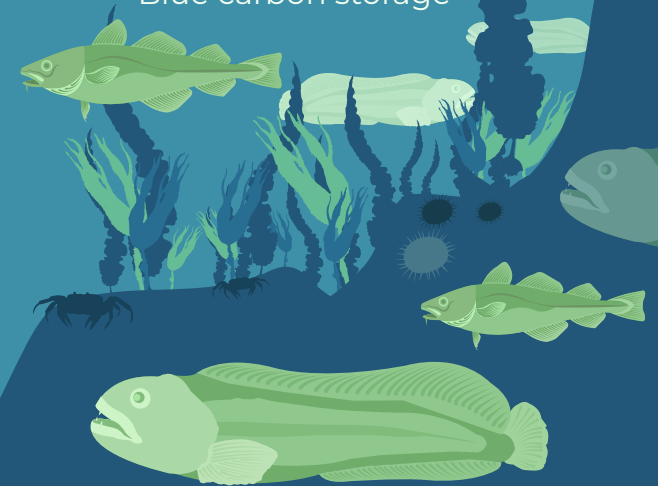
Protection

FUTURE

Boosts biodiversity

Stronger fisheries

Blue carbon storage



Recovery

Key Messages

- Ecosystem restoration should start with a key species
- Ownership of the solution by the local community is vital

Policy Relevance

International policies

- OSPAR Convention
- UN Sustainability Goal 14 Life below water
- UN Decade on Ecosystem Restoration 2021–2030

National policy

- Nature Diversity Act (2009)



Photo: Ismaele Torella

What is the Challenge

Several coastal fish stocks have been depleted by fisheries. Important habitats for their juveniles, such as kelp forests which provide food and shelter, have largely disappeared due to overgrazing by sea urchins. This has caused a negative spiral both for the ecosystem and subsequently fisheries, as the abundant coastal fishes once controlling the kelp predators fails to rebuild due to lack of habitat for juveniles.

“I believe that every single wolffish individual is valuable, because the stock is so depleted”

– local fisher, 74 years old



An Innovative Solution

The solution embeds community-led protection of a key predatory species to support rebuilding damaged ecosystems.

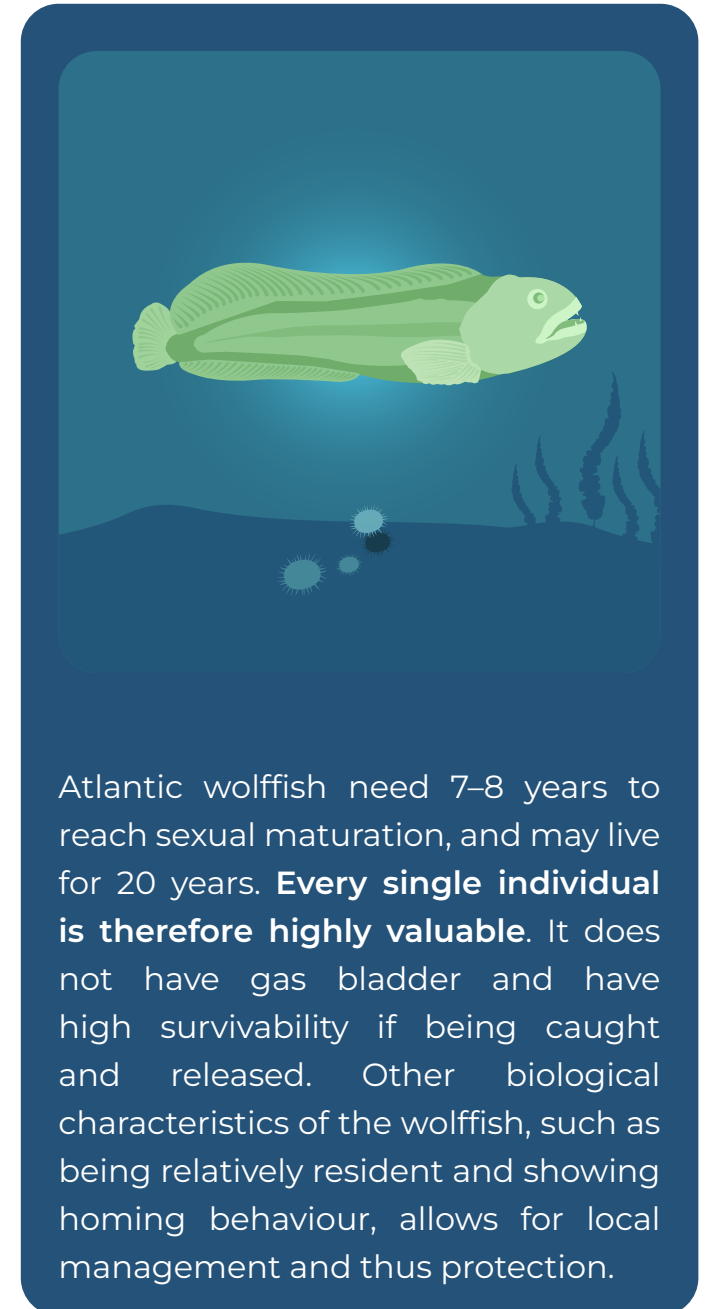
As full restoration of an ecosystem in one move is difficult, rebuilding a key player in the ecosystem is a cost efficient and realistic first step. The selected key predatory species has limited commercial value and is mainly caught as bycatch – and have high survival rate if released after being caught. By implementing restrictions in collaboration with the local community, we expect a significant reduction in fishery mortality. Engaging and educating school children facilitates a long term sustainable solution.

The Benefits the solution produces

- Rebuilding a depleted fish: increase biodiversity and enhance fisheries in the long term
- Supporting kelp forest recovery: Increased key predator abundance could reduce the number of grazing sea urchins and hence restore feeding and nursery grounds
- Indirect effect on smaller predators: a key predator may impact the behaviour of small predators such as sculpins, who preys upon juveniles from the depleted fish stocks
- Transfer awareness and knowledge between generations: Counteract the “shifting baseline syndrome” where every generation experience less biodiversity than the previous

“On sandy bottoms they were there, all the small flounders and wolffishes, we could literally pick them up. It was crowded; they were everywhere”

– local fisher describing his teenage years in the 1960-ies



Atlantic wolffish need 7–8 years to reach sexual maturation, and may live for 20 years. **Every single individual is therefore highly valuable.** It does not have gas bladder and have high survivability if being caught and released. Other biological characteristics of the wolffish, such as being relatively resident and showing homing behaviour, allows for local management and thus protection.



How developed is the solution

The solution is being tested in the wild in Karlsøy municipality, northern Norway (Social Readiness Level, SRL, 4). We expect an increased abundance of the predator due to a reduction of human induced mortality. In order to proceed to level 5 and beyond, there are two main uncertainties that needs to be resolved:

- Mortality rates from natural wolffish predators such as otters and seals must be investigated
- Although assumed to form local populations, fine scale migration patterns and genetic structure of the wolffish need to be mapped

Where could also be applied to?

Declining fish stocks and loss of habitat such as kelp forests is not isolated to Norway, these are common issues globally. Here we describe a potential way out of the negative spiral by combining **ecological knowledge and local societal engagement to rebuild a key species.**

Area characteristics

Intention for applying this solution

An area with one (or few) particularly important and resident species

Ecosystems are usually more complex than we think, but restoring a known broken link should be the first step

The area must be under pressure from anthropogenic stressors, such as commercial-, local- and/or tourist fishery

Reduce negative human impacts to restore lost habitats such as kelp forests and rebuild depleted fish stocks

The area should have a value for the local community

Encouraging local engagement and stewardship is important for long term success



Photo: Vebjørn Karlsen

Key characteristics of your key species

- Resident within the area, preferably throughout its life cycle
- Should be spawning locally
- Low value for fisheries, to avoid harvesting
- Should survive being released if caught unintentionally

Who is this relevant to?

- Local community
- Fishers
- Tourist businesses
- Local and national authorities

What do you need to have in place?

Before you dive into implementing this solution, it is worth having, or establishing, the following key things in your area:

- **Identify the problem.** Include its possible causes and identify a candidate species that should be rebuilt (potential key species)
- **A local community** who care for, and recognise the importance of healthy ecosystems
- **Highly motivated contact persons** to build bridges between the local community, local authorities (e.g. the municipality) and scientists



Photo: Vera Hausner

Key components of implementation:

Map the stakeholders.

Who are the users of the area (including economic interests in current and future scenarios) and who have the proper tools to induce changes on local, regional and national levels.

Engage the local community.

Approach both citizens and municipal administration with an open mind to describe the problem through interviews or workshops – in person. Co-producing potential solutions ensure local ownership to the process. All parties should be kept informed about any decisions or progress through workshops and information material (printed or digital).

Assess current impact factors to the key species.

These may not be the same as in the past. Compare and complement knowledge from the local community with available scientific literature and explore knowledge gaps that may be closed through e.g. Master student projects.

Establishing area restrictions.

Early contact with relevant stakeholders is vital. Consider the level of restrictions needed (e.g. full or seasonal fishery ban), area size (e.g. include all habitats necessary to complete the life cycle of the key species) and time scale (permanent or temporary).

Engaging school children.

For transfer of knowledge between generations, long term success and facilitating ocean literacy, school children should be engaged and informed about the project and the ecosystem through in- and outdoor activities



“Local stakeholders, such as fishermen, provided essential information on past and present wolffish hotspots, including past and present kelp forest distribution.”



Photo: Ismaele Tortella

Monitoring your success

The main goal is rebuilding a key species. As each individual in a depleted species may have high value, non-invasive methods for monitoring is preferred. A baseline can be established by use of environmental DNA and should be repeated by revisiting the same stations every 5th year – taking possible seasonal migrations into account. This method detects traces of DNA from water samples, and results must be interpreted with care.

Alternative monitoring could be long lining in given localities, and carefully release the specimens. Anecdotal evidence provided by the local community indicate that wolffish were frequently sighted in shallow waters back in the 1980ies, which could be an effect of larger population densities. Visual sightings in shallow water could therefore indicate increased population size. The time frame until effects are seen is dependent upon the generation time of the key species.

Monitoring behavioural change and awareness in the local community could be conducted through interviews or questionnaires every five years.

“A local agreement, where fishing and retaining wolffish is socially unaccepted, is important to establish.”

Costs and Timeframes

Cost is indicated as low if it only require less than 100 working hours and/or less than 500 Euro.

| | Approximate cost | Cost Range | Approximate timeframe | Timeframe ranges |
|--|------------------|---|---|---------------------|
| Map the stakeholders | Low | | Few days | 1 day to 2 months |
| Engage the local community | Low | Low – medium , depending on travelling costs, frequency, and associated costs such as rental of premises or refreshments | Throughout the project period | |
| Assess the current impact factors to the key species | Medium | Low – High , depending on what knowledge gaps are present (e.g. experiments to reveal cause and effect) | Depends | From weeks to years |
| Establishing area restrictions | Medium | Low – Medium . A scientific justification of area restrictions is needed, and is dependent on the knowledge gaps above. Potential loss of income due to restrictions (e.g. for fishers) must be considered | Two years. Political treatment is likely necessary, which can take time. The process may be shorter if the area in question already have a form of restrictions | Two to ten years |
| Engaging school children | Low | Low – medium , depending on travel costs, or equipment needed | Throughout the project period and in consecutive generations | |



The challenges you may encounter

| Activity | Challenge 1 | Challenge 2 |
|---|--|---|
| Map the stakeholders | Overlooking key stakeholders, and the list must be revised according to new knowledge as the project progresses | Keeping all relevant stakeholders in the information loop |
| Engage the local community | Identify and obtain personal contact with citizens and municipal administration who are highly motivated for participation | The involved scientists need to produce timely results, and communicate in a popular scientific manner |
| Assess the current impact factors to the key species | Limited knowledge about the species/area may exist | There may be a large distance between the perception of cause and effect may between the local community and scientific knowledge |
| Establishing area restrictions | Stakeholders with economic interests could oppose restrictions | Changes in the legal framework on a national level may be time consuming, and could involve several departments |
| Engaging school children | Dedicated teachers are vital. Teaching activities may be suggested, but is of no use if not being implemented | As pupils age range between 6 – 15 years, different activities must be organized based on their current educational and cognitive level |



Key Contact who to talk to about your application idea

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Further information

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- Norderhaug, K. M., Nedreaas, K., Huserbråten, M., & Moland, E. (2021). Depletion of coastal predatory fish sub-stocks coincided with the largest sea urchin grazing event observed in the NE Atlantic. *Ambio*, 50(1), 163-173. DOI: <https://doi.org/10.1007/s13280-020-01362-4>. Last accessed 28 Oct 2025.
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- Fagerli et al. (2026). Connecting people to the ocean: Practical guidelines for volunteer-based kelp restoration, school engagement and predator conservation. NIVA-report 1894-7948. Connecting people to the ocean: Practical guidelines for volunteer-based kelp restoration, School engagement and predator conservation - Norwegian Research Information Repository. <https://nva.sikt.no/registration/019dd35eb927-b4e6f4e1-a52c-40dc-bf7e-61815facbd37>



Blueprint

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predator species

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