Photo: Eli Rinde

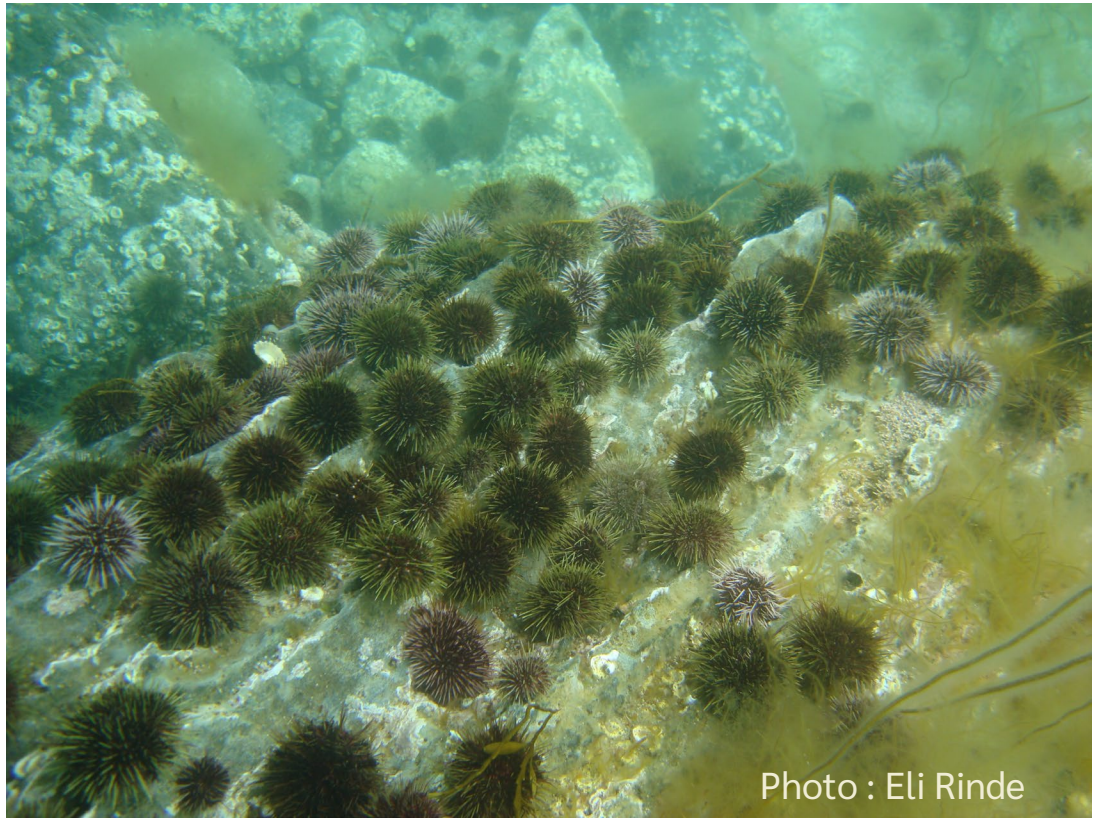
Different methods for restoring kelp forests in urchin barrens

Blue Missions Atlantic & Arctic Lighthouse webinar:
European macroalgae governance and management: The case of the Norwegian kelp forests.

19. March 2025

Eli Rinde

Overview



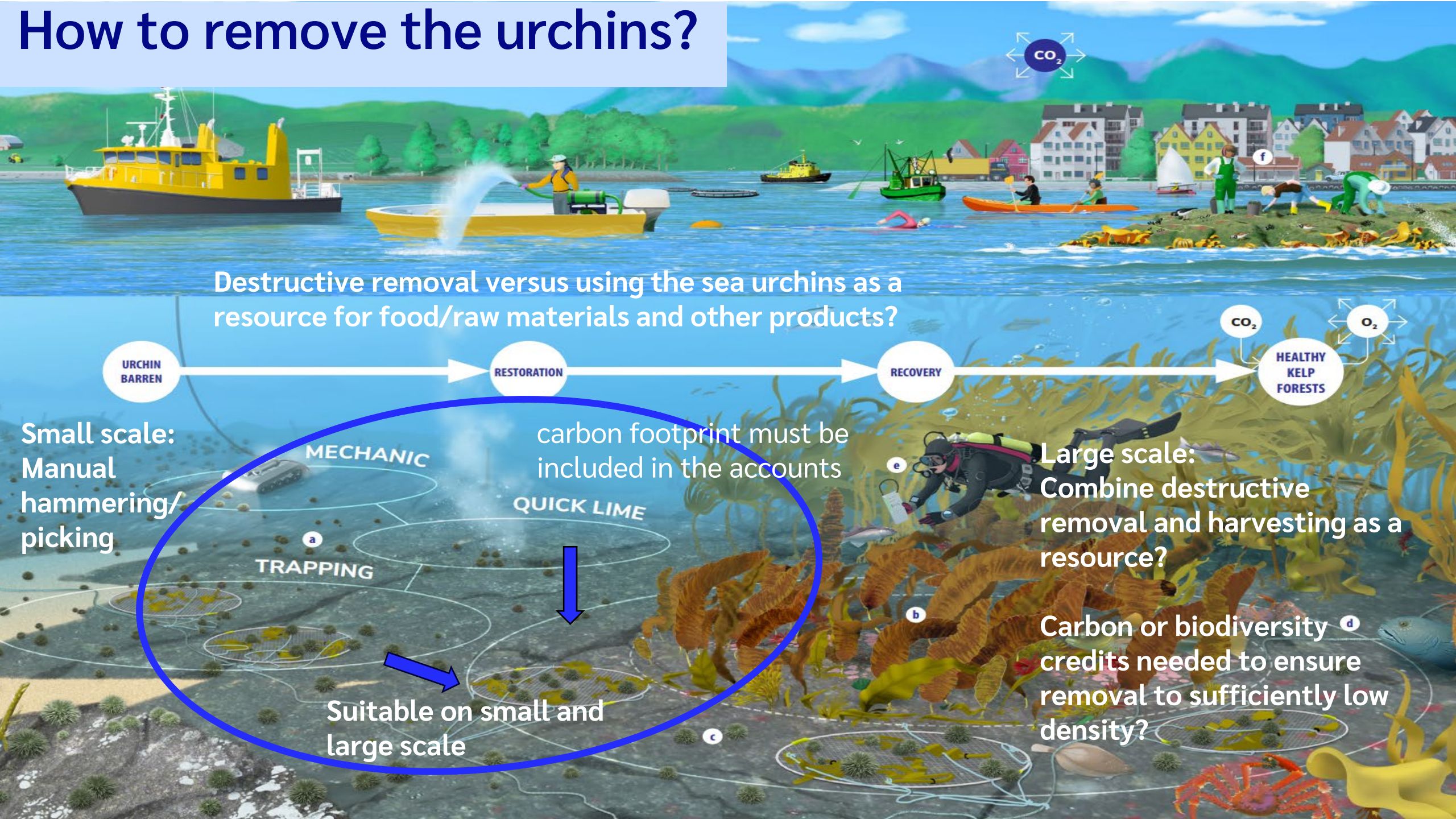
- **Knowledge-based** key measures to restore lost kelp forests in urchin barrens
- How to **remove** sea urchins on small and large spatial scale?
- How to **control** sea urchin abundance over time?
- The need for a **coordinated** and **long-term** strategy
- Manuals and guidelines

Knowledge-based key measures

- **Removal of sea urchins initiates the return of kelp forests.** This is documented on small and large scale over 35 years, cf. Christie et al. 2024 – **IMR** and **NIVA** have restored 70 hectares of sea urchin barrens in the Porsangerfjord using 200 tons of quicklime.
- Several studies in Norway and at global scale (e.g. California, Alaska, New Zealand) show that **sowing, planting or proximity to existing kelp forests is not needed to initiate kelp recovery in urchin barrens.**
- **Sea urchin control** is however needed to prevent new blooming and grazing of the restored kelp forest.

Photo : Eli Rinde

How to remove the urchins?



How to control the sea urchins?

- **Chose an area with low urchin recruitment** – prioritize the southern part of the grazed region? Areas with few hiding places for the sea urchins (such as smooth bedrocks), large distance to maerl/stony bottom (breeding areas for the sea urchins)?
- **Restore a sufficiently large area that** initiate a **self-sustaining ecosystem**? Is this possible without repeating sea urchin removal/other measures? How large? Regional differences in the size of the area?
- **Increase the population of predators** - Increased abundance of **edible** crabs has resulted in the natural recovery of kelp forests in Norway (linked to ocean warming); increased abundance of the alien species **red king crab** has resulted in kelp recovery of a large area in the Porsangerfjord.

However, a negative development of the recovered kelp forests in the Porsangerfjord because of a decline in the king crab abundance - due to fishery (new paper submitted).

Methods to ensure predator control

- **Protection** and **population building** of **key predators** such as wolffish, cod and edible crabs (MPAs, no-take areas)
- **Breed and release predators** such as wolffish
- Create artificial **hiding places/habitats** for predators if these are lacking
- **Monitoring** and **ecosystem-based management** of the key species in the ecosystem is needed to ensure trophic balance (kelp, urchins, cod, crabs, wolffish)

Photo : Erling Svensen

The need for a coordinated and long-term strategy

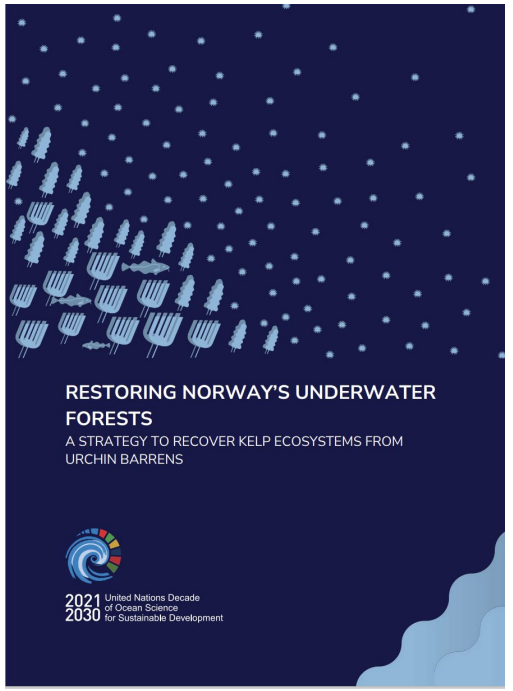
- Large area (5000 km^2)
- Different methods/scales for **sea urchin removal**: **destructive** removal vs. **harvesting** as a resource
- Different methods/scales to **control sea urchins**: **protection/management** of areas/predators; **breed/release** of predators; **artificial marine habitats** as shelters for key predators
- The need for locally **adapted solutions**: different environmental conditions result in variations in recruitment, growth and survival of both kelp, sea urchins and predators, and must be taken into account.
- **Many different actors** from industry, management, research, etc.

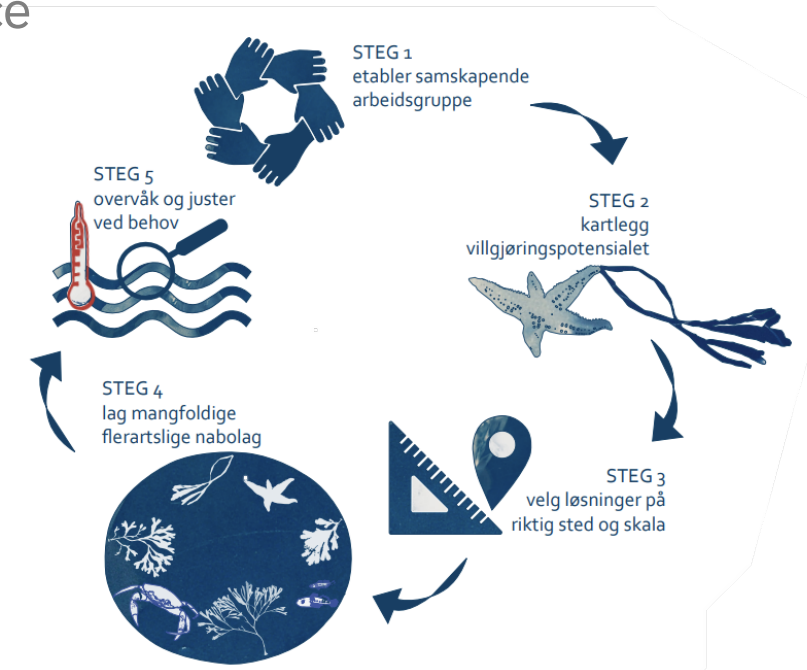
A knowledge-based, holistic and long-term strategy – and coordinated efforts - are needed to successfully restore kelp forests on large spatial scale

Photo : Hartvig Christie

Manuals and guidelines

- Strategy, methods and factsheets for the **general public**, **decision-makers**, **industry** (English/Norwegian) for restoration of kelp forests in Northern Norway; Verbeek et al. (2021) Restoring Norway's underwater forests. Published by SeaForester, NIVA, Akvaplan-niva.
- Global kelp forest restoration: past lessons, present status, and future directions; Eger m.fl. 2022.
- A Nordic handbook for Nature-based Solutions (2024)/ best practice for **NbS in the Nordic** describes **sea urchin removal** as a NbS for kelp forest restoration (in English/to be translated into all Nordic languages)
- Rewilding manual (Rinde og Sørensen 2022) provides general guidelines and principles for promoting marine biodiversity, including kelp forest restoration





Thanks for your attention!
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