

NORWEGIAN BLUE FORESTS NETWORK (NBFN)

# TOP TEN TRENDS FROM 2025



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# Top ten trends from 2025

2025 was a year marked by contrasts in the international and national policy landscape, with both positive and negative implications for blue forest ecosystems.

This report highlights a selection of the most important national and global trends from the past year, as seen by the Norwegian Blue Forests Network (NBFN). We showcase where progress has been made, what gaps remain, and which initiatives and trends to monitor in 2026 and beyond.

Globally, security and resilience featured strongly on the global and Norwegian agendas. Climate change brought new rounds of extreme weather, including marine heatwaves in Norway and beyond, with warming waters affecting the health and resilience of blue forests and the wildlife that relies on them.

Crucially, the outcomes of the UN Ocean Conference in Nice and detailed blue forest restoration ambitions in national biodiversity and climate action plans demonstrated that countries see good ocean governance as a priority. Important

underpinning methodologies and technology, including for ocean accounting, blue forest mapping, and blue carbon markets, improved significantly. Finally, Norway moved one step closer to restoring its blue forests, with the kelp forests status report published ahead of the 2026 national action plan.

This is the fourth and - for now - final NBFN “top trends” report. Over the last ten years, the Network has been privileged to receive earmarked national funding. That funding has now concluded, as priorities shift toward large-scale restoration and management of blue forests. We have achieved our original ambition of placing blue forests on the national policy and research agenda. We are truly grateful for your engagement and support over the past ten years.

–Norwegian Blue Forests Network

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# Sammendrag (norsk)

**2025 var et år preget av kontraster i det internasjonale og nasjonale politiske landskapet, med både positive og negative konsekvenser for blå skog-økosystemer. Denne rapporten løfter fram et utvalg av de viktigste nasjonale og globale trendene det siste året, slik de vurderes av Norsk nettverk for blå skog (Norwegian Blue Forests Network). Vi viser hvor det har vært fremgang, og hvor det fortsatt finnes kunnskapshull og utfordringer:**

*Økt tempo for restaurering (trend #1 - #2).*

Restaurering av blå skog globalt gikk i 2025 fra plan til praksis. Norges statusrapport for taesskog kom med klare budskap, og understreket at det viktigste restaureringstiltaket for å sikre bærekraftige marine økosystemer er bærekraftig forvaltning av eksisterende, sunne taeskoger. Selv om kunnskapsmangler og risiko er til stede, er den største risikoen knyttet til mangel på tiltak.

Metodeutvikling for taeskogrestaurering fortsatte, inkludert arbeid med kråkebolle fjerning, "grønn grus", og steinbit, og et koordineringsprosjekt ble startet for å lære av alle småskalatiltak for blå skog restaurering. Norge anerkjente blå skog i sine nasjonalt fastsatte bidrag (NDC-er), men anbefalte videre kunnskapsutvikling før et nasjonalt mål blir satt. På internasjonalt nivå nevnte 78 % av NDC-er havet, og alger kom for første gang på listen over kystsystemer i IPCCs metoderapport om karbon. En meta-analyse viste at marin restaurering har en gjennomsnittlig suksess på 64%.

*Kartlegging og overvåking for sunne økosystemer (trend #3 - #4).* Arbeidet med å verdisetne og kartlegge blå skog tok betydelige skritt i 2025. På FNs tredje havkonferanse signerte 19 land og syv organisasjoner, inkludert Norge, et løfte om å utvikle havregnskap innen 2030. Nasjonalt fortsatte arbeidet med Lofoten-piloten for marint naturregnskap. En testversjon av "Naturpoeng" ble lansert som kan hjelpe fornybarnæringen med å oppnå naturpositive utfall, men tilpasning til marine miljøer gjenstår.

Parallelt økte marin kartlegging; et heldekkende kystkart er på vei, en ny kartleggingsprotokoll for 13 blå skog naturtyper ble testet, og fremskritt innen fjernmåling og akustiske sensorer åpner for mer kartlegging av blå skog naturtyper og helsetilstand. En kartlegging av datatilgjengelighet

for økosystemregnskap pekte på fragmenterte datasett på tvers av etater og databaser – en utfordring som vanskeliggjør naturregnskap, overvåking og kommunal planlegging. Kommuner vektla naturmangfold og blå skog, mens forskning pekte på et behov for å endre kommunal arbeidsflyt så tilgjengelig kunnskap tas bedre i bruk.

*Nye trusler følges (trend #5-#6).* Presset fra klimaendringer og nye trusler intensiveres. Marine hetebølger satte nye varmerekorder. Studier viste hvordan hetebølger samhandler med andre belastninger som er til stede langs kysten, blant annet ved å fremskynde skiftet fra taesskog til lurv, og hvordan dette kan påvirke fiskesamfunn. Forskning pekte også på behovet for proaktive forvaltningstiltak for å redusere økologiske og økonomiske tap forårsaket av hetebølger. I nord påvirker bresmelte vann akkumuleringen av tungmetaller i tare og endrer taremikrobiomet. Invaderende arter – fra havnespy i Norge til planter som utkonkurrerer mangrover i Vest-Afrika – forsterker risikobildet og kan drastisk redusere artsmangfold i blå skog habitater.



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*Bærekraftig forvaltning (trend #7 - #10).* Flere land, blant annet Indonesia, Kenya og Japan, tok store steg for å integrere blått karbon i klimapolitikk, økosystemforvaltning og økonomiske beslutninger. EU arbeidet parallelt for å styrke blått karbon politikken, med viktige publiseringer fra Europakommisjonen og JPI Oceans. Den nye Rødlista for naturtyper ble publisert, hvor 22 blå skog naturtyper ble vurdert. Åtte av disse, inkludert ruglbunn, ble løftet inn på rødlista på grunne av påvirkninger som formørkning av kystvannet, overfiske, hetebølger og eutrofiering. Korallrev ble første marine naturtype på listen som "utvalgt naturtype"; ingen blå skog-naturtyper er utvalgt.

Industrielt og næringsmessig var bildet todelt. I Norge holdt villhøsting av tang og tare seg stabilt, mens dyrking ble halvert. Takket være logistikkforbedringer ble derimot all 2025-dyrket tare solgt, i motsetning til i 2024. Innovasjon rundt

nye arter, samlokalisering og nye produkter skyter fart, og det er indikasjoner på at karbonlagring under tarenlegg kan være betydelige. For grisetang ble det avdekket et reguleringsmessig etterslep: høsting skjer med begrenset formell forvaltning sammenlignet med andre land, som Canada og Island, og det blir etterlyst mer åpenhet og kunnskap om lokale naturkonsekvenser. Pågående studier blir et viktig bidrag inn mot en veileder for bærekraftig høsting.

Dette er den fjerde - og foreløpig siste - «topp trender»-rapporten fra Nettverket. De siste ti årene har nettverket hatt privilegiet av å motta øremerkede nasjonale midler for å løfte blå skoger inn på den nasjonale politikk- og forskningsagendaen. Finansieringen er nå avsluttet og oppmerksomheten rettes mot restaurering og forvaltning av blå skog på stor skala. Vi er takknemlige for all støtte og engasjement gjennom de siste ti årene.

–Norsk nettverk for blå skog



## RESTORATION PICKS UP PACE

# #1 Kelp restoration

**Norway’s status report for kelp forests is published, pilots are underway, and new research is sharpening site selection, source material, and methods.**

The status report on Norway’s kelp forests was published as the first step towards developing a national action plan for restoring these habitats.<sup>1</sup> The report follows on from the 2024 political breakthrough for Norwegian kelp forest restoration, when Parliament requested that the Government present a systematic restoration plan for the country.<sup>2</sup> The status report summarised Norway’s kelp forests’ condition and trends, restoration experience, and the current regulatory framework, and set out key messages on restoration:

1. Sustainably managing healthy kelp forests is the most important restoration action
2. Restoration is complex and takes time
3. Restoration at the scale requested by the Parliament does not appear to have been attempted anywhere in the world
4. Norway is well placed to lead internationally, due to strong research groups, active private and civil-society actors, and growing public-sector focus
5. There are significant knowledge gaps and risks, but the greatest risk is inaction
6. Societal benefits are substantial. Restoring lost kelp forests could yield gains on the order of around 160 billion NOK over 30 years (2020-2050)

NBFN provided critical input to the status report through its 2024 conference, co-hosted with partners, on *What is needed to bring kelp forests back to Northern Norway?*<sup>3</sup>

Efforts to further develop methods and small-scale projects continued in 2025. Activities included: advancing sea urchin removal and “green gravel”; rearing, releasing, and moving wolffish; and further commercialising sea urchins.<sup>4-9</sup> At the international level, a decision framework and cost-benefit analysis were developed to sharpen site selection.<sup>10,11</sup> At the same time, “assisted adaptation” work showed that strategically selecting kelp to produce seedlings maintains growth and improves survival in warmer seas.<sup>12,13</sup> Specific method studies found that site and attachment technique affect “green gravel” success,<sup>14</sup> and well-managed Marine Protected Areas enhance kelp forest stability under increasing climate stress.<sup>15</sup>

### What to expect in 2026

- A report outlining proposals for a national plan and measures to restore Norway’s kelp forests (expected 2026–2027)<sup>16</sup>
- Use of emerging technology and artificial intelligence to plan for, implement and monitor restoration efforts



*The Restorative Continuum. FAO, SCBD & SER, 2024.*

# #2

## Blue forest restoration: From recognition to results

**Countries are increasingly listing blue forests in their national biodiversity and climate plans. However, whether high-level plans are supplemented by quantified targets and projects varies. 2025 focused on closing data gaps, launching pilots, and unlocking finance for restoration.**

While potential options for blue forest restoration have been discussed in Norway this year,<sup>17</sup> Jamaica<sup>18</sup> and Belize<sup>19</sup> were among the countries to take restoration plans one step further, listing specific targets such as hectares of restored mangroves in their Nationally Determined Contributions (NDCs). Marine ecosystems are increasingly being recognised as key to climate solutions internationally. Among the NDCs, 78% mentioned the ocean.<sup>20</sup> In Norway, the White Paper accompanying the revised NDCs recognised blue forests' importance but delayed setting a restoration target.<sup>21</sup> The Norwegian Environment Agency argued data on blue forests absorbing and storing carbon is insufficient, recommending continued knowledge development to establish a future national greenhouse gas inventory for marine systems.<sup>22</sup>

In October 2025, the IPCC agreed on the content of the 2027 Methodology Report on carbon dioxide removal technologies, carbon capture, utilization and storage.<sup>23</sup> In the instructions to authors, seaweeds are, for the first time, listed as examples of coastal systems.

As restoration climbs higher on the global political agenda, a meta-analysis found an average marine restoration success rate of 64%. Among blue forests, saltmarshes had the highest rate, and seagrass the lowest,<sup>24</sup> with success primarily measured by survival. A European Commission report similarly highlighted issues surrounding metrics and reporting in blue carbon restoration projects.<sup>25</sup> Two studies highlighted benefit-cost ratio of mangrove restoration, including sites with high return on investment in terms of climate mitigation and finance.<sup>26,27</sup>

In Norway, the Environment Agency commissioned a study on how to prioritize restoration sites.<sup>28</sup> Findings include that marine data and mapping remain patchy, complicating assessment of marine restoration value. The Oslofjord seagrass transplantation was scaled up,<sup>29</sup> and a coordination project established to learn from the multiple small-scale restoration efforts.<sup>30</sup>



*Collection of seagrass for transplantation*  
© Janne Gitmark/ NIVA

### What to expect in 2026

- EU countries' draft national restoration plans under the EU Nature Restoration Regulation
- The establishment of a formal [European Seagrass Restoration Alliance](#)
- Two key European briefs from JPI Oceans, covering how blue carbon ecosystems can be further integrated into reporting requirements and methodologies under the Land Use, Land Use Change and Forestry Regulation; and included in national restoration plans and implementation of the EU Nature Restoration Regulation

# #3 Accounting for blue forests

Countries pledge to advance ocean accounting. Progress is made on accounting for the health and value of blue forest ecosystems in Norway.

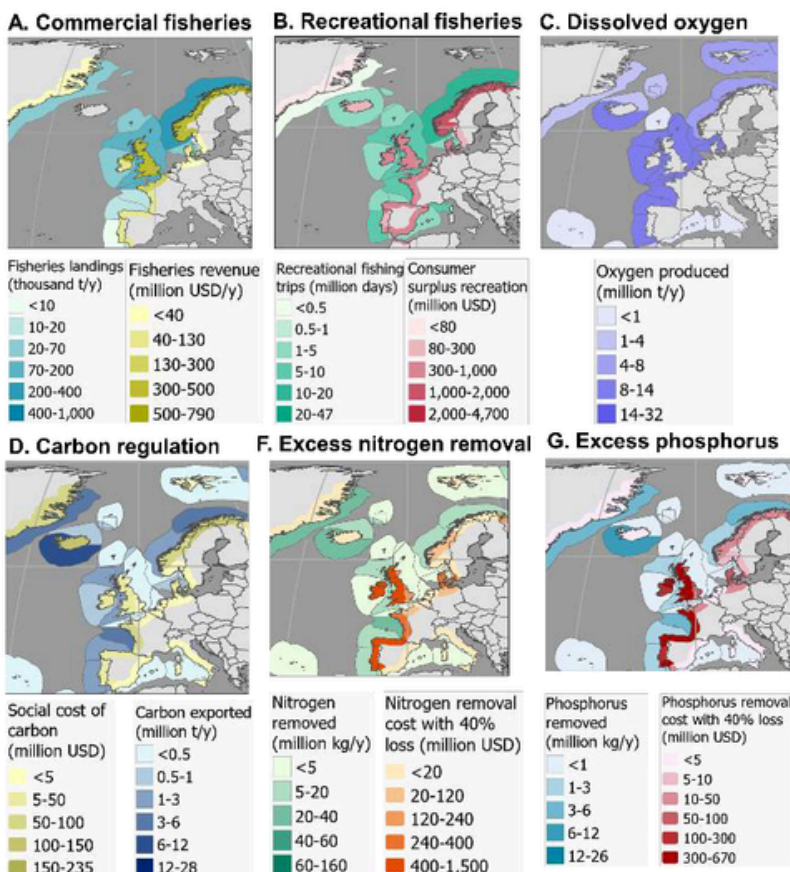
The 3rd UN Ocean Conference (UNOC3), held in Nice June 2025, saw 19 countries and seven organizations sign the Costa Rica-led [Pledge to advance ocean accounts by 2030](#). Among these countries was Norway. The Pledge follows the 2024 publication of the revised UN *System of Environmental-Economic Accounting framework*, which sets out the role of ecosystem accounting in keeping track of ecosystems' health and locations, and their importance for the blue economy.<sup>31</sup>

As predicted in last year's Top Ten Trends report, marine ecosystem accounting continues to progress in Norway.<sup>32</sup> The Lofoten marine ecosystems account pilot is in progress.<sup>33</sup> The Norwegian Mapping Authority (*Kartverket*) published their report on data availability for ecosystems.<sup>34</sup>

The 2024 Top Ten Trends report also highlighted likely private sector interest in ecosystem accounting. Fornybar Norge published its test version of the "Naturpoeng" method,<sup>35</sup> to support actors within the renewable energy sector in achieving nature-positive outcomes. The method is based on international methodologies, such as the UK Biodiversity Metric.<sup>36</sup> The Naturpoeng approach is currently developed for land and freshwater ecosystems only. An understanding of this system's application to marine ecosystems is needed.

## What to expect in 2026

- A push towards advancing ecosystem accounting by 2030
- Report on marine ecosystem mapping from Lofoten Pilot accounting project<sup>33</sup>
  - Publication of two key scientific papers by the NBFN-supported network on Global ecosystem services Assessment for Kelp forests (GEAK)<sup>37,38</sup> (see Figure 1)



**Figure 1.** Monetary values from kelp forest for A) commercial fisheries, B) recreational fisheries, C) dissolved oxygen, D) carbon regulation, F) excess nitrogen removal, and G) excess phosphorus (values estimated in the GEAK project). From: [Restaurering av tareskog i Norge](#).

# #4

## Blue forest mapping for future decisions

Record amounts of ecological mapping data is being collected, driven by technological advances and increasing demands for sustainable ocean management. However, data remains fragmented, creating challenges for compilation and use.

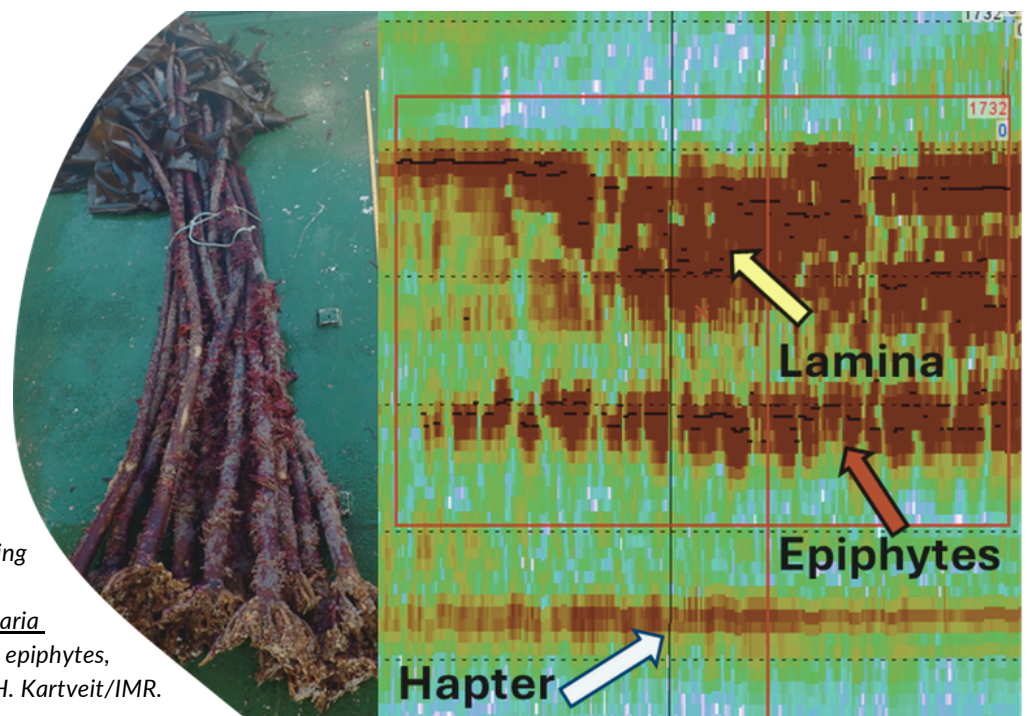
This year, the Norwegian Environment Agency commissioned a coastline-wide, full-cover map of marine nature types at coarse spatial resolution, to be developed by combining artificial intelligence, remote sensing, and spatial-distribution modelling in 2026. Building on SeaBee infrastructure protocols,<sup>39</sup> the EU-funded OBAMA-NEXT project expanded habitat mapping to the Mediterranean, Black Sea, and Skagerrak.<sup>40</sup> This demonstrated how remote sensing technologies can be used to map and monitor coastal habitats across Europe.

Acoustic sensing, particularly multibeam echo sounders, continued to evolve as a key tool for mapping seafloor habitats, enabling better habitat discrimination and modelling of canopy structure.<sup>41-43</sup> The recent years' increased blue forest focus have now also extended to single beam echo sounders, and emerging studies demonstrate their usefulness for assessing kelp forest health (see Figure 2), e.g. canopy height, density, and epiphyte cover.<sup>44</sup> Research also highlighted the opportunities – as well as legal and policy challenges – of unmanned surface vessels as cost-effective solutions to carry these sensors.<sup>45</sup>

Traditional mapping remains crucial. In 2025, the Norwegian Environment Agency expanded testing of a new mapping protocol, including for 13 blue forest ecosystems. Publication is expected in 2026.<sup>46</sup> Meanwhile, the Norwegian Mapping Authority highlighted the spread of data across databases and agencies.<sup>47</sup> This fragmentation complicates ecosystem accounting, monitoring and municipal planning. Municipals showed a growing interest in protecting biodiversity,<sup>48</sup> with for example Utsira and Larvik explicitly mentioning blue forests in their planning documents.<sup>49,50</sup> However, failure to halt biodiversity loss despite increasing ecological data collection indicates a need for updated municipality workflows.<sup>51</sup>

### What to expect in 2026

- Increased incentive for standardised acoustic mapping for blue forest health
- OBAMA-NEXT reports on benthic mapping and monitoring best practice
- Publication of the shallow marine mapping protocol



**Figure 2.** Novel acoustic experiment (using single beam echo sounder) showing the different structural components of kelp *Laminaria hyperborea* forest; hapter, epiphytes, and lamina. Photo: Kyrre H. Kartveit/IMR.

# #5 Heatwaves reshaping coastal ecosystems

As coastal ecosystems face renewed pressure from marine heatwaves, the scientific community highlights impacts, cascading effects, and the need for cohesive management strategies.

Marine heatwaves made a significant comeback in 2025, breaking a 30-year record in Vestlandet.<sup>52,53</sup> While focus has primarily been on the ecological impacts from heatwaves during summer months, new research indicated that heatwaves could be more severe during winter months when temperature variations are lower, and called for more studies to elucidate impacts.<sup>54</sup>

The scientific community delivered a state-of-the-art synthesis of marine heatwave impacts, knowledge gaps and mitigation options,<sup>55</sup> and called for proactive management strategies to reduce ecological and economic loss, including to blue forests.<sup>55,56</sup> Emerging studies showed how marine heatwaves interact with other coastal pressures, leading to additive impacts. For example, heat combined with low light conditions or low salinity negatively affected macroalgae and fucoids (*tang*), respectively.<sup>57,58</sup> Both reduced salinity and diminished light—driven by factors such as more land runoff—are increasingly affecting our coast.

Marine heatwaves are shown to drive or intensify the shifts from kelp to turf algae (including *lurv*)

communities. A study from the Gulf of Maine, US, found that turf algae can release chemicals that directly suppress survival of kelp seedlings.<sup>59</sup> Research from the Oslofjord showed habitat changes cascade to fish (see Figure 3): as turf replaces kelp, marine heatwaves strengthen the ecosystem change towards smaller fish, and lower trophic levels in coastal fish communities.<sup>60,61</sup>

In 2024 the Norwegian term *lurv* was defined (note: this definition covers less than the term *turf*), followed by the Top Trends prediction of an increased mapping effort of these threadforming algae.<sup>62</sup> Two citizen science projects demonstrated higher frequency of sightings in southern Norway, but with occurrences also reported in the north.<sup>63-65</sup> As threadforming algae occur naturally along our coast, further data is needed to document seasonal and annual changes, particularly in relation to pressures such as marine heatwaves, and clarify tolerance limits for blue forest habitats.

## What to expect in 2026

- Continued research on combined effects of marine heatwaves and other coastal pressures
- Continued mapping of *lurv* to understand more about extent and temporal changes



**Figure 3.** Transformation of coastal ecosystems over the last two centuries. From [More but Smaller: Marine Heatwaves Exacerbate Size Truncation in Overfished Fish Communities in the Skagerrak](#).

# #6 Next wave of coastal threats

Research highlights possible far-reaching impacts from invasive species and uncovers a new potential cascading effect from climate change.

At the tail end of 2024, it was found that climate change alters how Arctic kelp accumulate harmful elements. Sugar kelp growing in areas influenced by runoff from retreating glaciers accumulated higher levels of cadmium, lead, and mercury, with mercury levels 60-70% higher than in non-runoff areas.<sup>66</sup> Additionally, the microbial community associated with the kelp was significantly altered. With limited research in this area, it is not yet clear what the risks are for human consumption, marine food webs, cultivation of kelp for other purposes, or carbon sequestration.

Like land plants, seaweeds serve as hosts to numerous microorganisms, which play crucial roles in seaweed host health. Prior to 2025, research highlighted the various functions microorganisms provide, including pathogens that cause disease.<sup>67</sup> Warmer waters are expected to increase the introduction and establishment of new pathogens. A 2025 study found that higher temperatures can make certain seaweeds hotspots for pathogenic bacteria harmful to humans.<sup>68</sup>

Researchers called attention to invasive grass outcompeting mangroves in West-Africa,<sup>69</sup> following on from the 2024 report that invasive trees posed threats to mangroves in Brazil.<sup>70</sup> In Norway, the carpet tunicate (*havnespy*, *Didemnum vexillum*) has been closely monitored since it was first observed in 2020.<sup>71</sup> This year, it did not spread to new locations, but increased in coverage at existing locations at Askøy, Bømlo, and Egersund.<sup>72</sup> With kelp forests previously highlighted as one of the habitats that could be severely impacted,<sup>73</sup> new research demonstrated that *Laminaria hyperborea* (*stortare*) fouled by *havnespy* supports significantly lower amounts of macroalgae and fauna,<sup>74</sup> which could have cascading effects on other species (see Figure 4).

## What to expect in 2026

- Continued monitoring of invasive species
- Continued research on microbiome of natural and farmed kelp and seaweed, focusing on pathogens.
- Studies looking at combined effects of on-going and future threats

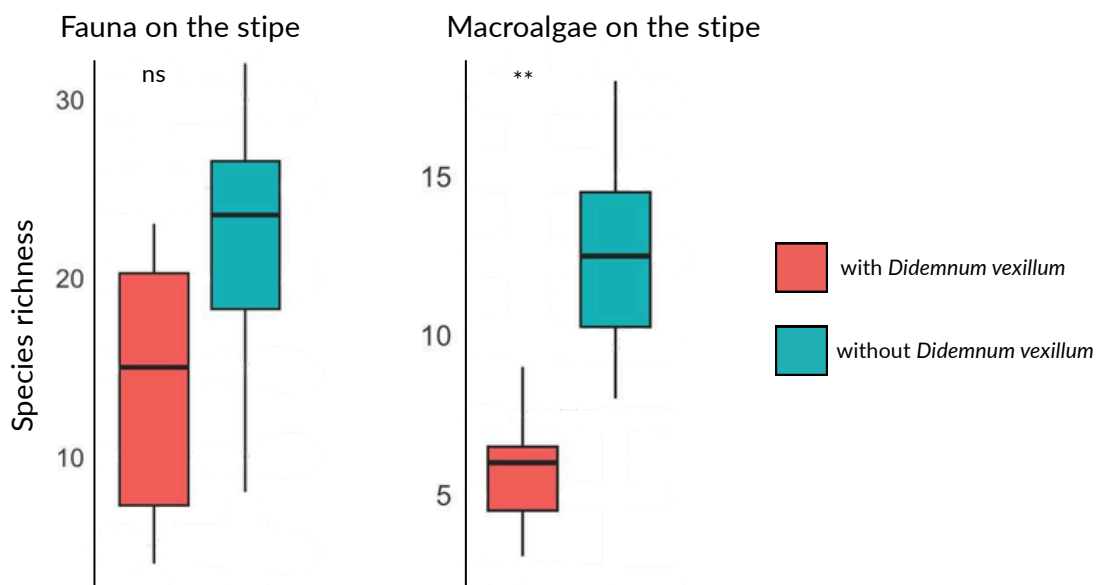


Figure 4. Average total number of taxa (4<sup>th</sup> root transformed) of fauna (left) and seaweeds (right) on *Laminaria hyperborea* stipes with and without presence of the invasive species 'havnespy' *Didemnum vexillum*. Modified from Banshoya 2025.



# #8

## Blue forest on the updated Red List

Norway publishes an updated Red List of Ecosystems, placing more blue forest habitats into threatened categories. However, the management tools that could be used to protect these habitats, are in limited use.

The new Norwegian Red List of Ecosystems, published in November, assessed the threat level of 22 different blue forest ecosystems.<sup>84</sup> Changes such as revised delineations and new analyses of long time-series resulted in more blue forest habitats being added to the list. Two ecosystems were listed as Endangered, two as Vulnerable, and three as Near Threatened.<sup>85-91</sup> The threat level was identical or higher compared to 2018 (see Figure 6), with pressures including coastal darkening, overfishing, marine heatwaves, and eutrophication. In addition, Maerl beds – a nature type considered a seaweed ‘hotspot’, and which may act as seed banks,<sup>92,93</sup> was moved from the Data Deficient category to Near Threatened.<sup>94</sup>

Red Lists are key national and global indicators for tracking nature loss and biodiversity decline. Although the Red List itself has no direct legal authority in Norway, it contributes to the

knowledge base referred to in the Nature Diversity Act, as well as the knowledge base for impact assessments under the Planning and Building Act. The list can also be used to assess the ecological status of water bodies under the Norwegian implementation of the Water Framework Directive.

The Nature Diversity Act provides tools that can be used for the protection of blue forest; *Zostera noltii* (*dvergålegress*), as the only marine plant, was listed as a priority species in 2015<sup>95</sup> – triggering prohibitions on damage or destruction of their ecological functional areas. This year, coral reefs became the first marine selected habitat<sup>96</sup> – meaning they may require action plans for management and restoration to preserve biodiversity and ecological processes. No blue forest habitat has been designated as a selected habitat type yet.

### What to expect in 2026

- Impact assessments taking Red Listed nature types into account
- An updated list of Management Relevant nature types (Forvaltningsrelevante Naturtyper) based on the new Red List

Redlist 2018		Redlist 2025
Northern sugar kelp forest - EN	Moderately exposed sugar kelp forest in the Norwegian Sea and southern Barents Sea - EN	EN
	Moderately exposed sugar kelp forest in the eastern Greenland Sea, northern Barents Sea and Arctic Ocean - LC	LC
Southern sugar kelp forest - EN	Moderately exposed sugar kelp forest in Skagerrak - EN	EN
	Moderately exposed sugar kelp forest in the North Sea - LC	LC
Northern tangle kelp forest - NT	Moderately exposed tangle kelp forest in the Norwegian Sea and southern Barents Sea - NT	NT
	Moderately exposed oarweed forest in the Norwegian Sea and southern Barents Sea - VU	VU
Northern oarweed bottom - VU	Moderately exposed oarweed forest in the eastern Greenland Sea, northern Barents Sea and Arctic Ocean - LC	LC
	Moderately exposed oarweed forest in the North Sea - NT	NT
Shallow marine hardbottom - LC	Moderately exposed tangle kelp forest in the North Sea - NT	NT
	(also split up in several other nature types)	
Marine meadows - LC	Marine meadows in extreme brakish water in Skagerrak - VU	VU
	Six other marine meadow naturtypes split in regions and salinity (brakish, extreme brakish, and salt) - LC	LC
Saltmarshes - LC	Three saltmarsh nature types split in salinity (brakish, extreme brakish, and salt) - LC	LC
	Maerl beds - DD	
Maerl beds, Svalbard - DD	Shallow maerl beds - NT	NT

**Figure 6.** An overview over changes in redlist categories for blue forest nature types from 2018 to 2025. LC = Least concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, DD = Data Deficient.

# #9

## Consistency in wild harvesting and unlocking potential in seaweed farming

The Norwegian seaweed industry continues to face both challenges and opportunities. Wild harvesting remains stable, while the farming industry faces uncertainties. New seaweed products provide hope for future developments.

Wild harvesting accounts for most of Norway's seaweed biomass production, with 130,000–180,000 tonnes trawled annually. In 2025, Norway saw regional harvest shifts, with declines in Rogaland and Vestland, and increases in Trøndelag.<sup>97</sup> This could be reflecting either differences in kelp availability or harvesting effort. Most *Laminaria hyperborea* (stortare) forests were in good condition ahead of the September 2025 harvest, though some areas showed weak recovery and were advised against harvesting.<sup>98</sup>

European seaweed farming remains limited, contributing 0.8% of global production. In Norway, farmed kelp production totalled 150 tonnes in 2025, half of 2024 levels. In contrast to 2024, all production was sold - improved logistics enabled fresh kelp to be shipped, frozen, and dried in Sweden for food use.<sup>99</sup> Renewed interest from the Norwegian food industry, with all seeded production for 2026 already sold, signalled a change in momentum after Orkla Ocean was dissolved earlier in the year.<sup>100</sup> However, the industry still lacks major buyers or plans for large-scale expansion. Small-scale trials took place for new species, including sea

lettuce (*Ulva* spp.) and dulse (*Palmaria palmata*), and for testing of co-located cultivation of kelp and sea squirts (*Ciona intestinalis*).<sup>101</sup>

Researchers highlighted that the carbon burial beneath seaweed farms may match that of some blue carbon habitats.<sup>101</sup> EU estimates suggest 10,000 km<sup>2</sup> of farms could sequester 1.1 million tonnes of carbon annually, worth €17.4 billion in avoided climate damages.<sup>102</sup> Innovation in seaweed products such as biofertilisers and biostimulants accelerated, and at the tail end of the year a new “Centre of gravity” for seaweed innovation was awarded funding.<sup>103</sup> Potential toxic elements present in seaweed, for instance arsenic and cadmium, warrant further study.<sup>104</sup>

### What to expect in 2026

- Launch of the Oslofjorden Tarepark pilot kelp project, in response to the Norwegian Parliament request to increase low-trophic aquaculture<sup>105</sup>
- Production growth, including increasingly diversifying species grown
- Greater diversification into non-food markets such as biofertilisers, biostimulants, and innovative seaweed-based foods and materials



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# #10 The other seaweed: Harvesting rockweed

Although rockweed is harvested extensively in Norway, little is known about localized environmental impacts. Landowners and researchers call for changes to management practices and tools to ensure sustainable harvesting.

In Norway, rockweed (*tang*), including knotted wrack (*grisettang*), has been harvested mechanically for over 80 years, with 15,000 - 20,000 tonnes harvested annually in recent years. In 2025, landowners highlighted a lack of transparency in harvesting practices.<sup>106</sup> With companies looking to expand operations, concern has been raised about the unknown effects harvesting can have on blue forest ecosystems.<sup>107</sup>

Rockweed, and other brown algae, are harvested primarily for their alginate, for use in textiles, foods, and pharmaceuticals. As rockweed provides extensive habitat in the coastal zone,<sup>108-110</sup> researchers highlighted the need for impact studies from harvesting to monitor total habitat loss, recovery, and cumulative environmental impacts, to develop harvest recommendations.<sup>111</sup>

Harvesting of rockweed occurs in shallow waters, outside the scope of the Marine Resources Act, often only requiring the landowner's permission. No formal management or harvest monitoring exists in

Norway beyond reporting landings, leaving sustainability largely up to the industry.<sup>112</sup> By contrast, in Canada, harvesters must submit an audited evaluation of the rockweed biomass before harvesting, report annual harvested biomass, and a maximum extraction rate is set to 25%.<sup>113</sup> In Iceland, harvesting regulations were updated in 2025, covering techniques that impact recovery time.<sup>114</sup>

If global trends continue, harvesting in Norway is likely to rise. The ASCOMAP project, a collaboration between PolarAlgae and NIVA, is currently researching effects from harvesting of knotted wrack, a study that will provide valuable input to a sustainable harvesting guide.<sup>115</sup>

## What to expect in 2026

- Results from ASCOMAP project on environmental impacts of knotted wrack (*grisettang*) harvesting, including regrowth and biodiversity impacts
- Publication of a guide for sustainable harvesting of knotted wrack (*grisettang*)



*Left:* Knotted wrack (*grisettang*, *Ascophyllum nodosum*) and fucoids (*sagtang*, *Fucus serratus*). Photo: Erling Svendsen/IMR.  
*Right:* Trine Bekkby sampling knotted wrack for the ASCOMAP project. Photo: Marit Bjorbækmo/NIVA.

# References

## #1 Kelp restoration

1. Norderhaug, K.M. et al. (2025). Restaurering av tareskog i Norge. Rapport I – Statusrapport. Institute of Marine Research. ISSN: 1893-4536. <https://www.hi.no/hi/nettrapporter/rapport-fra-havforskningen-2025-44>
2. Stortinget (2024). Vedtak 789 - Helhetlige forvaltningsplaner for de norske havområdene - Barentshavet og havområdene utenfor Lofoten, Norskehavet, og Nordsjøen og Skagerrak. <https://www.stortinget.no/no/Saker-og-publikasjoner/Vedtak/Vedtak/Sak/?p=98342>
3. Wathne, C.L. et al. (2025). Hva må gjøres for å få tareskogen tilbake i Nord-Norge? Report from conference organised by NBFN and partners 13th November 2024 at Framsenderet in Tromsø. <https://nbfno.no/wp-content/uploads/2025/06/Tromso-report.pdf>
4. Opdal, V.L. (2025). Glupsk redningspatrulje: Steinbit skal spise opp problemet. Institute of Marine Research. <https://www.hi.no/hi/nyheter/2025/august/steinbit-skal-spise-opp-problemet> (Accessed 10 October 2025)
5. Kjøllesdal, B.(2025). Dette var ein ørken: No veks frodig tare på kunstige rev. Forskning.no. <https://www.forskning.no/havet-havforskning-havforskningsinstituttet/dette-var-ein-orken-no-veks-frodig-tare-pa-kunstige-rev/2570043> (Accessed 19 November 2025)
6. Frantzen, M. (2025). Restaurering av tareskog gjennom utsett av 500 gråsteinbit. Akvoplan-niva. <https://akvoplan.no/no/pressemelding/2025-09-25/restaurering-av-tareskog-gjennom-utsett-av-500-grasteinbit-3406544> (Accessed 10 October 2025)
7. Miljødirektoratet (2025). Søknadssenter: Tilskudd til naturrestaurering. <https://soknadssenter.miljodirektoratet.no/Innsyn/Skjema/Na-turrestaurering> (Accessed 1 December 2025)
8. Fardal, S. (2025). Samarbeider om marin restaurering. Bellona. <https://bellona.no/nyheter/havbruk/2025-06-samarbeider-om-marin-restaurering> (Accessed 10 October 2025)
9. Ocean Green (2025). From urchin barrens to kelp forests. Ava Ocean. <https://avaocean.no/ocean-green> (Accessed 1 December 2025)
10. Giraldo-Ospina, A. et al. (2025). A site selection decision framework for effective kelp restoration. Biological Conservation, 302: 110980. <https://doi.org/10.1016/j.biocon.2025.110980>
11. Carnell, P.E. et al. (2025). Prioritising investment in kelp forest restoration: A spatially explicit benefit-cost analysis in southern Australia. Ecosystem Services, 74: 101739. <https://doi.org/10.1016/j.ecoser.2025.101739>
12. Champion, C. et al. (2025). Enhancing kelp productivity in restoration and assisted adaptation interventions under ocean warming. Scientific Reports, 15: 38796. <https://doi.org/10.1038/s41598-025-22691-y>
13. Dykman, L.N. et al. (2025). Testing the roles of local adaptation and genetic diversity to improve Giant kelp (*Macrocystis pyrifera*) restoration. Restoration Ecology, 33: e70114. <https://doi.org/10.1111/rec.70114>
14. Lis, E. and Aguirre J.D. (2025). Kelp canopy and adhesives enhance the success of kelp reforestation using the 'green gravel' technique. Marine Ecology Progress Series, 766, 43-55. <https://doi.org/10.3354/meps14904>
15. Oritiz-Villa, E.M. et al. (2025). Marine protected areas enhance climate resilience to severe marine heatwaves for kelp forests. Journal of Applied Ecology, 62, 2439-2453. <https://doi.org/10.1111/1365-2664.70112>
16. Klima- og miljødepartementet (2025). Tildelingsbrev 2026 for Miljødirektoratet. Regjeringen.no. <https://www.regjeringen.no/contentassets/d3b5f27dd4d34f2085b505b6df7fb5d4/miljodirektoratet-2026.pdf>

## #2 Blue forest restoration: From recognition to results

17. Norderhaug, K.M. et al. (2025). Restaurering av tareskog i Norge. Institute of Marine Research. ISSN: 1893-4536. <https://www.hi.no/hi/nettrapporter/rapport-fra-havforskningen-2025-44>
18. Government of Jamaica (2025). New and Updated Nationally Determined Contribution (NDC) of Jamaica – Jamaica's NDC 3.0. Planning Institute of Jamaica. <https://unfccc.int/sites/default/files/2025-09/Jamaica%20ICTU%20Final%20Report%20Sep19.pdf>
19. Government of Belize (2025). Belize's Third Nationally Determined Contribution. Ministry of Sustainable Development, Climate Change, and Solid Waste Management. <https://unfccc.int/sites/default/files/2025-06/BELIZE%20FINAL%20NDC%203.0.pdf>
20. UN FCCC (2025). Nationally determined contributions under the Paris Agreement: Synthesis report by the secretariat. FCCC/PA/CMA/2025/8. [https://unfccc.int/sites/default/files/resource/cma2025\\_08.pdf](https://unfccc.int/sites/default/files/resource/cma2025_08.pdf)
21. Meld. St. 25 (2024-2025). Klimamelding 2035 – på vei mot lavutslippssamfunnet. Klima- og miljødepartementet. <https://www.regjeringen.no/contentassets/d51d0e3cc153440b9611cdece49f4549/no/pdfs/stm202420250025000dddpdfs.pdf>
22. Miljødirektoratet (2025). Nytt kunnskapsgrunnlag om hav og klima. Notat fra Miljødirektoratet til KLD. <https://www.miljodirektoratet.no/aktuelt/fagmeldinger/2025/juni-2025/nytt-kunnskapsgrunnlag-om-hav-og-klima/>
23. IPCC (2025). Sixty-third session of the IPCC: Decision adopted by the panel. Decision IPCC-LXIII-6, Lima, Peru. <https://www.ipcc.ch/site/assets/uploads/2025/11/Decision-6-MR-CDR.pdf>
24. Danovaro, R. et al. (2025). Assessing the success of marine ecosystem restoration using meta-analysis. Nature Communications, 16: 3062. <https://doi.org/10.1038/s41467-025-57254-2>
25. Remeta, P. et al. (2025). Studies in support of the implementation of the Mission – Wetlands and Blue Carbon: Final Report. Publications Office of the European Union. [https://cinea.ec.europa.eu/publications/digital-publications/studies-support-implementation-mission-wetlands-and-blue-carbon-final-report\\_en](https://cinea.ec.europa.eu/publications/digital-publications/studies-support-implementation-mission-wetlands-and-blue-carbon-final-report_en) (Accessed 1 December 2025)
26. Zhang, J. et al. (2025). Getting the best of carbon bang for mangrove restoration buck. Nature communications, 16: 1297. <https://doi.org/10.1038/s41467-025-56587-2>
27. Goto, G.M. et al. (2025). Implementation costs of restoring global mangrove forests. One Earth, 18: 101342. <https://doi.org/10.1016/j.oneear.2025.101342>
28. Colman J.E. et al. (2025). Kartlegging og prioritering av restaureringsareal i Norge – en tilnærming. Naturrestaurering Rapport 16-06-25. [https://naturrestaurering.no/wp-content/uploads/2025/11/Kartlegging-og-prioritering-av-restaureringsareal-i-Norge-%E2%80%93-en-tilnaerming\\_ISBN-978-82-94220-00-7.pdf](https://naturrestaurering.no/wp-content/uploads/2025/11/Kartlegging-og-prioritering-av-restaureringsareal-i-Norge-%E2%80%93-en-tilnaerming_ISBN-978-82-94220-00-7.pdf) (Accessed 1 December 2025)
29. NIVA (2025). Ålegras på flyttefot: Oslo får restaureringshjelp fra nabokommuner. <https://www.niva.no/nyheter/alegras-pa-flyttefot-oslo-far-restaureringshjelp-fra-nabokommuner> (Accessed 1 December 2025)
30. Sparebankstiftelsen (2025). Tildelinger: NB Oslofjorden! <https://sparebankstiftelsen.no/tildelinger/nb-oslofjorden/> (Accessed 1 December 2025)

### #3 Accounting for blue forests

31. UN (2024). System of Environmental-Economic Accounting – Ecosystem Accounting. Statistical Papers. Series F No.124. [https://seea.un.org/sites/seea.un.org/files/documents/EA/seea\\_ea\\_f124\\_web\\_12dec24.pdf](https://seea.un.org/sites/seea.un.org/files/documents/EA/seea_ea_f124_web_12dec24.pdf)
32. Wathne, C. et al. (2025). 9: Ecosystem accounting for the ocean. In: Top ten trends from 2024, pp. 18-19. Norwegian Blue Forest Network. <https://nbnf.no/top-10-trends-for-blue-forests-2024/>
33. SALT (2025). Kartlegging av data til utvikling av tilstandsregnskap for hav. <https://salt.nu/prosjekter/kartlegging-av-data-til-utvikling-av-tilstandsregnskap-for-hav> (Accessed 1 December 2025)
34. Bögelsack K. et al. (2025). Data- og kunnskapsevaluering for økosystemkart til bruk i marint naturregnskap. Kartverket. Rapport 19/04811-22. <https://www.kartverket.no/globalassets/forskning-og-utvikling/rapporter/rapport-data-og-kunnskapsevaluering-for-okosystemkart-til-bruk-i-marint-naturregnskap.pdf>
35. Fornybar Norge (2025). Utvikling av metode for prosjektbasert naturregnskap. Asplan Viak, Multiconsult og Rambøll. <https://www.fornybarnorge.no/contentassets/bd151062748446ae95ca14a250cc8791/20250623-utvikling-av-metode-for-prosjektbasert-naturregnskap-for-publiserings-1.pdf>
36. Gov.UK (2023). Guidance: Statutory biodiversity metric tools and guides. Department for Environment, Food & Rural Affairs. <https://www.gov.uk/government/publications/statutory-biodiversity-metric-tools-and-guides>
37. Zimmerhackel, J. et al. (n.d.). The value of recovering Norway's kelp forests. (In prep).
38. Zimmerhackel, J. et al. (n.d.). Assessing the value and function of the world's kelp forests. (In prep).

### #4 Blue forest mapping for future decisions

39. Kvile, K.Ø. et al. (2024). Drone and ground-truth data collection, image annotation and machine learning: A protocol for coastal habitat mapping and classification. *MethodsX*, 13: 102935. <https://doi.org/10.1016/j.mex.2024.102935>
40. Staehr P.A.U. et al. (2025). Synthesis report on use of remote sensing for mapping benthic habitats and organisms. OBAMA-NEXT Deliverable 3.2. 104 pp
41. Menandro, P.S. et al. (2025). Multifrequency seafloor acoustic backscatter as a tool for improved biological and geological assessments—updating knowledge, prospects, and challenges. *Frontiers in Remote Sensing*, 6:1546280. <https://doi.org/10.3389/frsen.2025.1546280>
42. Berry, J., and Nanlal, C. (2025). Assessment of the application of each multibeam echosounder data product for monitoring of *Laminaria digitata* in the UK. *Frontiers in Remote Sensing*, 6:1521958. <https://doi.org/10.3389/frsen.2025.1521958>
43. Nau A.W. et al. (2025). Advanced detection and classification of kelp habitats using multibeam echosounder water column point cloud data. *Remote Sensing*, 17: 449. <https://doi.org/10.3390/rs17030449>
44. Kartveit, K.H. et al. (n.d.) Acoustic signatures of individual kelp plants: disentangling size, epiphytic growth, and structural components using controlled EK80 measurements. (In prep).
45. Pastra A. et al. (2025). The use of emerging autonomous technologies for ocean monitoring: insights and legal challenges. *Frontiers in Marine Science*, 12: 1561737. <https://doi.org/10.3389/fmars.2025.1561737>
46. Miljødirektoratet (2025). Kartlegging av marine naturtyper - miljødirektoratet.no. (Accessed 4 December 2025)
47. Bögelsack K. et al. (2025). Data- og kunnskapsevaluering for økosystemkart til bruk i marint naturregnskap. Kartverket. Rapport 19/04811-22. <https://www.kartverket.no/globalassets/forskning-og-utvikling/rapporter/rapport-data-og-kunnskapsevaluering-for-okosystemkart-til-bruk-i-marint-naturregnskap.pdf>

48. Miljødirektoratet (2025). Disse kommunene tek grep for naturmangfaldet. <https://www.miljodirektoratet.no/aktuelt/nyheter/2025/juni/desse-kommunene-tek-grep-for-naturmangfaldet/> (Accessed 4 December 2025)
49. Utsira kommune (2025). Kommunedelplan naturmangfold 2025-2033. <https://utsira.kommune.no/wp-content/uploads/2025/11/delplan-naturmangfold-endelig-etter-behandling-okt-25.pdf>
50. Larvik kommune (2025). Kommuneplanens arealdel 2025-2037. [https://www.larvik.kommune.no/media/xpvy4ft/vedlegg-4\\_planbeskrivelse-datert-050225-rev-130225.pdf](https://www.larvik.kommune.no/media/xpvy4ft/vedlegg-4_planbeskrivelse-datert-050225-rev-130225.pdf)
51. Normannsen, S. (2025) Hvorfor skjer det ingenting med nedbygging av naturen? – Vi leverer fra oss dataene, men så stopper det. *Forskning.no*. <https://www.forskning.no/klima-miljo-miljopolitikk/hvorfor-skjer-det-ingen-ting-med-nedbygging-av-naturen-vi-leverer-fra-oss-dataene-men-sa-stopper-det/2581485> (Accessed 4 November 2025)

### #5 Heatwaves reshaping coastal ecosystems

52. Paolantonacci, P. (2025). Vestlandet: Kraftigste marine hetebølge på minst 30 år. Institute of Marine Research. <https://www.hi.no/hi/nyheter/2025/september/vestlandet-kraftigste-marine-hetebolge-pa-minst-30-ar> (Accessed 4 October 2025)
53. Wilthil, J.-E. (2025). Marin hetebølge i Norge: – Ekstrem havtemperatur. NRK. (Accessed 4 August 2025) [https://www.nrk.no/buskerud/marin-hetebolge-i-norge\\_-\\_ekstrem-havtemperatur-1.17505285](https://www.nrk.no/buskerud/marin-hetebolge-i-norge_-_ekstrem-havtemperatur-1.17505285)
54. Wilson, R.J. et al. (2025). Seafloor marine heatwaves outpace surface events in the future on the northwestern European shelf. *Ocean Science*, 21, 1255–1270. <https://doi.org/10.5194/os-21-1255-2025>
55. Wernberg, T. et al. (2025). Marine heatwaves as hot spots of climate change and impacts on biodiversity and ecosystem services. *Nature Reviews Biodiversity*, 1, 461–479. <https://doi.org/10.1038/s44358-025-00058-5>
56. Smith, K.E. et al. (2025). Ocean extremes as a stress test for marine ecosystems and society. *Nature Climate Change*, 15, 231-235. <https://doi.org/10.1038/s41558-025-02269-2>
57. Wernberg, T. and Straub, S.C. (2024). Low light exacerbates effects of marine heatwaves on seaweeds. *Marine Ecology Progress Series*, 747, 49–59. <https://doi.org/10.3354/meps14695>
58. Pedersen, M. et al. (2025). Additive effects of climate change-related stress factors in *Fucus serratus* and *Fucus vesiculosus*. *Marine Ecology Progress Series*, 762, 13-26. <https://doi.org/10.3354/meps14867>
59. Farrell, S.P. et al. (2025). Turf algae redefine the chemical landscape of temperate reefs, limiting kelp forest recovery. *Science*, 388, 876-880. <https://www.science.org/doi/10.1126/science.adt6788>
60. Kjøllestadal, B. (2025). Marine hetebølger gjør vondt verre: «Lurv» tek over for tare og fisken skrumpar. Institute of Marine Research. <https://www.hi.no/hi/nyheter/2025/juli/lurv-tek-over-for-tare-og-fisken-skrumpar> (Accessed 4 October 2025)
61. Norderhaug, K.M. et al. (2025). More but Smaller: Marine Heatwaves Exacerbate Size Truncation in Overfished Fish Communities in the Skagerrak. *Ecology and Evolution*, 15: e71404. <https://doi.org/10.1002/ece3.71404>
62. Wathne, C. et al. (2025). 6: “Lurv” – finally a definition of this growing threat to blue forests. In: Top ten trends from 2024, pp 14. Norwegian Blue Forest Network. <https://nbnf.no/top-10-trends-for-blue-forests-2024/>
63. Oslofjorden Friluftsråd (2025). Kartlegging av lurv. Oslofjordens Friluftsråd, NIVA. <https://www.oslofjorden.org/kartlegging-av-lurv/> (Accessed 4 October 2025)
64. Kjøllestadal, B. (2025). Forskarane treng hjelp til å kartlegge problem-alge. Institute of Marine Research. <https://www.hi.no/hi/nyheter/2025/juli/forskarane-treng-hjelp-til-a-kartlegge-problem-alge> (Accessed 4 October 2025)

65. Christie, H. and Rinde, E. (2025). Økning av lurv langs norskekysten er en trussel mot økosystemene. Forskeren.no. <https://www.forskeren.no/alger-havforskning-lurv/okning-av-lurv-langs-norskekysten-er-en-trussel-mot-okosystemene/2553620> (Accessed 6 October 2025)

## #6 Next wave of coastal threats

66. Niedzwiedz, S. et al. (2024). Run-off impacts on Arctic kelp holobionts have strong implications on ecosystem functioning and bioeconomy. *Scientific Reports*, 14: 30506. <https://doi.org/10.1038/s41598-024-82287-w>
67. Bjorbækmo, M.F.M. et al. (2023). 18S rDNA gene metabarcoding of microeukaryotes and epi-endophytes in the holobiome of seven species of large brown algae. *Journal of Phycology*, 59, 859-878. <https://doi.org/10.1111/jpy.13377>
68. Wilson, S. and Saha, M. (2025). Warmer oceans will increase abundance of human pathogens on seaweeds. *Phycology*, 5: 38. <https://doi.org/10.3390/phycolgy5030038>
69. Barrera, C. et al. (2025). Loss and early recovery of biomass and soil organic carbon in restored mangroves after *Paspalum vaginatum* invasion in West Africa. *Resources*, 14, 122. <https://doi.org/10.3390/resources14080122>
70. Brown, S. (2024). Experts call for urgent action as invasive species threatens Brazil mangroves. Mongabay. <https://news.mongabay.com/2024/09/experts-call-for-urgent-action-as-invasive-species-threatens-brazil-mangroves/> (Accessed 6 October 2025)
71. IMR (2024). Tema: Havnespy. <https://www.hi.no/hi/temasider/arter/havnespy> (Accessed 6 October 2025)
72. Dr. Vivian Husa. Institute of Marine Research. Personal communication, 5 December 2025.
73. Järnegren, J. et al. (2023). Assessment of risk and risk-reducing measures related to the introduction and dispersal of the invasive alien carpet tunicate *Didemnum vexillum* in Norway. Norwegian Scientific Committee for Food and Environment (VKM), report 2023:7. <https://hdl.handle.net/10037/31564>
74. Banshoya, A.Y.I. (2025). Impacts of the invasive colonial tunicate *Didemnum vexillum* Kott, 2002 on kelp *Laminaria hyperborea* (Gunnerus) Foslie 1884: photosynthesis and epiphyte diversity. [Unpublished master's thesis]. University of Bergen, Norway.

## #7 Blue carbon embedded in climate policy

75. Government of Indonesia (2025). Presidential Regulation No. 110 of 2025 on Implementation of Carbon Economic Value Instruments and National Greenhouse Gas Emission Control. [https://climate-laws.org/document/presidential-regulation-no-110-of-2025-on-implementation-of-carbon-economic-value-instruments-and-national-greenhouse-gas-emission-control\\_d013](https://climate-laws.org/document/presidential-regulation-no-110-of-2025-on-implementation-of-carbon-economic-value-instruments-and-national-greenhouse-gas-emission-control_d013)
76. Government of Kenya (2025). Draft Climate Change (Carbon Trading) Regulations, 2025. Republic of Kenya, Ministry of Environment, Climate Change and Forestry. <https://www.scribd.com/document/825551281/Draft-Climate-Change-Carbon-Trading-Regulations-for-public-consultations-24012025>
77. Fair Carbon (2025). Kenya's New Carbon Rules: Can Both Big and Small Projects Thrive? LinkedIn, 24 September 2025. <https://www.linkedin.com/pulse/kenyas-new-carbon-rules-can-both-big-small-projects-thrive-l7yxe/>
78. Japan Blue Economy Association (JBE) (2025). J-Blue Credit Certification Application Guidelines - Climate Change Mitigation Utilizing Blue Carbon. Ver. 2.5. Japan Blue Economy Association. [https://www.blueeconomy.jp/wp-content/uploads/jbc2025/20250331\\_J-BlueCredit\\_Guideline\\_v.2.5\\_en.pdf](https://www.blueeconomy.jp/wp-content/uploads/jbc2025/20250331_J-BlueCredit_Guideline_v.2.5_en.pdf)
79. Farahmand, S. et al. (2025). The rise and flows of blue carbon credits advance global climate and biodiversity goals. npj

- Ocean Sustainability, 4: 39. <https://doi.org/10.1038/s44183-025-00141-6>
80. The Scottish Government (2025). Scottish blue carbon action plan. Cabinet Secretary for Climate Action and Energy, Cabinet Secretary for Rural Affairs, Land Reform and Islands. <https://www.gov.scot/publications/scottish-blue-carbon-action-plan>
81. Miljødirektoratet (2025). Nytt kunnskapsgrunnlag om hav og klima. Notat fra Miljødirektoratet til KLD. <https://www.miljodirektoratet.no/aktuelt/fagmeldinger/2025/juni-2025/nytt-kunnskapsgrunnlag-om-hav-og-klima/> (Accessed 6 October 2025)
82. Remeta, P. et al. (2025). Studies in support of the implementation of the Mission – Wetlands and Blue Carbon: Final Report. Publications Office of the European Union. <https://data.europa.eu/doi/10.2926/9638373>
83. Ní Longphuirt, S. et al. (2025). Enhancing Blue Carbon considerations in the Marine Strategy Framework Directive. JPI Oceans Blue Carbon Knowledge Hub. Brussels, Belgium. <https://www.jpi-oceans.eu/en/new-policy-brief-launched-enhancing-blue-carbon-considerations-marine-strategy-framework-directive>

## #8 Blue forest on the updated Red List

84. Skjærvik, L. (2025). Ny oversikt over truga natur i Norge. Artsdatabanken. <https://artsdatabanken.no/aktuelt-og-innsikt/aktuelt/Ny-oversikt-over-truga-natur-i-Noreg> (Accessed 3 December 2025)
85. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Moderat eksponert sukkertareskog i Skagerrak. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1032> (Accessed 3 December 2025)
86. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Moderat eksponert sukkertareskog i Norskehavet og Barentshavet sør. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1031> (Accessed 3 December 2025)
87. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Moderat eksponert fingertareskog i Norskehavet og Barentshavet sør. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1024> (Accessed 3 December 2025)
88. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Undervannsenseng i ekstrembrakt vann i Skagerrak. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1197> (Accessed 3 December 2025)
89. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Moderat eksponert fingertareskog i Nordsjøen. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1023> (Accessed 3 December 2025)
90. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Moderat eksponert stortareskog i Nordsjøen. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1027> (Accessed 3 December 2025)
91. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Moderat eksponert stortareskog i Norskehavet og Barentshavet sør. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1028> (Accessed 3 December 2025)
92. Peña, V. et al. (2014). The diversity of seaweeds on maerl in the NE Atlantic. *Marine biodiversity*, 44, 533-551. <https://doi.org/10.1007/s12526-014-0214-7>
93. Fredericq, S. et al. (2019). The critical importance of rhodoliths in the life cycle completion of both macro- and microalgae, and as holobionts for the establishment and maintenance of marine biodiversity. *Frontiers in Marine Science*, 5: 502. <https://doi.org/10.3389/fmars.2018.00502>
94. Norderhaug, K.M. et al. (2025). Marint: Vurdering av Grunn

ruglbunn. Norsk rødliste for naturtyper 2025, Artsdatabanken. <https://lister.artsdatabanken.no/naturtyper/2025/1094> (Accessed 3 December 2025)

95. Forskrift om dvergålegras (*Zostera noltei*) som prioritert art (2015). FOR-2015-05-22-546. Lovdata. <https://lovdata.no/dokument/LTI/forskrift/2015-05-22-546>
96. Klima- og miljødepartementet (2025). Korallrev får bedre beskyttelse. Regjeringen.no. <https://www.regjeringen.no/no/aktuelt/utvalgte-naturtyper/id3115989/> (Accessed 3 September 2025)

## #9 Consistency in wild harvesting and unlocking potential in seaweed farming

97. Fiskeridirektoratet J-167-2024: (Current) Regulations on the harvesting of kelp, Møre og Romsdal and Trøndelag. <https://www.fiskeridir.no/yrkkesfiske/j-meldinger/j-167-2024>
98. Steen, H. et al (2025). Tilstandsvurdering av høstefelt for stortare i Rogaland og Vestland 2025. Institute of Marine Research, report 2025-50. ISSN: 1893-4536. <https://www.hi.no/hi/nettrapporter/rapport-fra-havforskningen-2025-50>
99. Marit Gjerstad. Norwegian Seaweed Association. Personal communication, 12 November 2025.
100. Krogsrud, Ø. (2025). Villhøsting dominerer – men dyrket tare kan bli større. Tekna Magasinet. <https://www.tekna.no/magasinet/villhosting-dominerer---men-dyrket-tare-kan-bli-storre/>
101. Duarte, C.M. et al. (2025). Carbon burial in sediments below seaweed farms matches that of Blue Carbon habitats. *Nature Climate Change*, 15, 180–187. <https://doi.org/10.1038/s41558-024-02238-1>
102. Directorate-General for Maritime Affairs and Fisheries (2025). Algae: new Commission study explores their bright future. EU Commission. [https://oceans-and-fisheries.ec.europa.eu/news/algae-new-commission-study-explores-their-bright-future-2025-09-08\\_en](https://oceans-and-fisheries.ec.europa.eu/news/algae-new-commission-study-explores-their-bright-future-2025-09-08_en) (Accessed 6 December 2025)
103. Kunnskapsdepartementet (2025). 768 millioner til forskningsdriven innovasjon. Regjeringen.no. <https://www.regjeringen.no/no/aktuelt/768-millionar-til-forskningsdriven-innovasjon/id3143037/>
104. Huang, L. et al. (2025). Heavy metals in seaweed: Implications for health benefits, risks, and safety regulations. *Journal of Agriculture and Food Research*, 21: 101830. <https://doi.org/10.1016/j.jafr.2025.101830>
105. Furset, S. (2025). Oslofjorden Tarepark: fra visjon til virkelighet. Bellona. <https://bellona.no/nyheter/havbruk/2025-12-oslofjorden-tarepark-fra-visjon-til-virkelighet> (Accessed 6 January 2026)

## #10 The other seaweed: Harvesting rockweed

106. Knudsen, K. (2025). Tang-selskap eid av den kinesiske stat inngår private avtaler med grunneiere: – Mange har stilt spørsmål. *Fiskeribladet*. <https://www.fiskeribladet.no/samfunn/tang-selskap-eid-av-den-kinesiske-stat-inngar-private-avtaler-med-grunneiere-mange-har-stilt-sporsmal/2-1-1848408> (Accessed 6 November 2026)
107. Knudsen, K. (2025). Nytt tangselskap inngår private avtaler: – Forutsetter at informasjonen er åpen. *Fiskeribladet*. <https://www.fiskeribladet.no/industri/nytt-tangselskap-inngar-private-avtaler-forutsetter-at-informasjonen-er-åpen/2-1-1853067> (Accessed 6 November 2026)
108. Bekkby, T. et al. (2022) Forslag til variabler for økologisk kvalitet for lokaliteter av forvaltningsrelevant marin natur. NIVA rapport 7797-2022. <https://www.miljodirektoratet.no/publikasjoner/2023/mars-2023/forslag-til-variabler-for-okologisk-kvalitet-for-lokaliteter-av-forvaltningsrelevant-marin-natur/>
109. Webber, H. (2024). The foundation roles of rockweed, *Ascophyllum nodosum* (Linnaeus) Le Jolis, in Maine's rocky

- intertidal zone. PhD Thesis: University of Maine. <https://digitalcommons.library.umaine.edu/etd/3954/>
110. Magnússon, J.T. et al. (2025). Icelandic intertidal fish communities and effects of knotted wrack (*Ascophyllum nodosum*) harvesting. *Journal of the Marine Biological Association of the United Kingdom* 105:e75. <https://doi.org/10.1017/S0025315425100301>
111. Snow, A.A. et al. (2025). Harvest recovery of a North Atlantic intertidal seaweed, *Ascophyllum nodosum*: experimental design issues. *Journal of Marine Science and Engineering* 13:2207. <https://doi.org/10.3390/jmse13112207>
112. Kvanneid, A.J. and Sundnes, F. (2024). Nature's values in marine resource governance: an ethnographic case study of rockweed in Norway, *Socio-Ecological Practice Research*, 6, 177-189. <https://doi.org/10.1007/s42532-024-00183-z>
113. Lauzon-Guay J.S. et al. (2021). Biomass and height of *Ascophyllum nodosum* after two decades of continuous commercial harvesting in eastern Canada. *Journal of Applied Phycology*, 33, 1695–1708. <https://doi.org/10.1007/s10811-021-02427-x>
114. Regulation on the commercial collection of marine vegetation, 1007/2024 (2024). Ministry of Food and Agriculture. <https://island.is/reglugerdir/nr/1007-2024> (Accessed 27 November 2025)
115. Dr. Trine Bekkby. The Norwegian Institute for Water Research (NIVA). Personal communication, 15 December 2025.



The logo for the Norwegian Blue Forests Network features a white circular arrow graphic on the left, pointing clockwise. To its right, the text "Norwegian Blue Forests Network" is displayed in a clean, white, sans-serif font, stacked in three lines.

# Norwegian Blue Forests Network

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