Time to Include Blue Carbon from Seaweed in Voluntary Carbon Removal Certification

Il est temps d'inclure le carbone bleu des algues dans la certification volontaire des absorptions de carbone

Es ist an der Zeit, blauen Kohlenstoff aus Meeresalgen in die freiwillige Zertifizierung des Kohlenstoffabbaus aufzunehmen

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On 30 November 2022, the European Union adopted a proposal for a first EU-wide voluntary framework for certification of carbon removals. It sets out criteria and rules necessary to spur the development of a voluntary Union Certification Framework and encourages the uptake of carbon removal technologies (European Commission, 2022b). The Communication discusses its consistency with existing EU policies on LULUCF (Land Use, Land-Use Change and Forestry), the EU forestry strategy and the Common Agricultural Policy. It sets out rules for the independent verification of carbon removals and rules to recognise certification schemes that can be used to demonstrate compliance with the EU framework. The EU introduced four so-called QU.A.L.ITY criteria to ensure the quality and comparability of carbon removals:

- Quantification: Carbon removal activities need to be measured accurately and deliver unambiguous benefits for the climate;
- Additionality: Carbon removal activities need to go beyond existing practices and what is required by law;
- Long-term storage: Certificates are linked to the duration of carbon storage to ensure permanent storage;
- Sustainability: Carbon removal activities must preserve or contribute to sustainability objectives such as climate change adaptation, circular economy, water and marine resources, and biodiversity.

Although the Communication acknowledges that carbon removal should not harm but should instead contribute to improving the marine ecosystem, it does not give specific attention to the large potential of the oceans for long-term and effective storage of carbon. With this, the Commission ignores the pivotal role of the oceans in mitigating climate change.

There is a growing global interest in blue carbon from seaweed due to the potential for climate change mitigation. It is argued that seaweed farming provides a carbon sink and can help to reduce atmospheric CO_2 concentration (Krause-Jensen *et al.*, 2018; Ortega *et al.*, 2019). Businesses, policy-makers (including the EU) and non-governmental organisations see opportunities to include seaweeds in climate and nutrient credit schemes; see for example European Commission (2022a).

The Blue Marine Foundation reported on the whole blue carbon potential of the UK and calculated that the quantity and restoration potential of seaweed lies between 400–800,000 ha for UK waters, which is far greater than conventional blue carbon habitats like saltmarshes with 44,000 ha and seagrass between 7,000–9,000 ha (Norris *et al.*, 2021). McKinsey (2022) calculated that under the high growth scenario seaweed farming has a global abatement potential, as in sequestration potential, of 0.3 Gt CO_2 per year and seaweed (kelp forest) conservation a potential of 0.04 Gt CO_2 per year. In 2019, the UK net terrestrial emissions totalled 0.46 Gt (454.8 million tonnes) (ONS, 2021) of carbon dioxide equivalent (CO_2e), with 80 per cent being carbon dioxide (Norris *et al.*, 2021).

> “Il y a un intérêt croissant pour le carbone bleu des algues au niveau mondial.”

This article looks at the process of certification. We focus on existing experiences with carbon and/or nutrient certification, believing there are valuable lessons to learn from these first initiatives to certify carbon

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Seaweed farm in Faroese waters © Sophie Koch.

uptake by seaweed. We review current practices along the four QU.A.L.ITY criteria introduced by the EU Commission (European Commission, 2022b). This analysis provides valuable insights when taking the next step to include seaweed's blue carbon in the EU certification guidelines. The article is based on a desk study review of good practices, a process of expert assessments within the project team, supplemented with personal communication. The next section describes four experiences with certification. The discussion section focusses on the lessons to be learned for the EU's carbon certification efforts. The article ends with a conclusions and recommendations section.

Experiences with carbon certification

Netherlands. The Seaweed Company BV, an international Impact Company with a head office in the Netherlands, offers seaweed certificates that can be purchased on their website. Certificates are available in various denominations: 1,000 kg seaweed (€500), 500 kg seaweed (€250), 250 kg seaweed (€125), 100 kg seaweed (€50). The Seaweed Company does not sell certificates for carbon that is stored during growth phase and thus carbon that would be sequestered in marine ecosystems, but it looks at carbon that is sequestered on land in particular degraded agricultural soils. The Seaweed Company creates carbon removal projects with farmers that aid farmers in transitioning to regenerative agricultural practices. The Seaweed Company provides farmers with their seaweed biostimulant that accelerates soil regeneration, maintains and often improves yield with reductions in synthetic inputs (fertilisers and pesticides), boosts soil biodiversity, and produces higher quality crops. These projects are funded through the sale of empirically validated carbon removal credits that are accredited through in-situ soil carbon sampling and translated into Tn CO_2 Ha/y^{-1}. The carbon removal credits are officially verified through the third party 'ONCRA'. The company's website presents impact via three pillars: CO_2 mitigation, community development and ocean restoration.

Italy. Venice based D&D Consulting developed the CO_2 Roadmap to measure the carbon burial rate from some forms of aquaculture. They act as intermediaries between buyers and sellers of CO_2 credits. One credit represents one ton of neutralised CO_2, and its market value fluctuates internationally. A seabream fish farm in Italy used the CO_2 Roadmap to calculate its carbon footprint, to determine where it can earn credits, and how to stay carbon neutral. The process involves satellite and soil analysis to identify areas where carbon credits can be created and certification following the Verified Carbon Standard to determine the number of credits generated.

> "Weltweit wächst das Interesse an blauem Kohlenstoff aus Meeresalgen."

Japan. In Yokohama Bayside Marina, Japan, an 8-hectare area of seabed is reserved for planting macroalgae and seagrass. A GPS survey estimated the area to be 7.8 hectares and measured a certified CO_2 storage of 12.3 tons. Blue carbon credits were issued by Japan Blue Economy (JBE) after third-party verification and purchased on the voluntary market. The project demonstrates successful public-private partnership between municipal governments, NGOs and citizens. Urchinomics, a private company, uses JBE's carbon credit standard to restore wild kelp forests by harvesting overgrazing sea urchins (Hermans, 2022).

United States of America. The Maryland Department of the Environment and Agriculture developed the Water Quality Trading Program, which promotes oyster aquaculture through nutrient credit trading. Oysters remove pollutants from the water, enabling municipalities and businesses to meet water quality permit requirements. Credits are calculated based on oyster size at harvest and can be bought and sold on the MDE Trading Market Board. Tax reductions are given to citizens who install oyster floats. Businesses and municipalities can purchase credits to meet their permit requirements, reducing the cost of expensive retrofits. The program helps address water quality issues in the Chesapeake Bay through nutrient credit trading.

Overlooking the experiences

The experiences presented above, summarised in Table 1, show that initiatives are taken to certify carbon or nutrient removal by aquaculture. The Seaweed Company, as a seaweed cultivator, found a way to quantify the carbon sequestered through seaweed. It might be using a deviation via the terrestrial path now, but it is showing that it is possible. The cases of Venice Bay and Chesapeake Bay illustrate how aquaculture's impact can be used to generate and sell credits. The case from Japan shows how ecosystem restoration, seaweeds aquaculture and credits can go hand in hand. The overview however also shows that there is no generally accepted method for quantification of carbon credits and that different routes from long-term storage (soil, deep sediment, shallow seabed) are considered.

Mainstreaming blue carbon certification

Under the current IPCC framework, blue carbon refers to carbon sequestered in saltwater marches, mangroves and seagrass. By 2020 only five projects were registered under approved methodologies, all fairly small-scale projects. As of now, renowned standards such as the Verified Carbon Standard, do not include blue carbon from seaweed in their eligible project types but other private standards are in the making.

ONCRA, short for Open Natural Carbon Removal Accounting, is an NGO that provides carbon removing entrepreneurs with methodologies to account for their carbon, and thus sell generated credits (ONCRA, 2022a). It is an open-source company focused on niche markets, like nature-based solutions, that was launched at the COP27. ONCRA is an additional framework, that allows use of the existing methods developed by, among others, Gold Standard and Verra. As for seaweed, the removal pathways via burial in the deep-sea layers are yet to be finalised, as uncertainties remain about the efficiency of carbon removal to these depths. The company therefore calculates carbon removal by looking at carbon in the terrestrial sediment and in the above ground biomass. ONCRA follows the ISO standards ISO 14064-1 (on quantification of greenhouse gas emissions and removals), ISO 14064-2 (with guidance at project level) and ISO 14064-3 (on validation and verification). All calculations must follow the principles of a full

Table 1: Summary of experiences

	Seaweed Company, the Netherlands	D&D Consulting, Venice Bay, Italy	Bayside Marina, Yokohama, Japan	Oyster Credits - Chesapeake Bay, Maryland, USA
The practice	Sells Nature-Based Carbon Removal with voluntary Seaweed Certificates™	Fish farms selling carbon credits, looking at the blue carbon footprint of fish farm operations	Managing macroalgal beds for carbon sink creation / ecosystem restoration	Promoting oyster aquaculture through nutrient credit trading, meeting water quality permit requirements using oysters' pollutant filtering capabilities
Carbon Credit type	Carbon removal credit	Carbon removal credit	Carbon removal credit	Nutrient removal credit
Quantification	Based on ONCRA quantification methodology	Own calculation based on satellite and soil data	Based on the IPCC guidelines 2014	Based on best practice document
Additionality	Credits support business case of farmers	Credits support business case of farmers	100% based on no seaweed existing without the project	Additional option to avoid retrofit
Long-term storage	Storage of carbon in soil, certified by ONCRA for 100 years	Focus on carbon sink in sediment	Sequestering on the seabed in shallow coastal ecosystems	Not applicable for nutrients credits
Sustainability	CO_2 mitigation, community development and ocean restoration as three pillars of their sustainability	Focus on climate mitigation	Ecosystem restoration, social benefits, scalable	Improve water quality

Seaweed farming in Eastern Scheldt, Netherlands © Sander van den Burg.

life-cycle analysis, as specified in ISO 14040 and ISO 14044. The process is divided into three steps: quantify, certify and verify. Each step has a checklist of information to deliver. ONCRA deals with the remaining uncertainties by adjusting the amount of credits released based on the technology readiness level (TRL) of a project. A buffer pool related to the TRL is held, ranging from 50 per cent for TRL 1–3, 35 per cent for TRL 4–6 and 20 per cent for TRL 7–9. This means that this percentage of credits is marked as 'on hold' until the applicable protocol has proven the physical removal and storage of CO_2.

The example of ONCRA shows that there are ways to deal with uncertainties in the quantification process. Assessing the TRL of the project or keeping a buffer pool for potential overestimation are two ways to allow climate change mitigating projects and companies to get support via carbon credits despite a remaining level of uncertainty. This paves the way forward in a situation where the critical situation and urgency faced with climate change outweighs remaining uncertainties. Uncertainties are not neglected, and the methodologies can always be updated and further developed, but it may open the road for projects and actions with high climate change mitigation potential, what would have otherwise been excluded.

> "There is a growing global interest in blue carbon from seaweed."

The step for marine lower trophic species, like seaweed and oysters, to be included in the global standards is not far off – and since they comprise similar verification processes, their carbon certification could be similar to other blue carbon ecosystems. The Verified Carbon Standard methodology for tidal wetland and seagrass restoration outlines procedures to estimate net GHG reductions and removals from project activities aiming at restoring tidal wetlands. The standard provides a detailed list of applicability conditions, addressing the type of activity, requirements for the project area, for example. It also presents a list under which conditions the methodology is not applicable, for instance if the activity qualifies for another accounting like REDD+, or if the project activities lead to a significant increase in GHGs outside the project area. An activity methodology is used for the additionality assessment, while for crediting the baseline for all projects a project methodology is used. It furthermore provides detailed methodologies for temporal and geographical boundaries and describes carbon pools and the different sources of green.

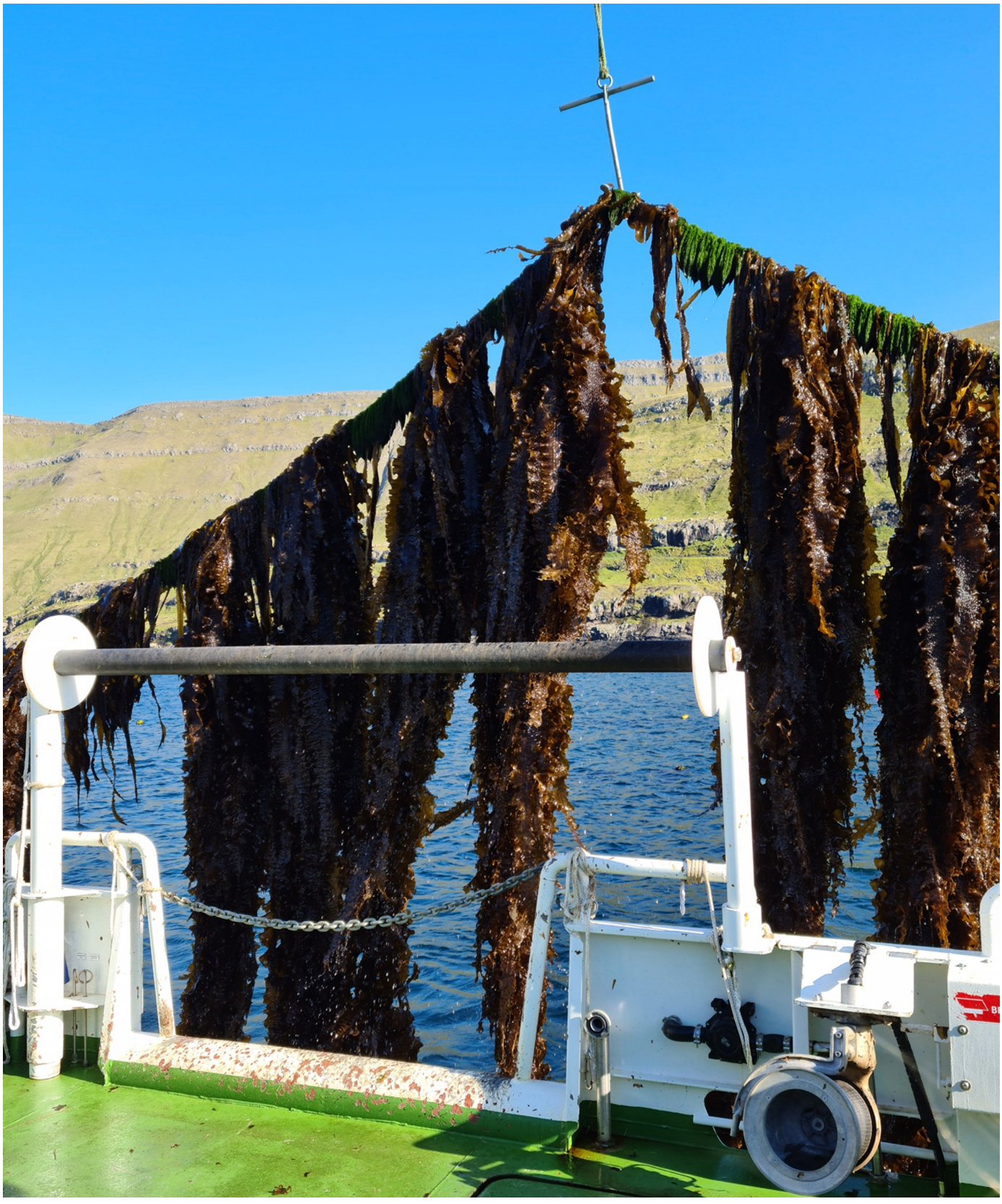
ONCRA differentiates between carbon removal credits and traditional carbon credits, which may only include emission reduction. Removal credits make sure that CO_2 is actually removed from the atmosphere. The company adheres buyers to the Oxford Principles, meaning that buyers of the credits (1) reduce their emissions, (2) shift to carbon removal offsetting, (3) shift to long-lived storage, and (4) support the development of net zero aligned offsetting.

Conclusions and recommendations

Issues like applicability and additionality of carbon offsetting are of recurrent concern in carbon certification and the examples reviewed illustrate it is possible to deal with these when discussing the carbon sequestration potential of seaweed. The importance of

seaweed farming and the possible contribution to CO_2 removals in marine and coastal ecosystems are widely acknowledged, but uncertainties regarding a long-term accountability for certified tradeable credits remain.

We call on the European Commission to move forward towards certification of blue carbon from marine lower trophic species such as seaweed under the development of the blue (bio-) economy (European Commission, 2022). We do not suggest that the seaweed sector needs fully certified, tradeable credits traded on exchanges like the European Climate Exchange right from the start of this process. We recommend a much less demanding approach to stimulate engagement



Seaweed lifted out of the water near the coast of Faroe Islands © Sander van den Burg.

and gradually evolving results. Presented above are examples of seaweed and shellfish carbon trading that are already matured and could be accelerated through public support.

One of the first steps could be to develop a platform for sharing knowledge and experiences in this field of interest. There are examples to build on, like the example from Venice, ONCRA and Oceans 2050 who are working on quantification of carbon storage in the sediment, expected to be public in 2023. The initiatives now are mainly private ones, while the public sector remains largely invisible. Building on examples of how it works, together with a broad field of stakeholders working through a platform for joint learning, could enhance the awareness and the acceptance of the carbon credits from seaweed, address challenges and create societal support for the solutions brought forward.

Secondly, to include seaweed in marine carbon certifications, a commonly accepted methodology has to be developed to quantify carbon credits earned, and to deal with inherent uncertainties. To tackle the uncertainties surrounding the quantity of carbon sequestered, and to ensure the longevity and success of seaweeds in the portfolio of blue carbon, it is crucial to acknowledge uncertainty first and subsequently build on the evidence based science.

The current reforms under the Fit-for-55 package for the period up to 2030 do not envisage any fundamental changes to the governance architecture relevant for carbon dioxide removal. If the EU is to be the global leader in combatting climate change, certified carbon removal using seaweeds should be further elaborated within an EU program, accompanied by a transparent and participatory development of a matching governance structure. In this process it is pivotal to look further than merely technology and business aspects. Social and ethical considerations must be central to arrive at long-term societal support for blue carbon credits.

Notes

For more information, see these websites:

- Blue Marine Foundation https://www.bluemarinefoundation.com/projects/blue-carbon/ 21.01.2023
- ONCRA (Open Natural Carbon Removal Accounting): www.oncra.org 21.01.2023

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Summary

Time to Include Blue Carbon from Seaweed in Voluntary Carbon Removal Certification

The EU has proposed a voluntary framework for certification of carbon removals which remains vague on blue carbon and in particular, carbon removal through use of seaweeds. Seaweed is considered an emerging blue carbon option. Various studies have confirmed the potential of seaweed to contribute to long-term carbon removal, storing it away from the atmosphere for 100 years and more. Certification of seaweed carbon sequestration is promoted, even in other EU communications. This article reviews early experiences with certification of carbon and nutrient removal by aquaculture using the QU.A.L.ITY criteria proposed by the EU. Examples reviewed include the Seaweed Company, Venice Bay, Yokohama Bayside marine, and Chesapeake Bay in the USA. After reviewing these examples, we call on the European Commission to move forward towards certification of blue carbon. If the EU is to lead global climate mitigation efforts, including carbon removal, it should take seaweed blue carbon seriously and include it in its voluntary framework. To enhance the awareness of the relevance and the acceptance of the carbon credits from seaweed, a methodology has to be developed that, building on experiences gained, deals with inherent uncertainties.

Il est temps d'inclure le carbone bleu des algues dans la certification volontaire des absorptions de carbone

L'Union européenne (UE) a proposé un cadre volontaire pour la certification des absorptions de carbone qui reste vague sur le carbone bleu et en particulier sur l'utilisation d'algues dans ce but. Les algues sont considérées comme une option émergente de carbone bleu. Diverses études ont confirmé le potentiel des algues à contribuer à l'élimination du carbone à long terme, en le stockant hors de l'atmosphère pendant 100 ans et plus. La certification de la séquestration du carbone par les algues est encouragée, même dans d'autres communications de l'UE. Cet article passe en revue les premières expériences de certification des absorptions du carbone et des éléments nutritifs par l'aquaculture en utilisant les critères Q.A.L.ITY proposés par l'UE. Les expériences examinées incluent la Seaweed Company, Venice Bay, Yokohama Bayside marine et la baie de Chesapeake aux États-Unis. Après avoir fait le bilan de ces expériences, nous appelons la Commission européenne à avancer vers la certification du carbone bleu. Si l'UE veut diriger les efforts mondiaux d'atténuation du changement climatique, y compris l'absorption du carbone, elle doit prendre au sérieux le carbone bleu des algues et l'inclure dans son cadre volontaire. Afin d'améliorer la prise de conscience de la pertinence et l'acceptation des crédits carbone des algues, il faut développer une méthodologie qui, en s'appuyant sur les expériences acquises, traite des incertitudes inhérentes.

Es ist an der Zeit, blauen Kohlenstoff aus Meeresalgen in die freiwillige Zertifizierung des Kohlenstoffabbaus aufzunehmen

Die EU hat einen Rahmen für die freiwillige Zertifizierung des Kohlenstoffabbaus vorgeschlagen. Dieser bleibt jedoch in Bezug auf den blauen Kohlenstoff und insbesondere den Kohlenstoffabbau durch die Verwendung von Meeresalgen vage. Meeresalgen werden als eine vielversprechende Option für blauen Kohlenstoff angesehen. Verschiedene Studien haben das Potenzial von Algen bestätigt, da sie den Kohlenstoff für 100 Jahre und länger außerhalb der Atmosphäre speichern können. Die Zertifizierung der Kohlenstoffspeicherung durch Meeresalgen wird befürwortet, auch in anderen EU-Mitteilungen. Im vorliegenden Artikel werden erste Erfahrungen mit der Zertifizierung der Kohlenstoff- und Nährstoffbindung durch Aquakulturen anhand der von der EU vorgeschlagenen QU.A.L.ITY-Kriterien beschrieben. Untersucht wurden die Seaweed Company, Venice Bay, Yokohama Bayside Marine und Chesapeake Bay in den USA. Nach der Auswertung dieser Beispiele fordern wir die Europäische Kommission auf, die Zertifizierung von blauem Kohlenstoff voranzutreiben. Wenn die EU eine Vorreiterrolle bei den weltweiten Bemühungen um den Klimaschutz, einschließlich des Kohlenstoffabbaus, einnehmen will, sollte sie den blauen Kohlenstoff aus Meeresalgen ernst nehmen und ihn in ihren freiwilligen Handlungsrahmen aufnehmen. Um das Verständnis für die Relevanz und Akzeptanz von Kohlenstoffzertifikaten aus Meeresalgen zu erhöhen, muss eine Methode entwickelt werden, die auf den gewonnenen Erfahrungen aufbaut und mit den dazugehörigen Unsicherheiten umgeht.