

IPBC Dialogue **Session 9 GHG Inventory**

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Blue Carbon Inclusion into National GHG Inventory of Japan

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Seaweed and Seaweed in Japan

- Traditionally consumed as food
- Conservation/recovery of seagrass meadows and seaweed beds are being implemented by local people/business/fishermen.

Seaweed with its zoospore

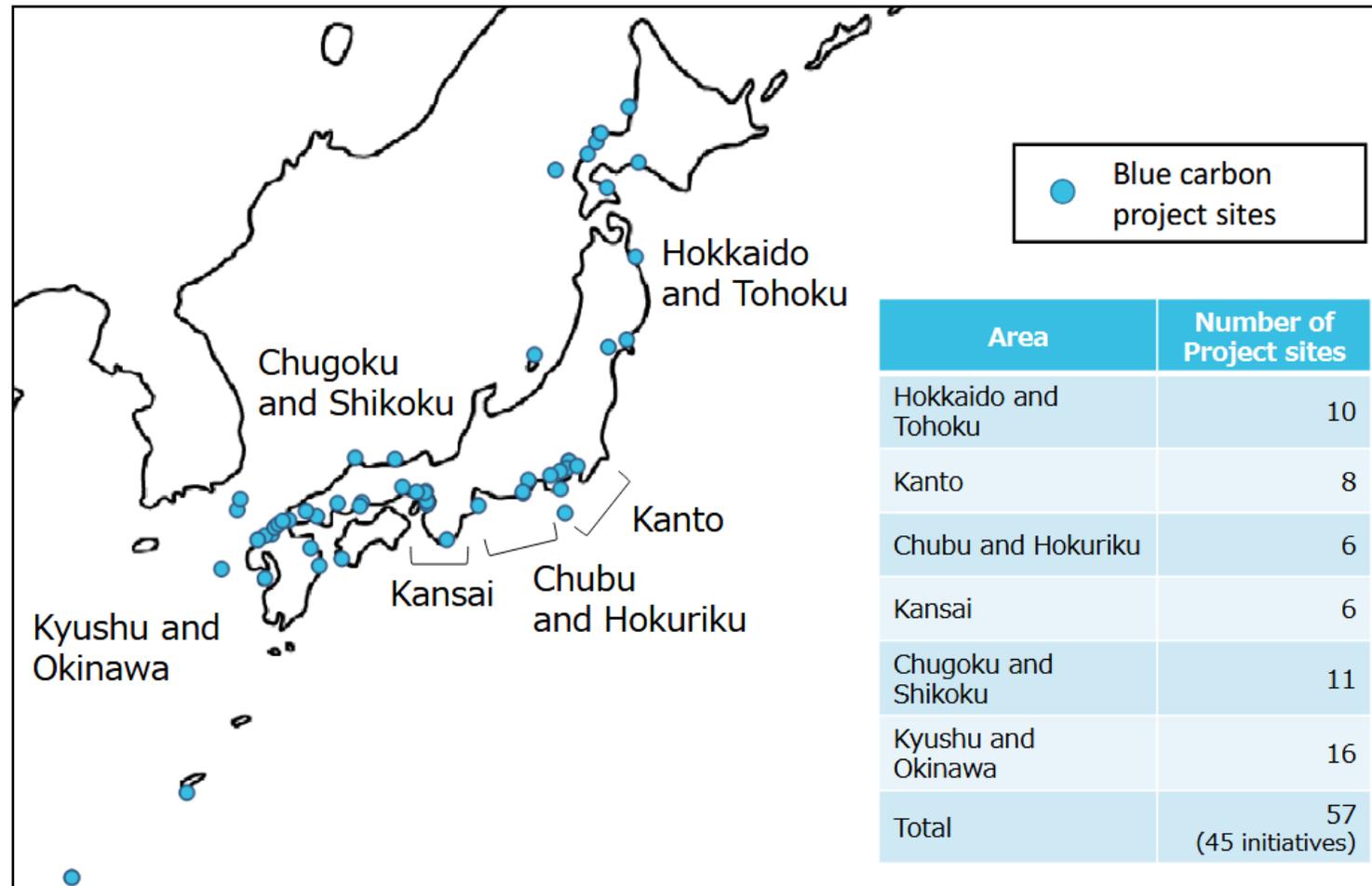


Pictures: "Traditional food in Japan", website of Ministry Agriculture, Forestry and Fishery (MAFF) of Japan



Preservation of seaweed beds (removal of sea urchins)

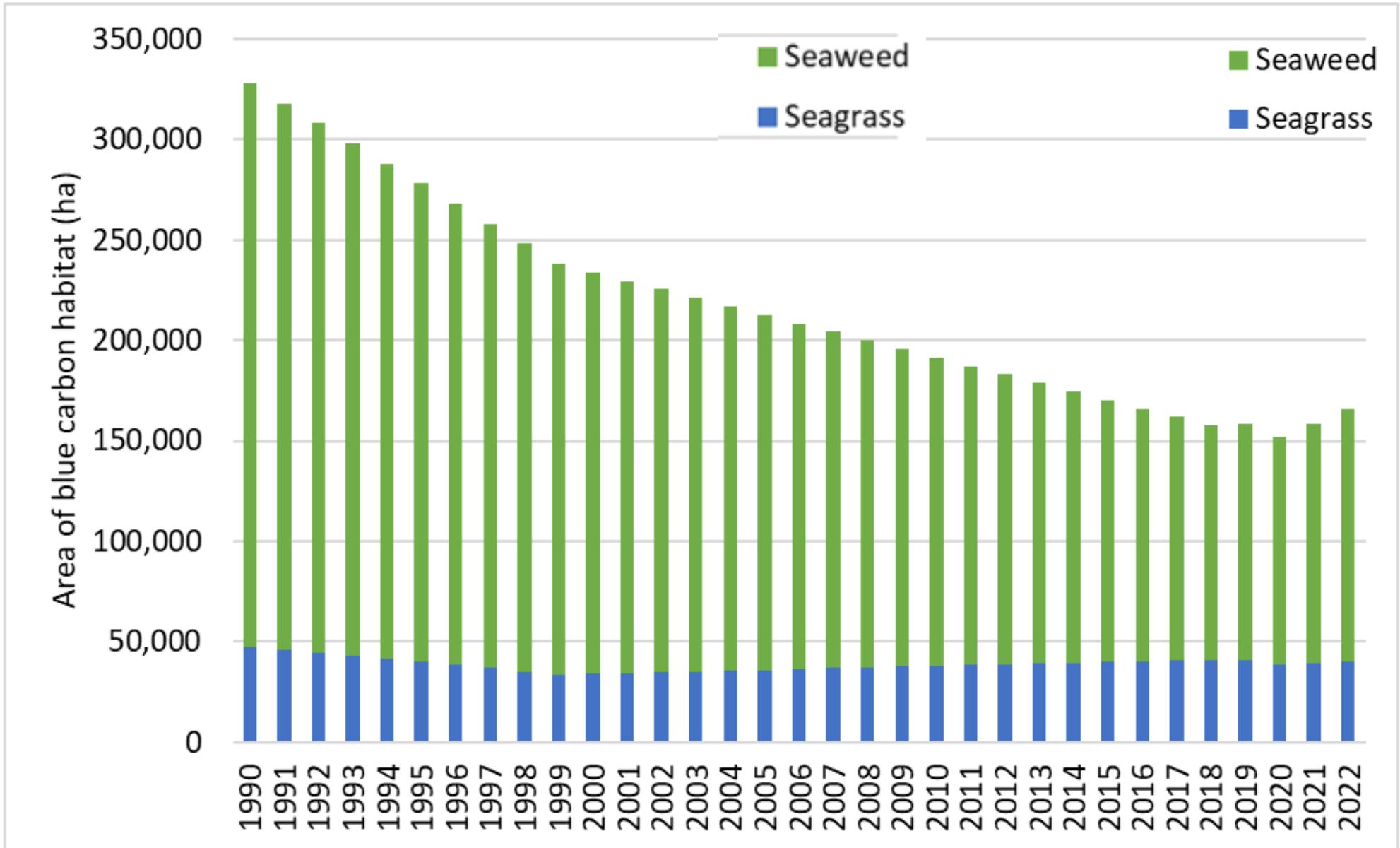
Source: Fishery annual report 2021, Ministry Agriculture, Forestry and Fishery



Source: Case Study on Blue Carbon Initiatives in Japan, MOEJ

Seaweed and Algae in Japan

■ Size of seagrass and seaweed area is decreasing, 160 kha in 2022.



Overview of Blue Carbon Activities in Japan

- Local action is supported by various organizations, because it has **multiple benefits** such as biodiversity conservation, regional development, and environmental education.
- **GHG Inventory** gives those action **scientific basis**.

Financial/Tech Support

■ "Creating Satoumi* Model Project": **MOEJ** has selected **41 projects** and financially supported since 2022.

*Marine and coastal environment along with human settlements

■ **MAFF*** supports local actions. In FY2021, **>400 organizations**, **>58 kha** seaweed beds or tidal flats.

Inter-Ministry / International Cooperation

■ **Blue Carbon Liaison Council** with relevant ministries to share information on initiatives by private sector and ministries.
■ MOEJ became a member of **International Partnership for Blue Carbon (IPBC)**.

Law/Vision

■ **Law** for the Promotion of Activities to Enhance Biodiversity in Local Communities.(in 2024)
■ **Future Vision** of Seaweed Beds and Tidal Flats (Fisheries Agency, revised in 2023)

Carbon Credit

■ **J Blue Credit®**: operated by Japan Blue Economy association (**JBE**), which was authorized by **MLIT**.

Local Action

■ **Conservation** activities
■ **Creating** seaweed
■ **Environmental education**

GHG Inventory

■ **Mangroves** are Reported in April 2023
■ **Seagrasses/Seaweeds** are Reported in April 2024

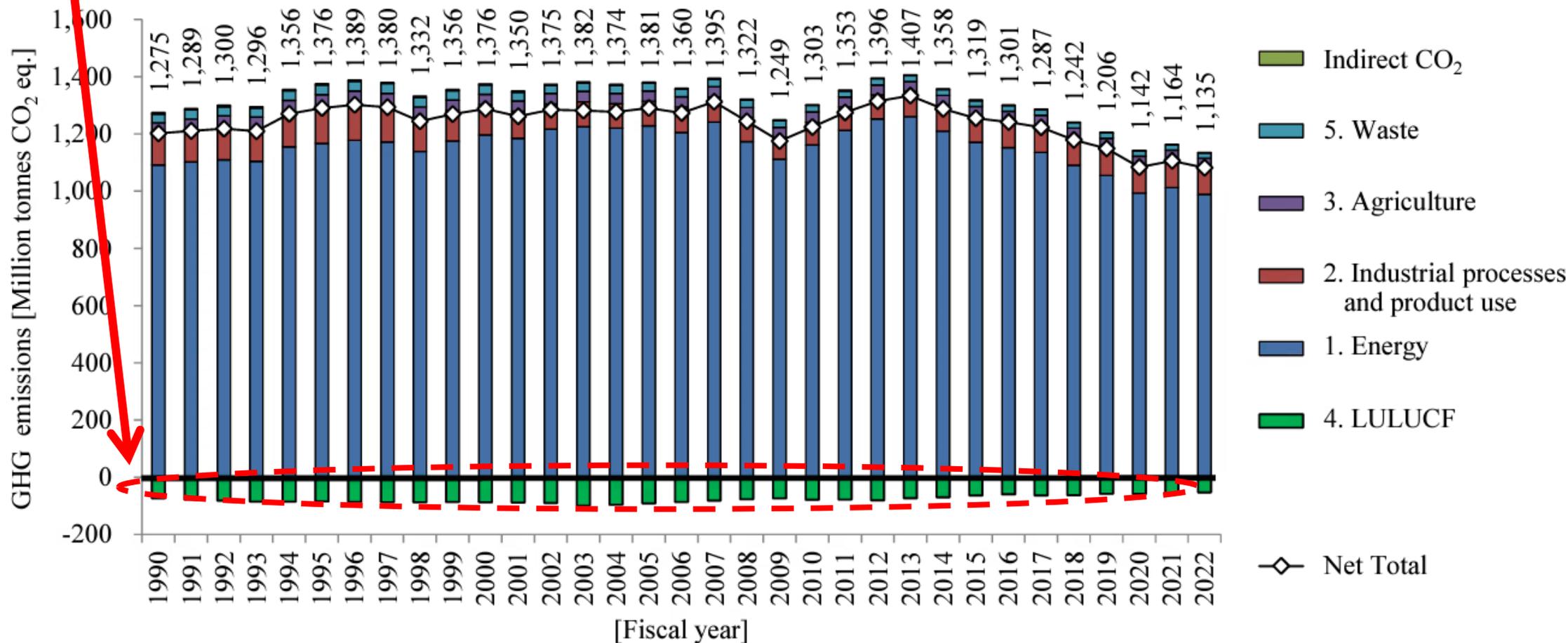
Multiple Benefits

■ Biodiversity ■ Water Quality ■ Tourism ■ Landscape
■ Fisheries ■ Education ■ Food ■ Biofuel and ■ Climate Change Mitigation...etc.

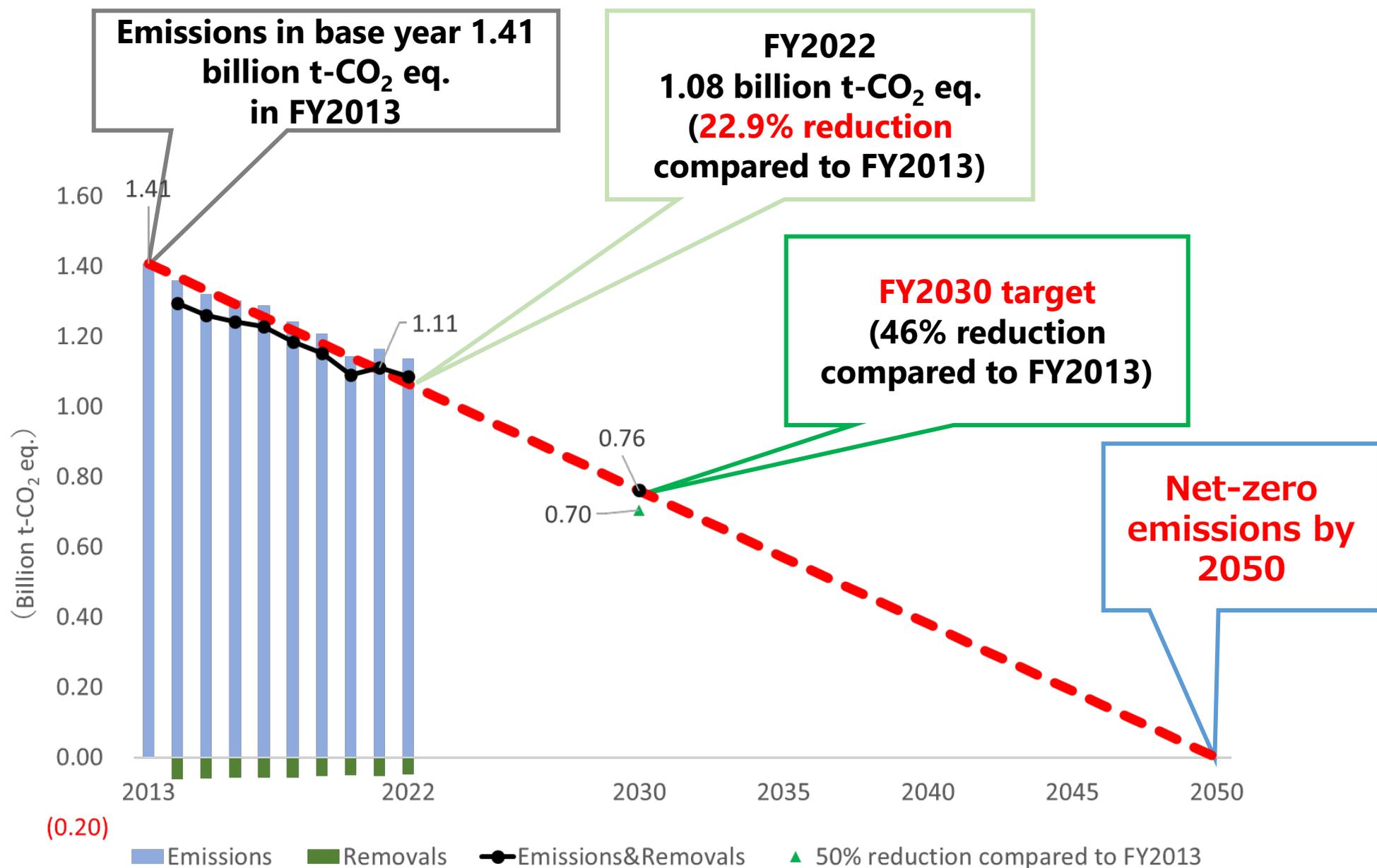
Trends in GHG emissions and removals in Japan

■ Bluecarbon was included in its GHG inventory in April 2024 calculated back from 1990 to 2022.

Blue Carbon is here!



Japan's Medium- and Long-term Targets for GHG Reduction



<Source> Ministry of the Environment of Japan

New calculation of blue carbon ecosystem (seagrass meadows and seaweed beds)

- **For the first time in the world, removals in seagrass meadows and seaweed beds were estimated and reported (approximately 0.35 Mt in FY2022).**
- The IPCC Guidelines provide methodologies for calculating emissions and removals in three ecosystems: mangroves, tidal salt marshes, and seagrass meadows. No methodology is provided for macroalgal beds.
- We are studying an original model to evaluate carbon sequestration in both seaweed and seagrass.

Status of Reflection of Blue Carbon Ecosystems in Greenhouse Gas Inventories



Assessment of carbon sequestration by seagrass and seaweed

- Treatment of CO₂ emissions and removals related to seagrass and seaweed

- IPCC Wetland supplement (2013)

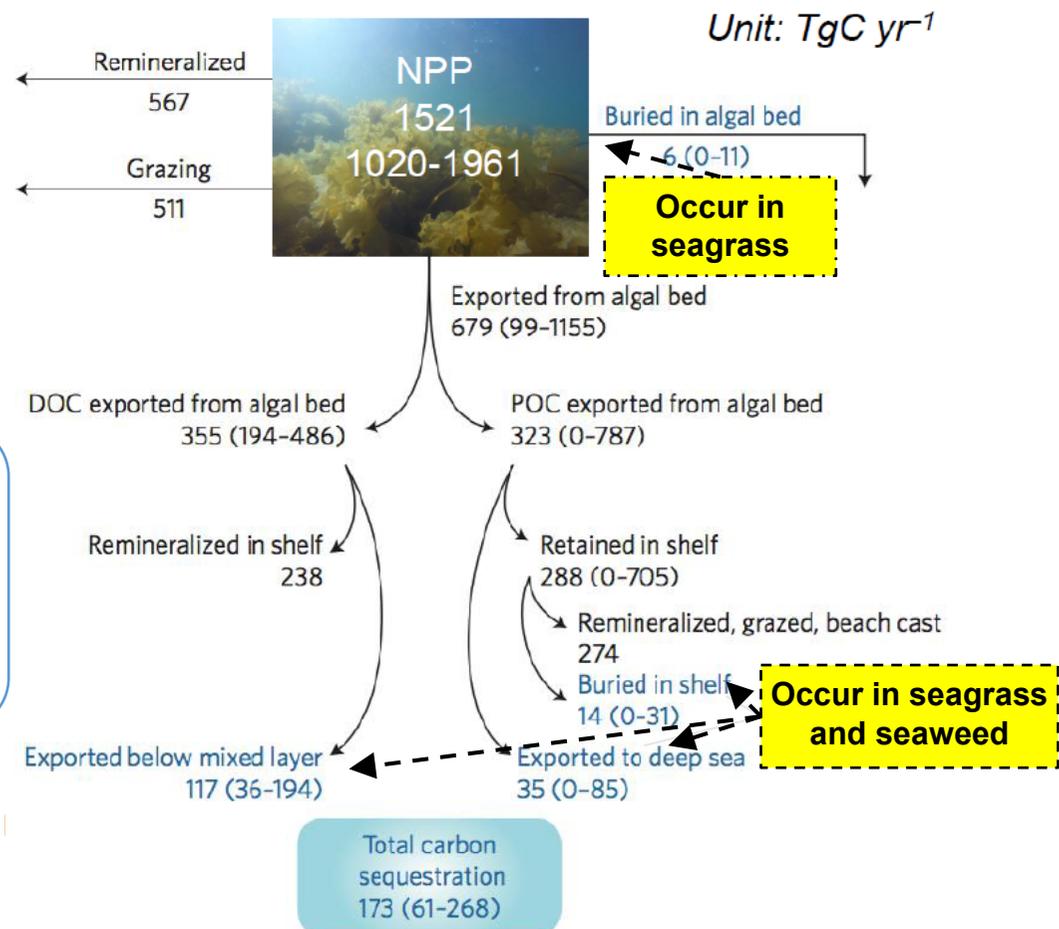
- Covers losses and creation of seagrass meadows only.
- Main carbon pool is on-site soils.

- Recent knowledge

- Covers seagrass as well as seaweed.
- Considers long term carbon sequestration exported to off-site (buried in shelf, exported to deep sea, exported as RDOC)



Japan's BC scientist community have developed ecosystem model to estimate long-term carbon sequestration based on this knowledge



Krause-Jensen and Duarte 2016, *Nature Geoscience*

Figure: Long term carbon sequestration processes based on recent science

Assessment of carbon sequestration by seagrass and seaweed

- Methodology of carbon sequestration calculation

Natural seagrass meadows and seaweed beds

A part of absorbed carbon by seagrass and seaweed exported to long-term sequestration processes. Japan assessed over 100 years sequestered carbon.

$$\begin{aligned}
 \text{CO}_2 \text{ sequestration} &= \sum_{i,j,k} \text{Net Primary Production (NPP)} \times \text{Ratio of long-term sequestration carbon to total NPP (r)} \\
 &= \sum_{i,j,k} \text{Area [m}^2\text{]}_{i,j} \times \text{Biomass/area (=B}_{\text{max}}\text{) [g/m}^2\text{]}_{i,j} \times \text{Annual Production/Biomass = (P/B}_{\text{max}}\text{) [/y]}_{i,j} \times r_{i,j,k} \\
 &= \sum_{i,j,k} \text{Area}_{i,j} \times \text{Fixed CO}_2 / \text{Area}_{i,j,k}
 \end{aligned}$$

i = areas (1,2,...,9)
 j = ecosystem types (1,2,...,16)
 k = sequestration processes (1,2,3,4)

Estimation based on observation such as National Coastal Surveys and modeling (led by **Ministry of Land Infrastructure Transport and Tourism: MLIT**)

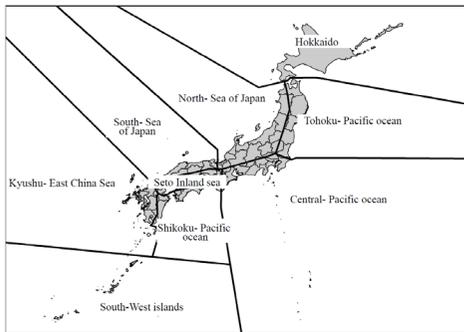
Obtained by scientific research (led by **Ministry of Agriculture, Forestry and Fisheries: MAFF**)

Methodological works for carbon sequestration assessment

- Classification of Seagrass and Seaweed into appropriate level for estimation.

9 sea areas

16 board types of seagrass and seaweed



Source (upper and right) : NID2024 Japan

Type of seagrass and macroalgal		Main species	
Seagrass meadows	Zostera marina type	<i>Zostera marina</i> , <i>Zostera caespitosa</i> , <i>Zostera japonica</i>	
	<i>Zostera caulescens</i> type	<i>Zostera caulescens</i>	
	Phyllospadix type	<i>Phyllospadix ivatensis</i> , <i>Phyllospadix japonicus</i> Makino	
	subtropical small type	<i>Halophila</i> sp., <i>Halodule pinnifolia</i> , <i>Zostera japonica</i> (subtropical type)	
	subtropical medium type	<i>Thalassia hemprichii</i> , <i>Cymodocea serrulata</i>	
subtropical large type	<i>Enhalus acoroides</i>		
Kelps	Kombu type	<i>Saccharina japonica</i> , <i>Laminaria religiosa</i> , <i>Kjellmaniella crassifolia</i>	
	Long-Kombu type	<i>Laminaria longissima</i> , <i>Costaria costata</i> , <i>Alaria</i> sp.	
Macroalgal beds	<i>Eisenia</i> and <i>Ecklonia</i>	<i>Eisenia bicyclis</i> (Arame), <i>Eisenia nipponica</i> , <i>Ecklonia cava</i> (Kajime), <i>Ecklonia kurume</i>	
	<i>Undaria</i>	<i>Undaria pinnatifida</i> (Wakame), <i>Undaria undarioides</i> (Hirome)	
	Sargassum spp.	Temperate <i>Sargassum</i> spp.	<i>Sargassum horneri</i> (Akamoku), <i>Sargassum fulvellum</i> , <i>Sargassum macrocarpum</i>
		Subtropical <i>Sargassum</i> spp.	<i>Sargassum ilicifolium</i> , <i>Sargassum verticostatum</i> , <i>Hornophlsa cuneiformis</i>
	Small green algae	<i>Monostroma nitidum</i> , <i>Ulva pertusa</i> , <i>Codium fragile</i>	
	Small red algae	<i>Gelidium elegans</i> , <i>Chondrus ocellatus</i> , <i>Holmes</i> , <i>Neopropria vezoensis</i>	
	Small brown algae	<i>Dicyota dichotoma</i> , <i>Fucus distichus</i> , <i>Dicvopteris latiuscula</i>	

- Development of parameters

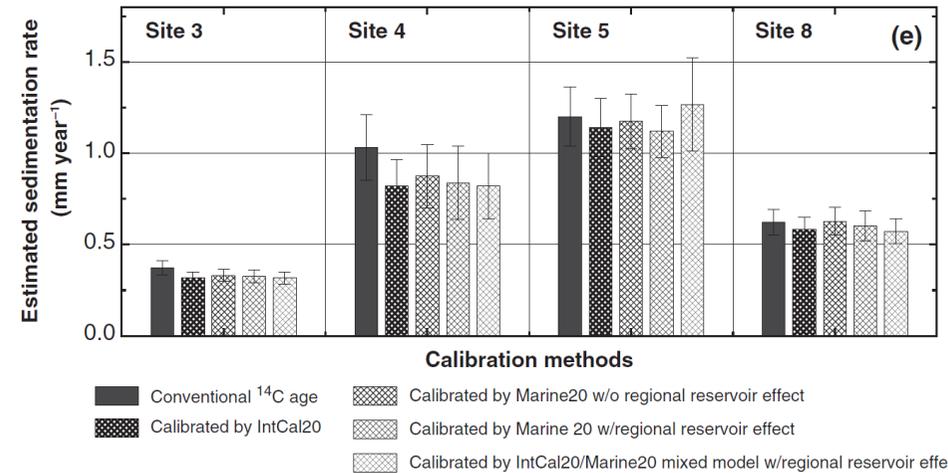
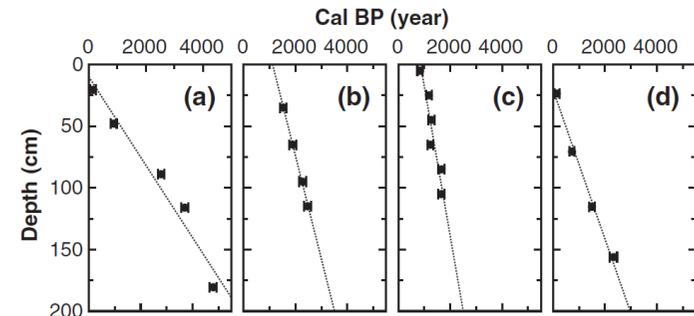
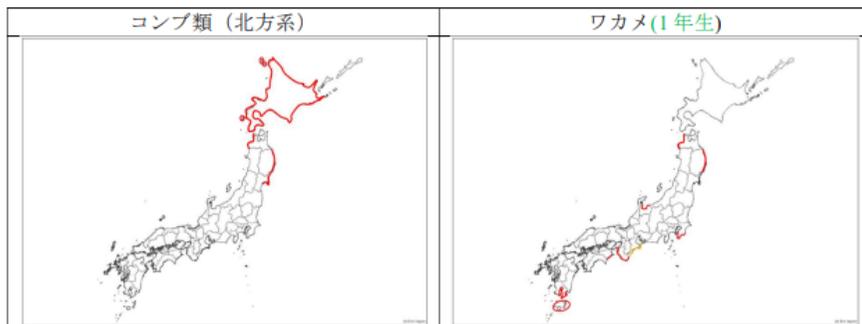


FIGURE 1 Estimation of sedimentation rates by ¹⁴C dating of sediment organic carbon (OC) for four different seagrass meadows. (a–d) Vertical profiles of ¹⁴C age of OC as calibrated by method 4 (see text) for *Zostera marina* meadow sites 3 (a), 4 (b), and 5 (c), and a *Z. japonica* meadow site 8 (d). (e) Comparison of sedimentation rates estimated for the same sites as the slope of sediment depth versus ¹⁴C age calibrated by five different methods described in the text (section 3.1) (mean ± 1σ; see text for details)

Source: Miyajima et al. 2021

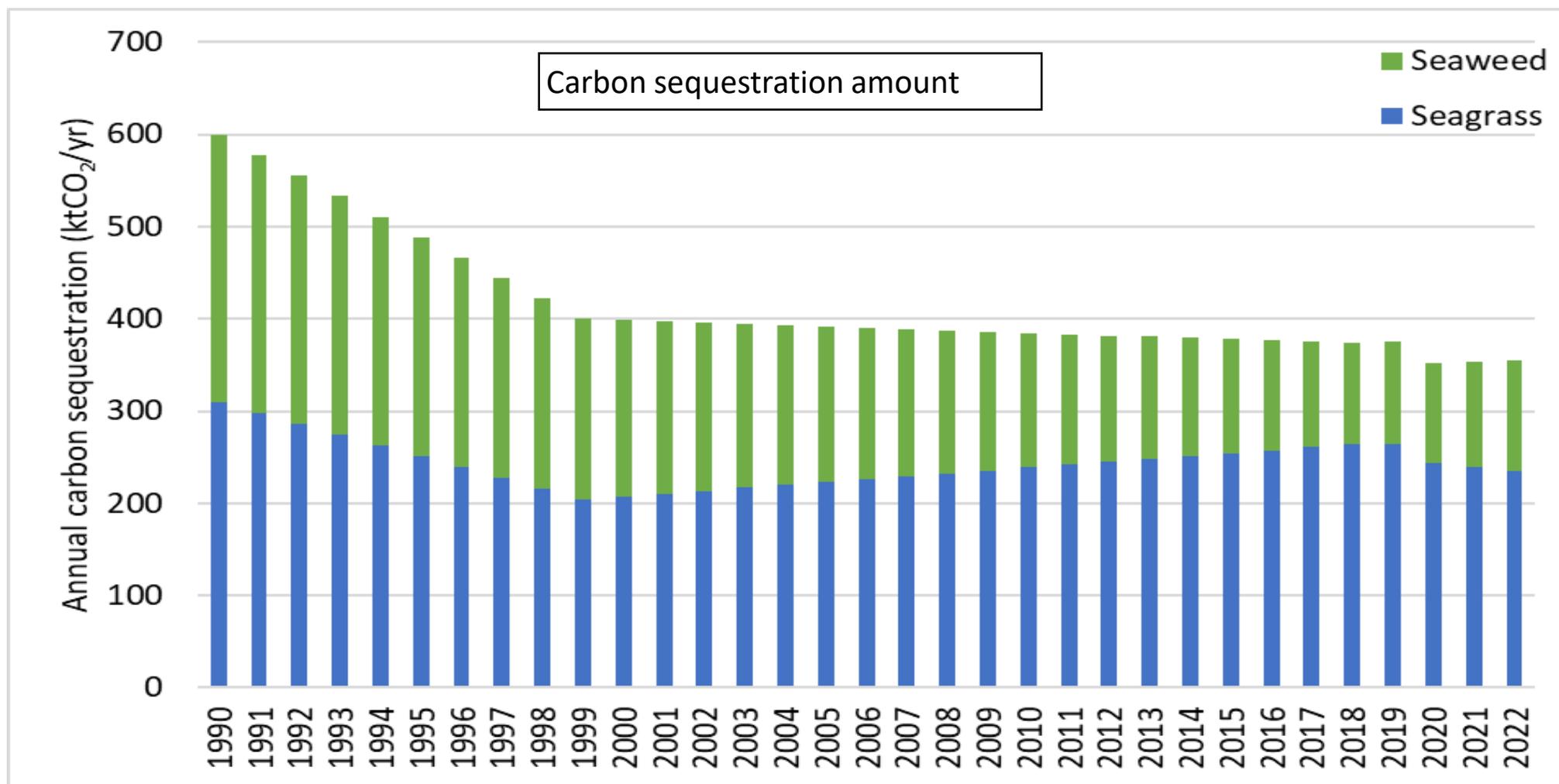
- Assessment of seagrass and seaweed area and development of area estimation method



Source: Fishery agency report about R4 research for basis of fishery

Estimation results of seagrass and seaweed carbon sequestration

- Japan reported about 350-600 ktCO₂/yr of carbon sequestration from seagrass and seaweed in the 2024 GHG inventory.



Data and Details: pp451-457, National Greenhouse Gas Inventory Document of JAPAN (2024)

<https://unfccc.int/sites/default/files/resource/NID-JPN-2024-v3.0.pdf>