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Monitoring seasonal variations in seagrass beds using acoustics method

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Back ground

Sea forests

Community of seagrass or seaweed in shallow waters

Sargassum bed

Seagrass bed

Kelp bed

Sea forests have high ecosystem services

Back ground

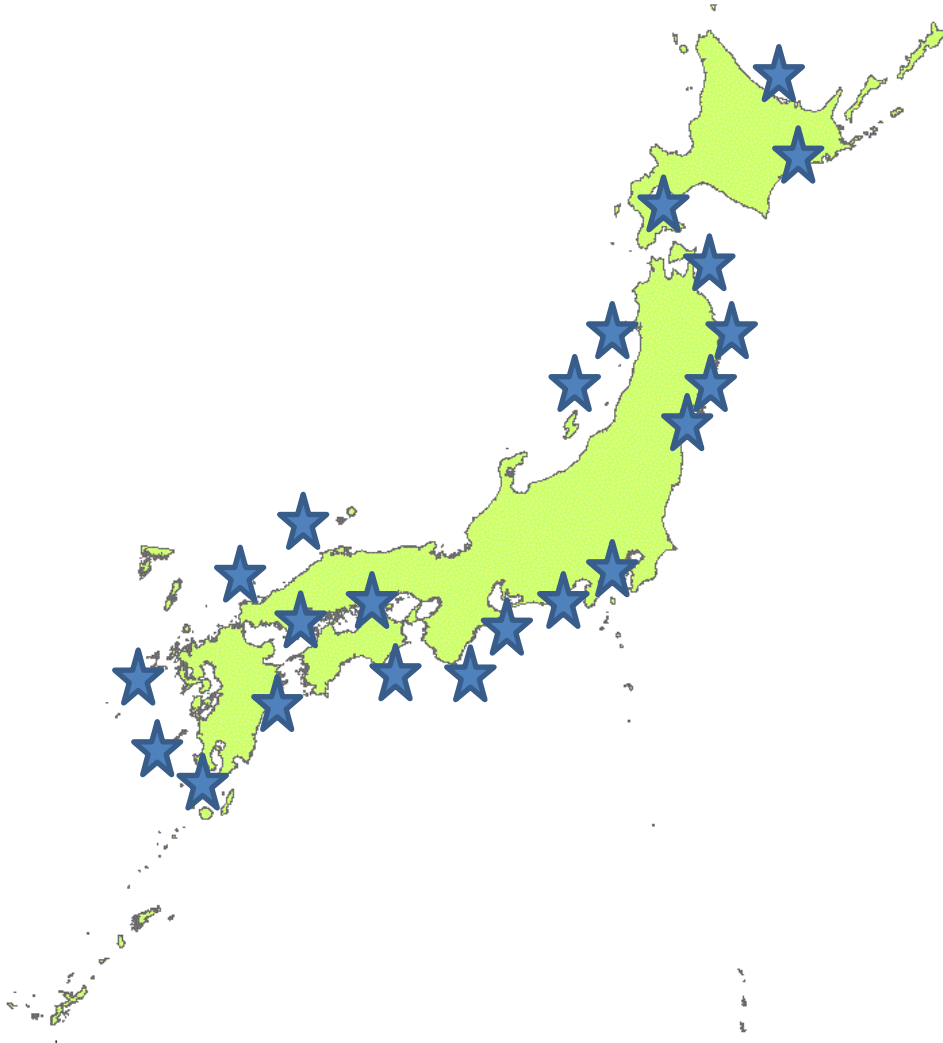
Eelgrass (*Zostera marina*)

In Japan,

- Annual to perennial plants
- Distributed in inner bays from Hokkaido to Kyushu
- Sandy/clay seabeds at one to several meters depth

(Oomori, 2000)

Length・・・Max 120cm
width・・・5～12mm



Seagrass beds contribute many function for ecosystem

Back ground

- Ecosystem service of seagrass bed is **underestimated**

(Shoji,2001)

Large seasonal variations in distributions

Many seasonal difference among function, biota and biomass

(Kamimura et al. ,2009)

- **Decrease** in seagrass bed

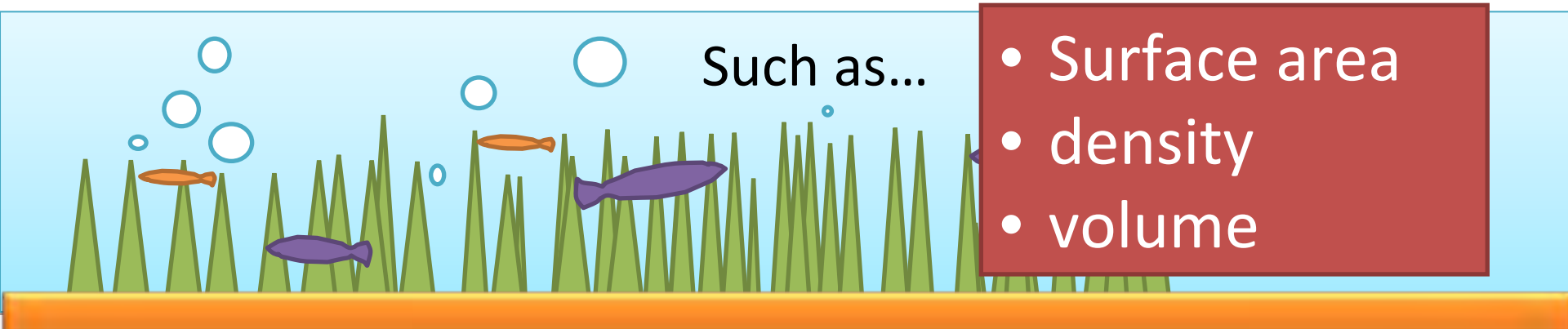
Sea forests has disappeared 40% during 1978 to 2007

(Fisheries Agency, Fishiries white book 2008)

Back ground

- Quantifying ecosystem services of seagrass bed
- Measuring the correct value

Determine the biomass of seagrass bed



Back ground

Methods for estimating the distributions in the past

- Quadrats method
- Visual observation by dives
- Aerial survey

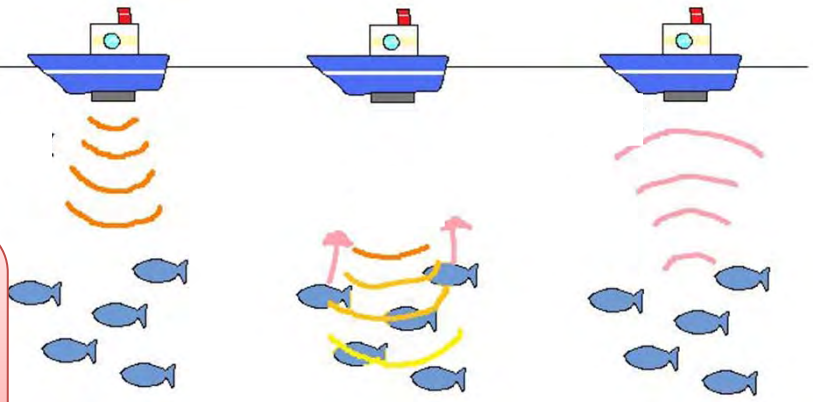
and more…

- Too much effort and time consuming
- Deterioration of estimation accuracy

Need for more simple methods to cover large area

Objectives

Acoustic methods



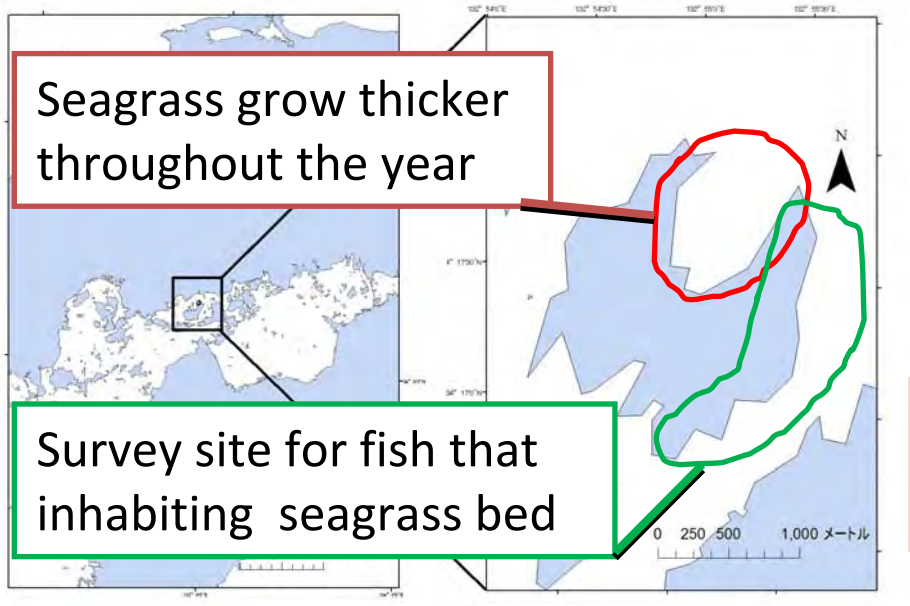
Quickly and quantitatively estimates biomass

In seagrass beds,

- Quantify distributions and test seasonal variation

- Examine and evaluate ecosystem services using estimated biomass

Materials and Methods



- Survey area

Northern and Eastern side of Ikunojima island (area2.26㎢)

off Takehara City, Hirosima

Have many study and knowledge of ecosystem of seagrass bed

e.g. Fish biomass, biota of sea forest
(Hirai et al., 2009 and Kinoshita et al.,2012)

- Survey dates

2011/11/26 (Autumn)
2012/5/23 (Spring)

- Vessel used

Karanusu-maru
(Hiroshima Univ. 2.2t)

Materials and Methods

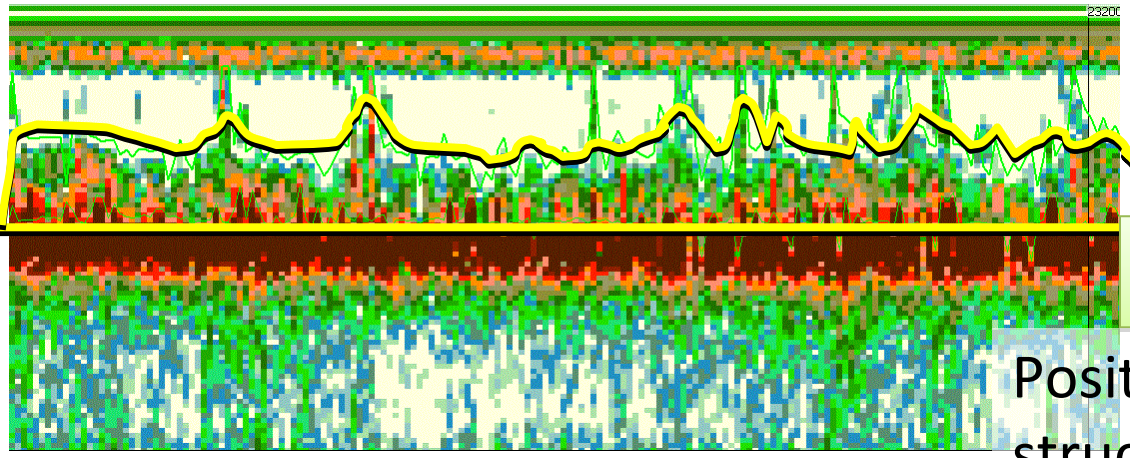
- Small quantitative echosounder KCE-300(kaijo sonic corporation,120kHz)
- Vessel speed, 3knots

- Deploy ROV(Pro3,VideoRay) where detections observed

Identify species and growth condition

- Physical oceanography monitoring with CTD

Positions, Analysis methods

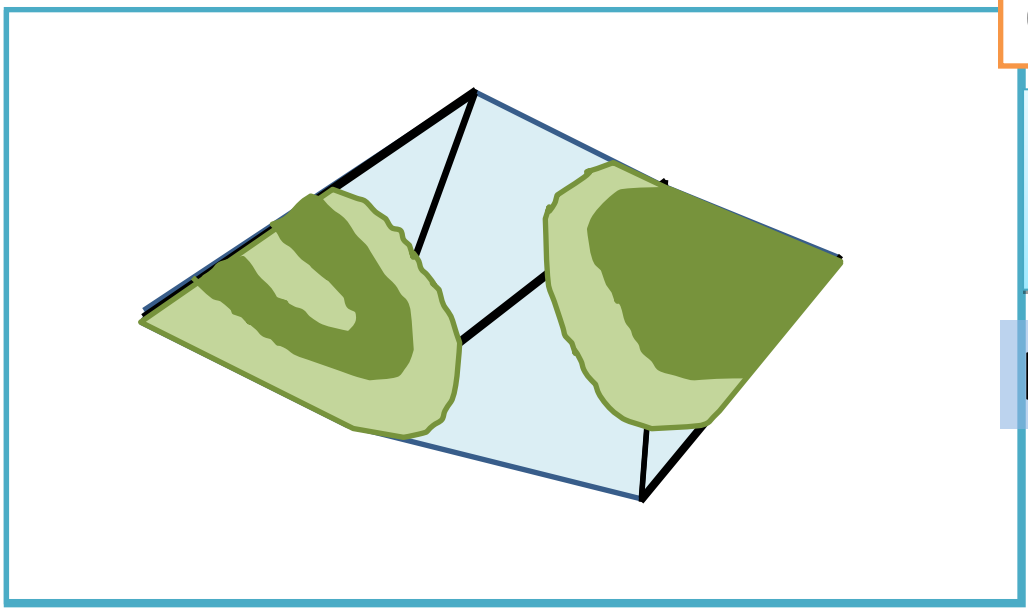


Echo View
(Myriax software Pty Ltd, ver, 4.9)

Extraction seagrass beds

Position, seagrass heights, bed's structures and reflected intensity

Arc GIS
(ESRI corporation, ver, 10)



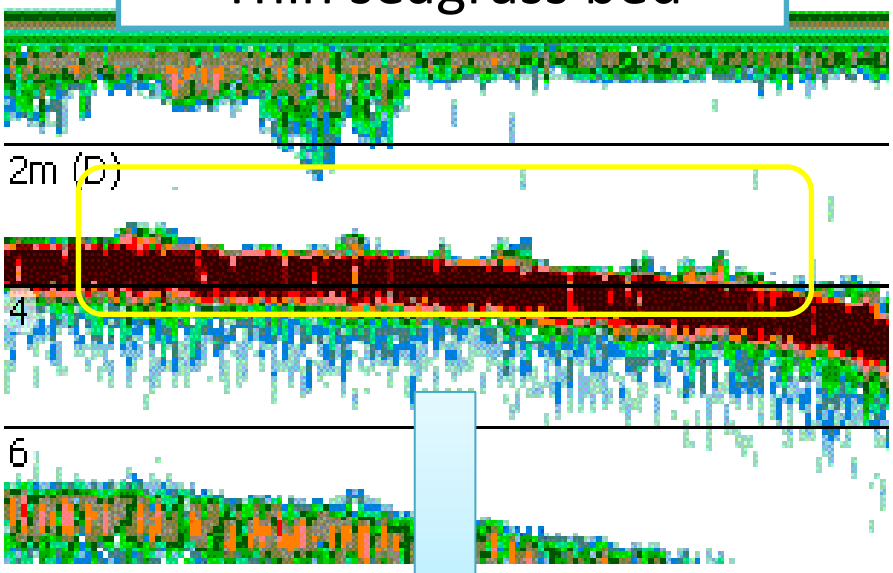
Mapping height of seagrass beds

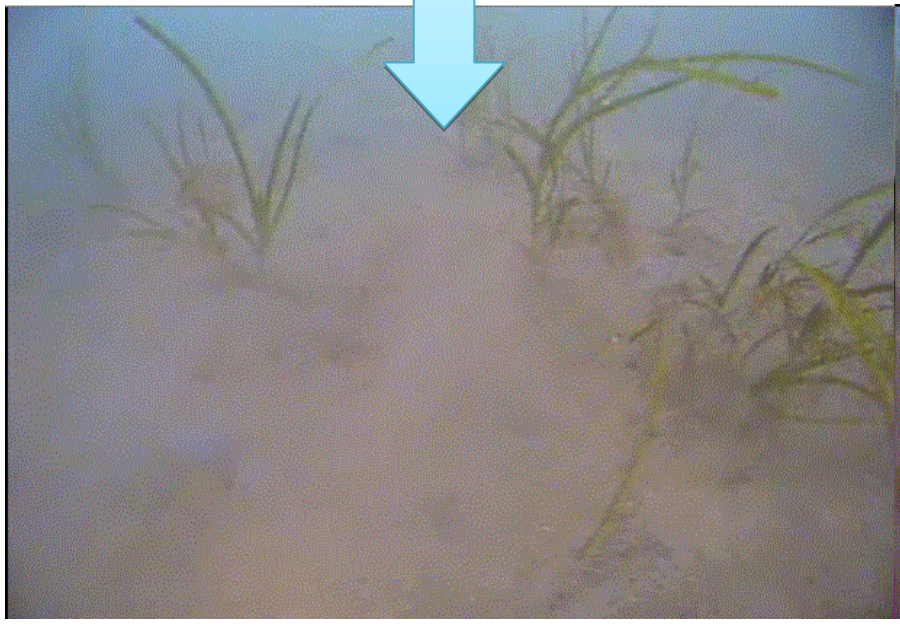
Interpolating using Kriging

Estimating distribution area

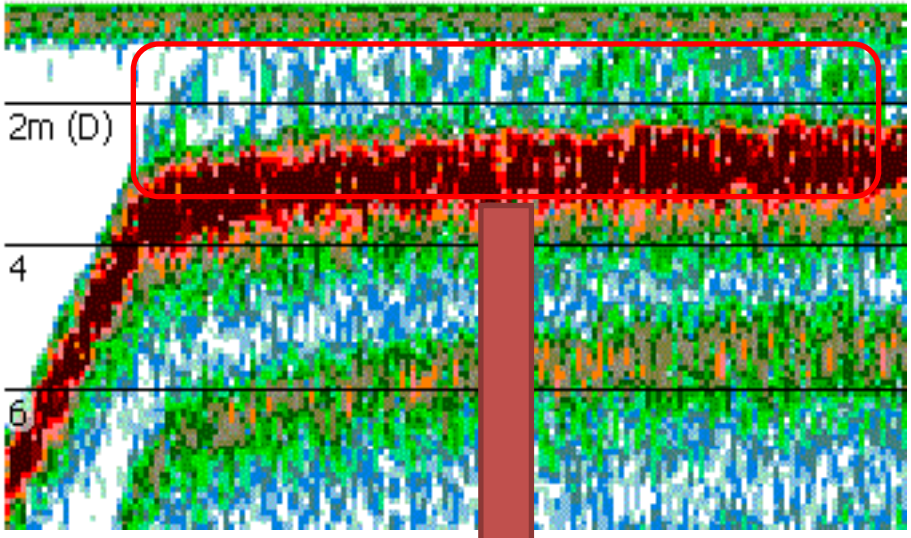
Results: Echosounder and ROV

Thin seagrass bed





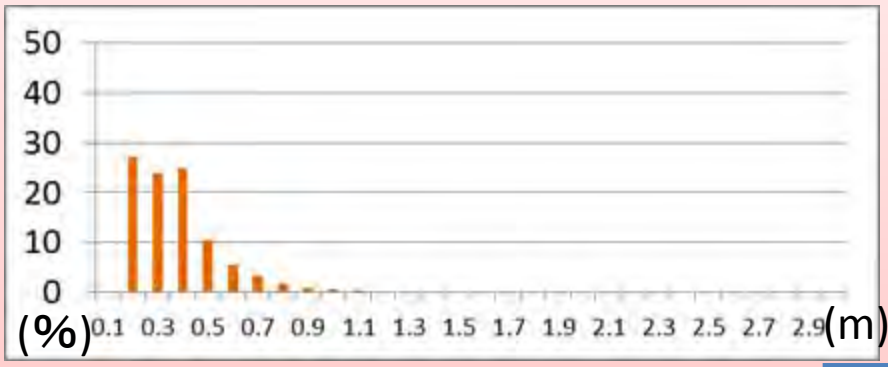
Thick seagrass bed

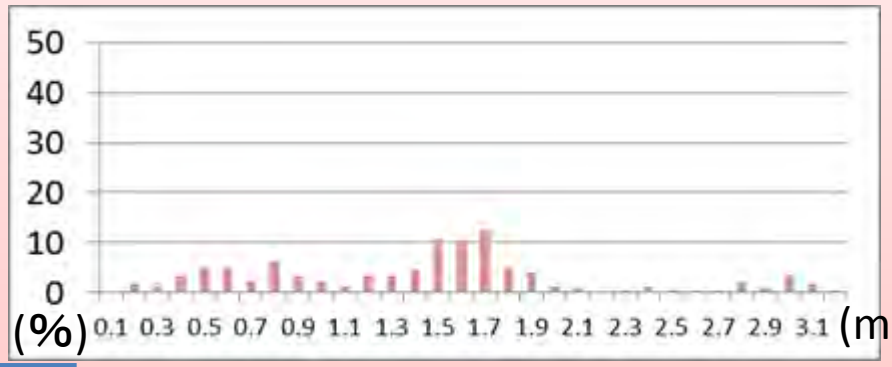


Results: heights of seagrass beds

Autumn	North	East
Mean(m)	0.33	0.28

Spring	North	East
Mean(m)	1.40	0.67

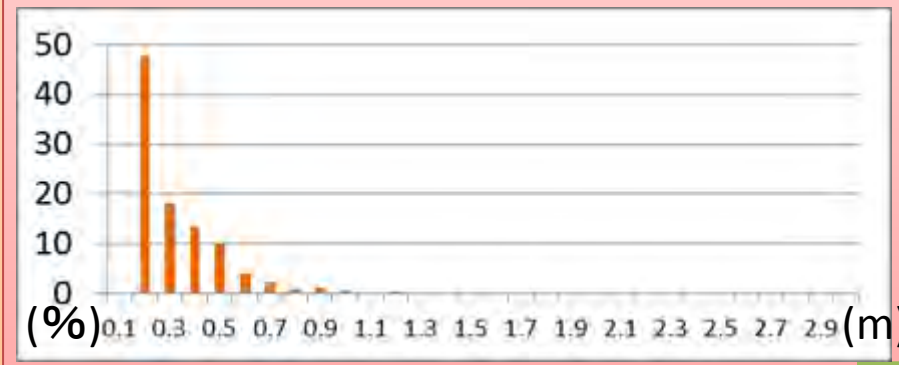


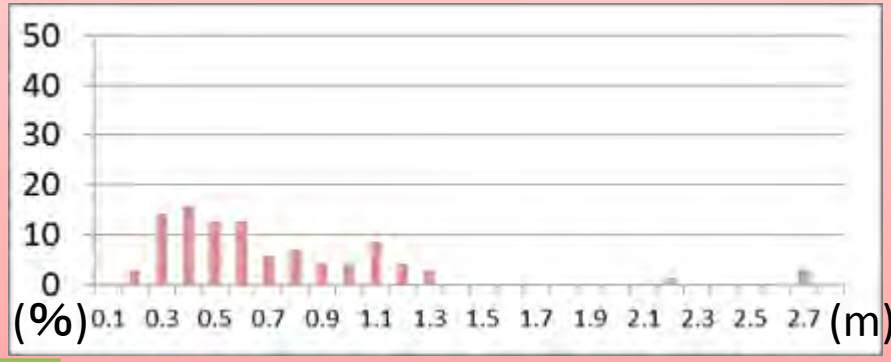


Autumn

North

Spring





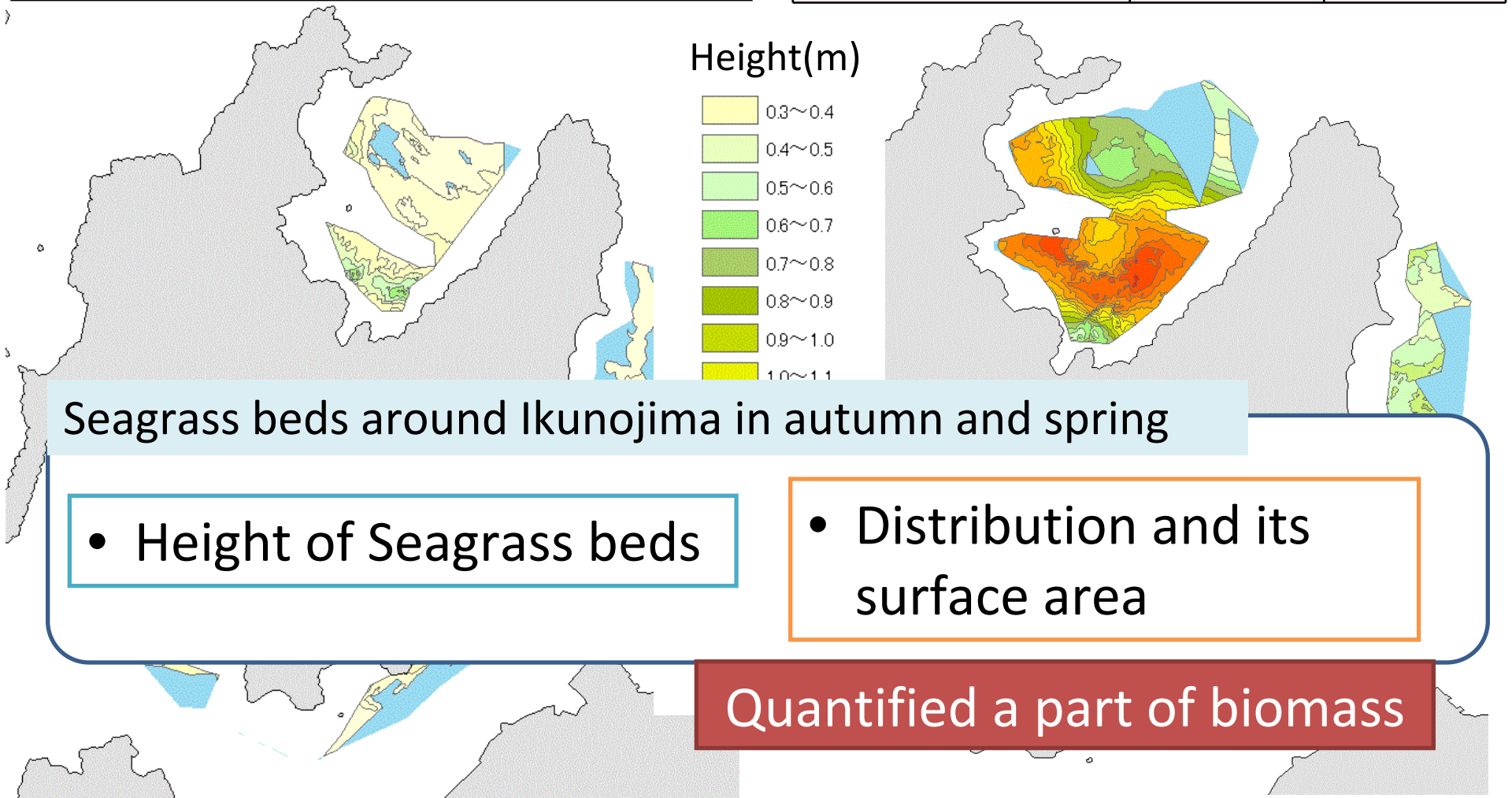
East

(m)

Results: Distribution area of seagrass bed

Autumn	North	East
Area(km^2)	0.18	0.19
Percentage(%)	92.36	61.35

Spring	North	East
Area(km^2)	0.25	0.06
Percentage(%)	81.27	45.21



Seagrass beds around Ikunojima in autumn and spring

- Height of Seagrass beds
- Distribution and its surface area

Quantified a part of biomass

Discussion

	height(m)	percentage(%)
Autumn	0.31	73.28%
Spring	1.04	70.26%

Autumn: **declining** period

Spring: **growth** period

Perennial eelgrass around survey area

Distribution stable throughout a year

Quantified seasonal variations of seagrass beds and verified with previous knowledge

Discussion

Acoustic data of seagrass beds using echosounder

Distribution

Heights

Reflection intensity

\+

Density

From other method

→ Quantitative biomass

Quantify seasonal ecosystem services

e.g.
- Nitrogen fixation
- Photosynthesis
- Fish biomass
- Fish production

Discussion

e.g. Quantify **interim** oxygen production

Oxygen production per unit hour eelgrass dry weight (Apparent photosynthesis)

117.3 μ mol O_2 g^{-1} dry weight h^{-1} (Caffrey and Kemp, 1991)

	Autumn	Spring
Oxygen production per unit area/day (g^{-1} m^{-2} day^{-1})	13.53	45.38

Oxygen production per day/distribution area (t)

Autumn	Spring
0.33	1.40

Quantified part of supporting services

Quantify other services

Thanks to

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