A case study of mapping seagrass in Nanano Bay using Seagrass Mapper

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Northwest Pacific Region Environmental Cooperation Center / NOWPAP CEARAC

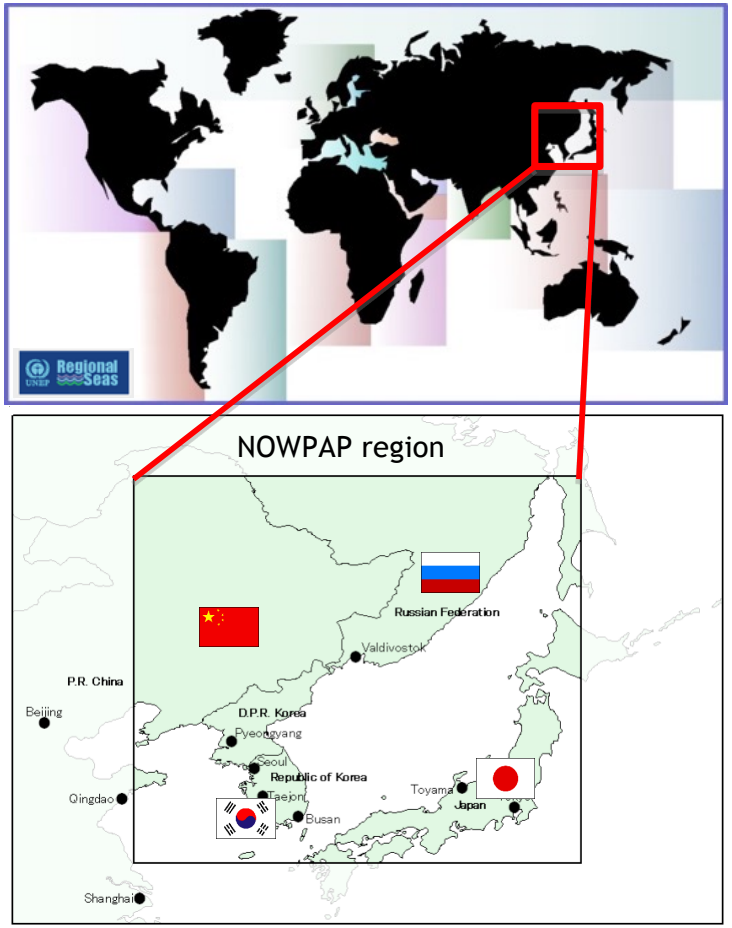
November, 2021

Regional Sea Program and NOWPAP

- Regional Sea Program (RSP)
  - Launched in 1974 by UNEP to address the accelerating degradation of the world's oceans and coastal areas.
  - RSP covers 18 regions across the world today

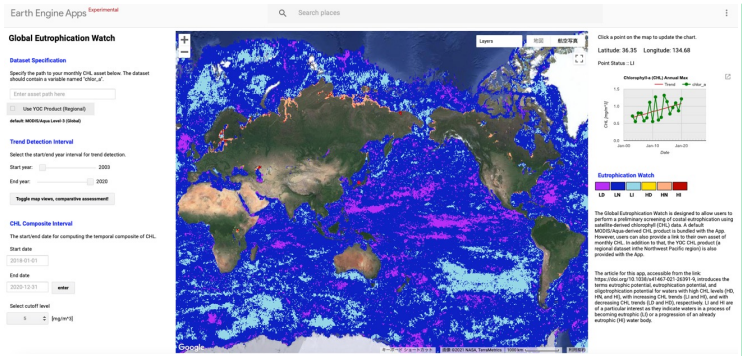
- NOWPAP

  (Northwest Pacific Action Plan)
  - Adopted in 1994
  - China, Japan, Korea and Russia
  - Latitude 33 - 52ºN
  - Longitude 121 – 143E

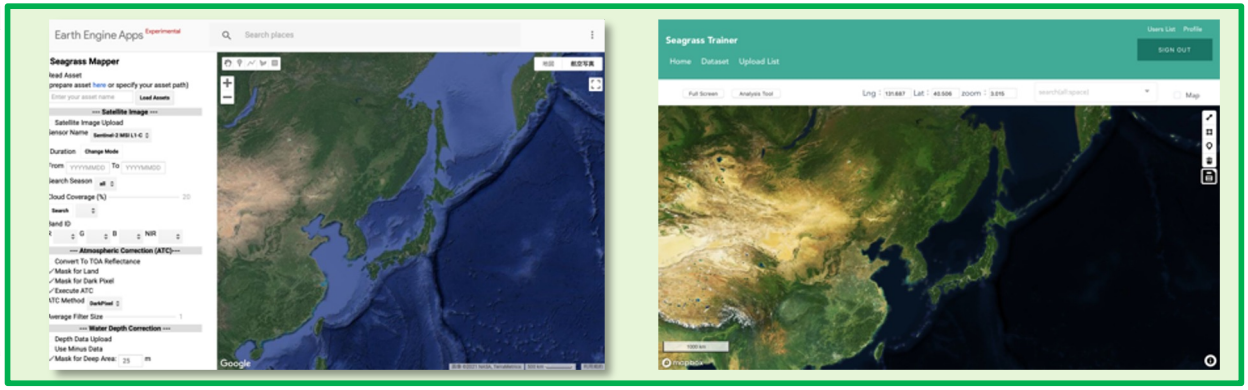


NOWPAP CEARAC leading cloud based remote sensing of marine environment

- NOWPAP Special Monitoring & Coastal Environmental Assessment Regional Activity Centre (CEARAC) is hosted by NPEC, as one of the regional activity centers of the NOWPAP.
- NOWPAP CEARAC specializes in monitoring and assessment of coastal environment using satellite remote sensing.



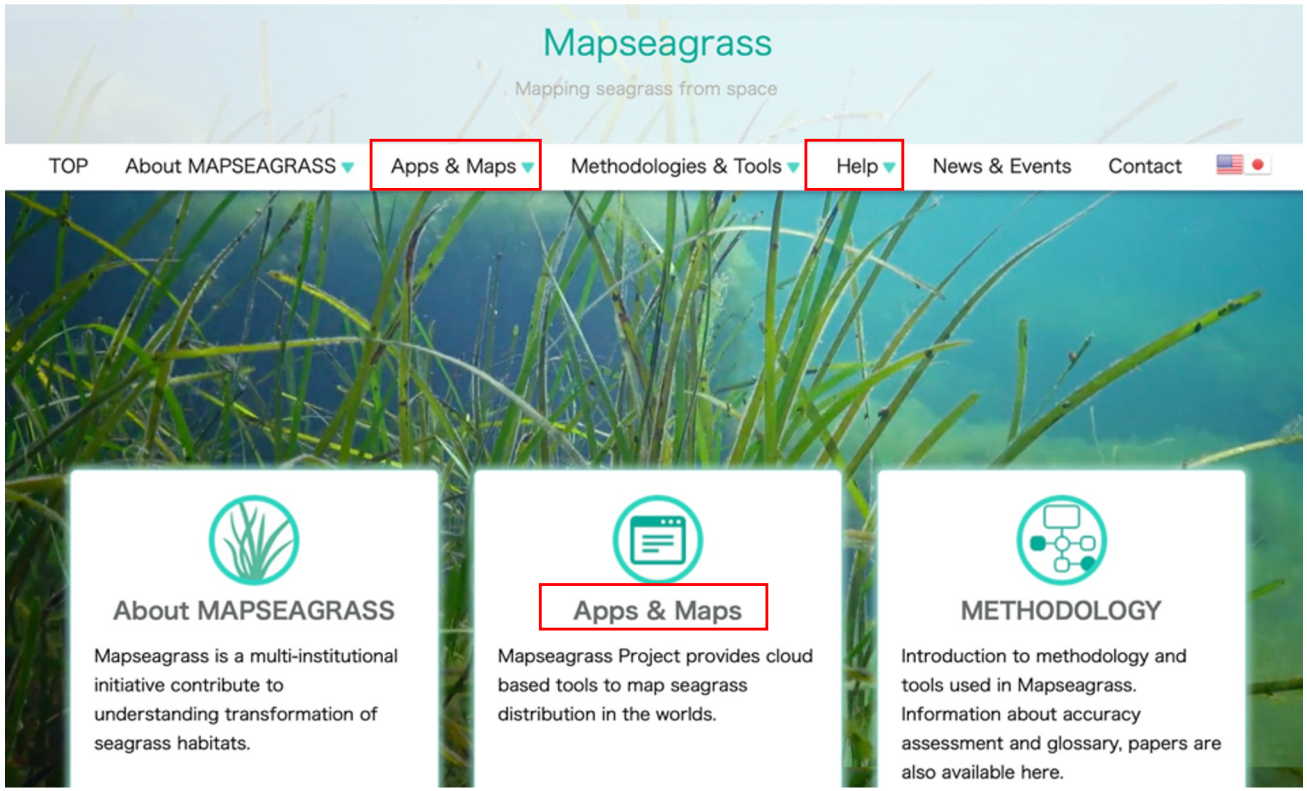
Global Eutrophication Watch



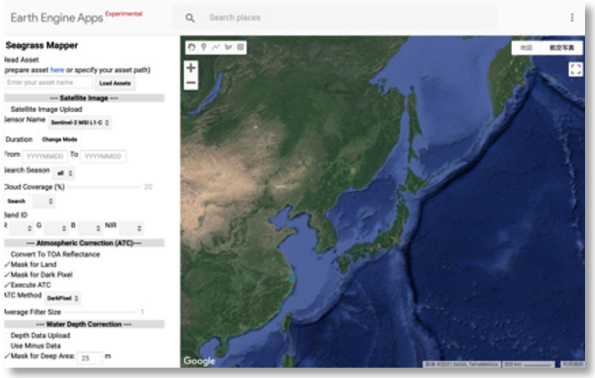
Seagrass Mapper

Seagrass Trainer

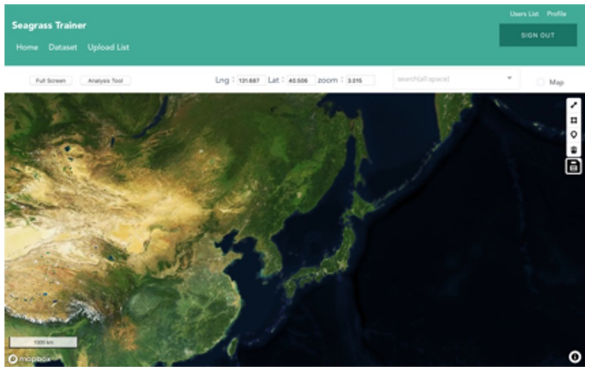
Accessing Seagrass Mapper and Seagrass Trainer



mapseagrass.org

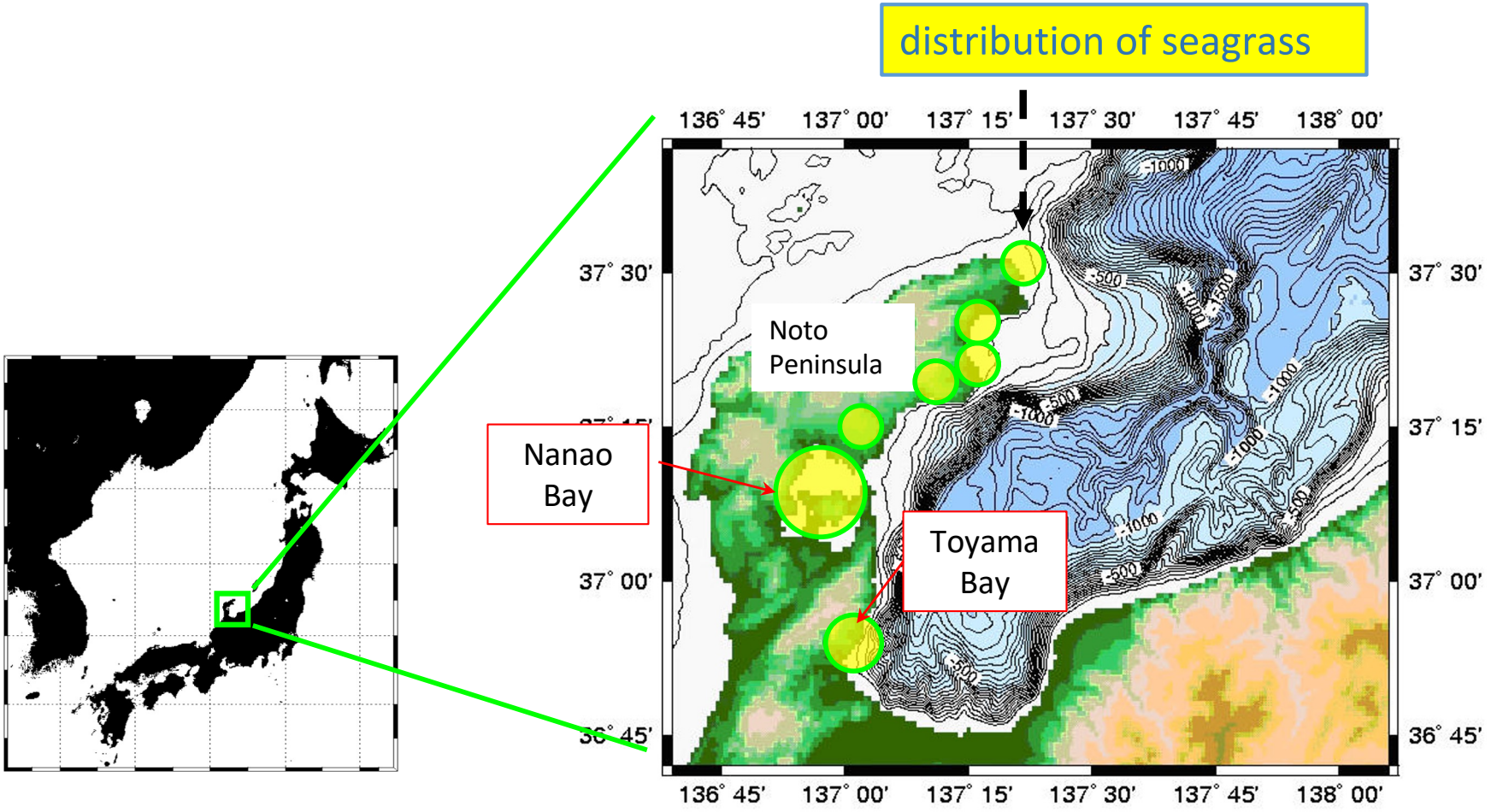


Seagrass Mapper



Seagrass Trainer

Location of Nanao Bay



A large scale die off of zostera marina has been reported…

A large scale seagrass die off has been observed in October 2012 due to high temperature (> 30 degree C) in summer (Ikemori et al, 2016), but not in 2013 and 2014 when temperature did not reach to 30 degree C in summer (Higashide et al, 2014).

のと海洋ふれあいセンター研究報告 第 20 号 (2014)

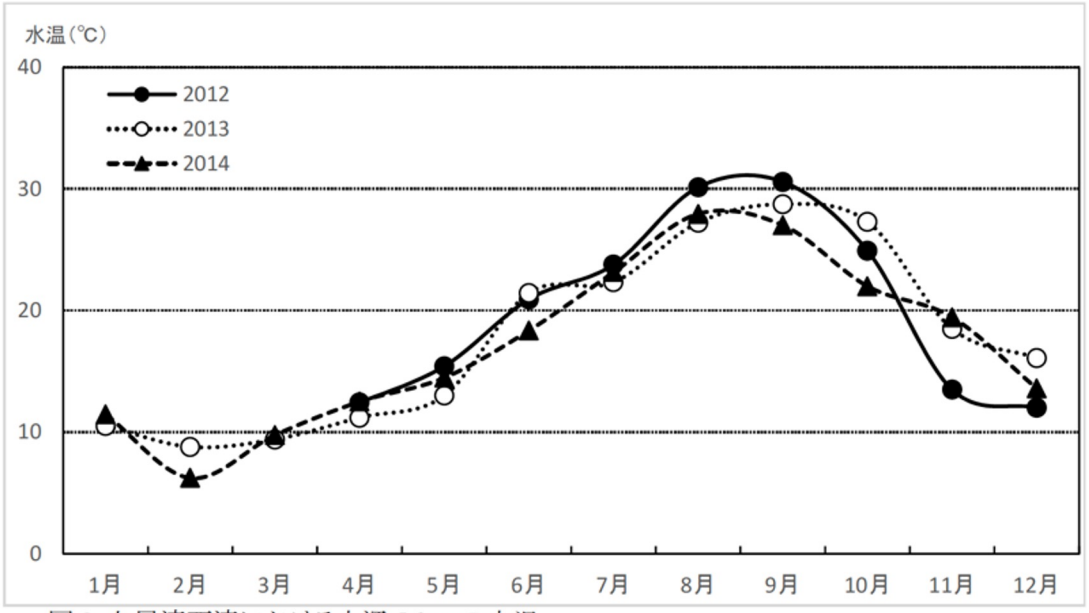


図 2 七尾湾西湾における水深 5.0 m の水温

Mapping seagrass with Seagrass Mapper and Seagrass Trainer

- Years
  - 2015 and 2019 for comparing seasonal change
  - 1994 to 2021 to study interannual change

- Satellite data
  - Landsat 8 OLI (2013-02-11 to present)
  - Sentinel 2 (2015-06-23 to present, 2017-03-07 to present)
  - Landsat 5 (1984-01-01 to 2012-05-05)

- Field data with underwater video camera from ship and stand up paddle surfboards.
  - 2015 June (1, 2 and 16), 2015 October (20 and 21)
  - 2019 June (12 and 13), 2019 October (9 and 10)

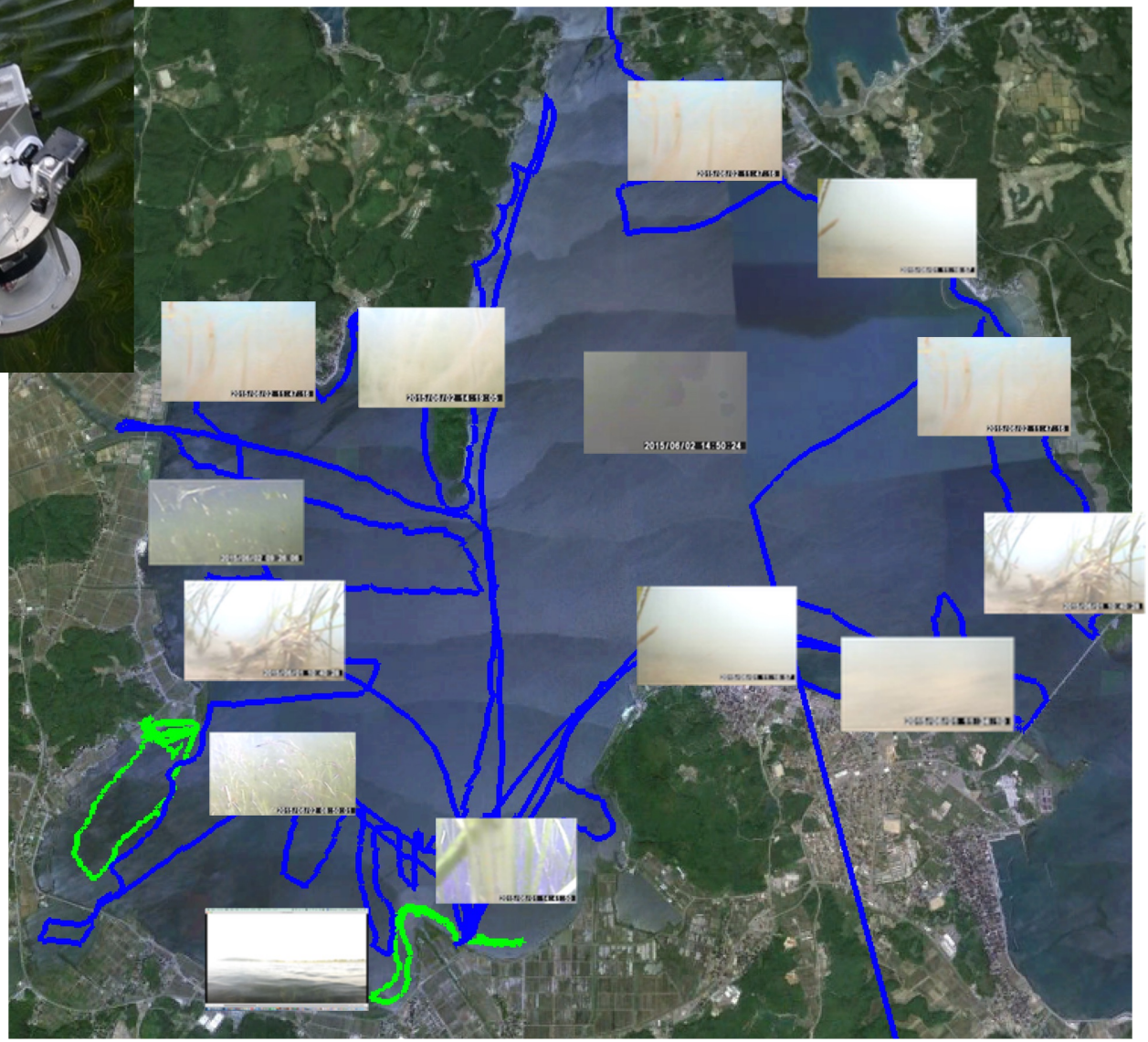
- Image correction
  - Atmospheric correction by deep water method
  - Water column correction by Bottom Reflectance Index (BRI) method

- Classification
  - Supervised classification by random forest method (70% for training 30 % for validation)

Collecting sea floor substrates information

Underwater camera

Visible check on
a stand up paddle surfboard



Defining features and their classes from collected information

sparse seagrass

Sand

Dense seagrass

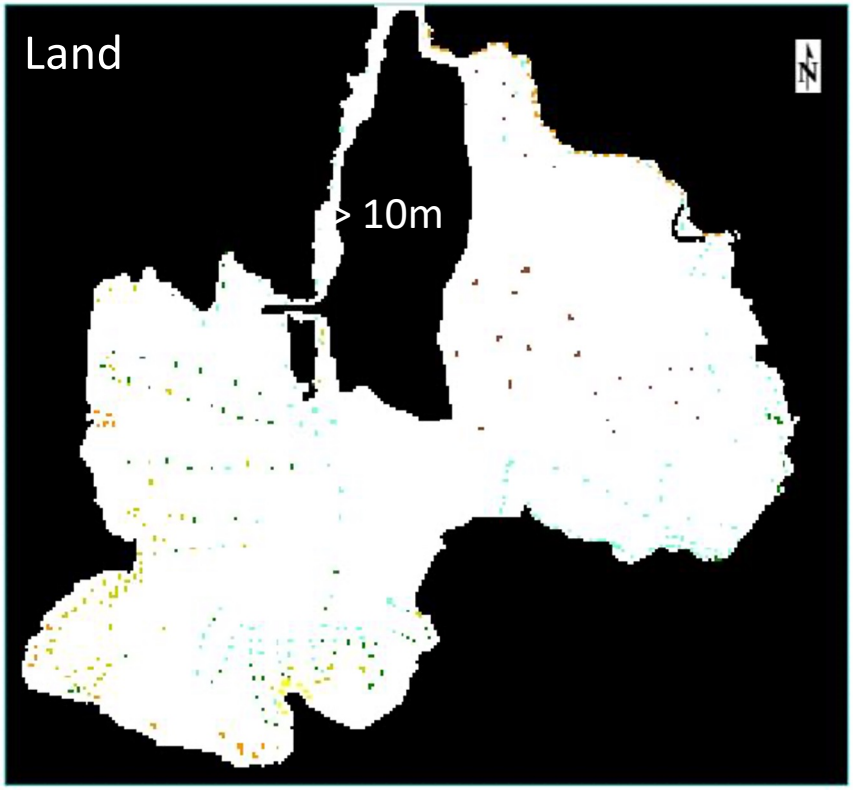
Seagrass with sargassum

Sargassum

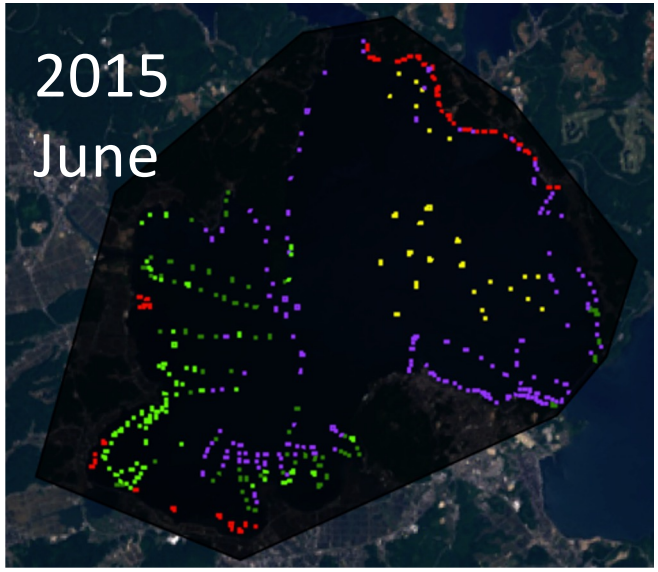
Preparing training data

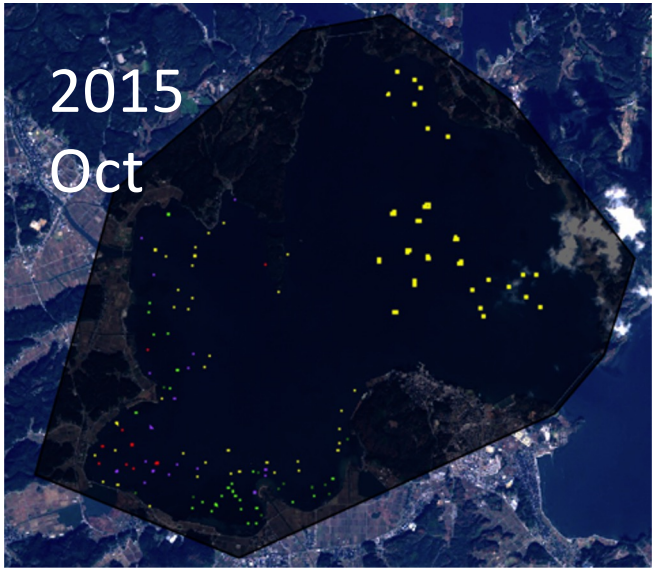
Class (number of pixels)

- Seagrass with sargussum (114)
- Dense Seagrass (104)
- Sparse seagrass (223)
- Seaweed (97)
- Sand-mud (45)



Field data collected





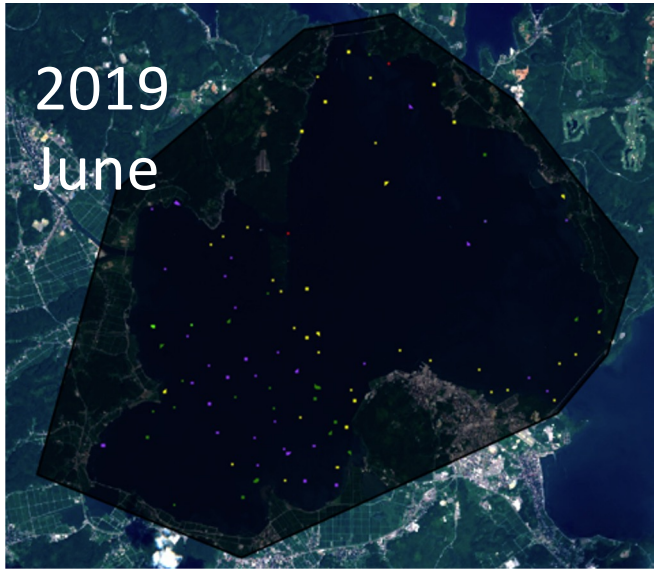
CLS1 Dense Seagrass

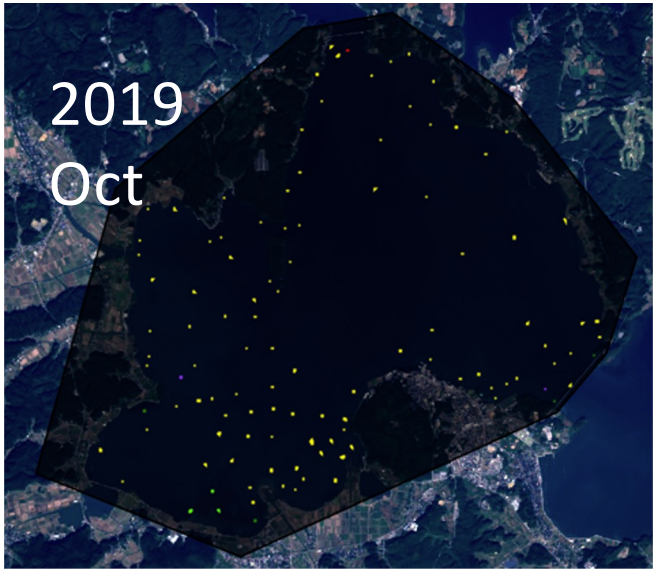
CLS2 Sand-Mud

CLS3 Seaweed

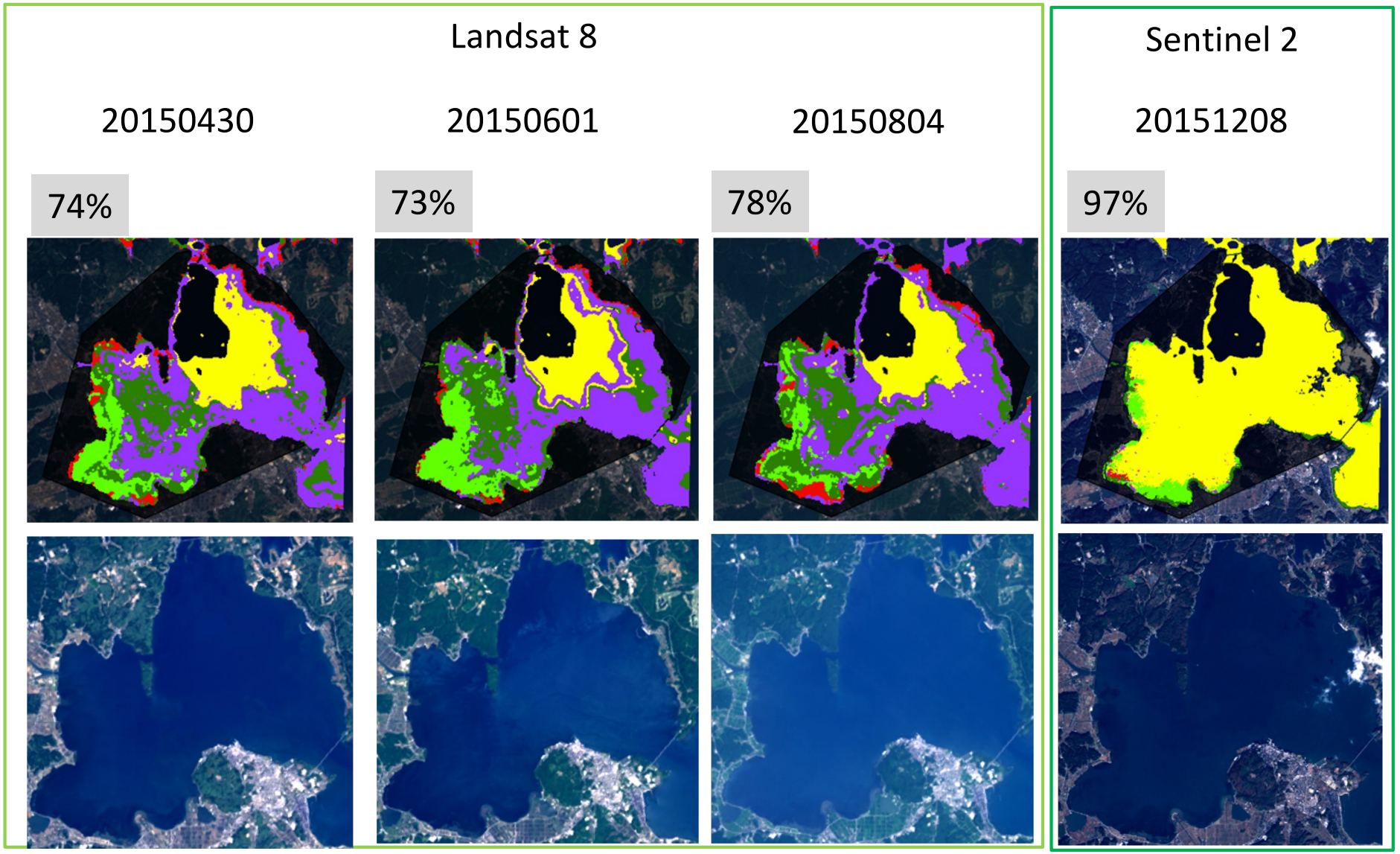
CLS 4 Sparse

CLS 5 Seagrass with Seaweed

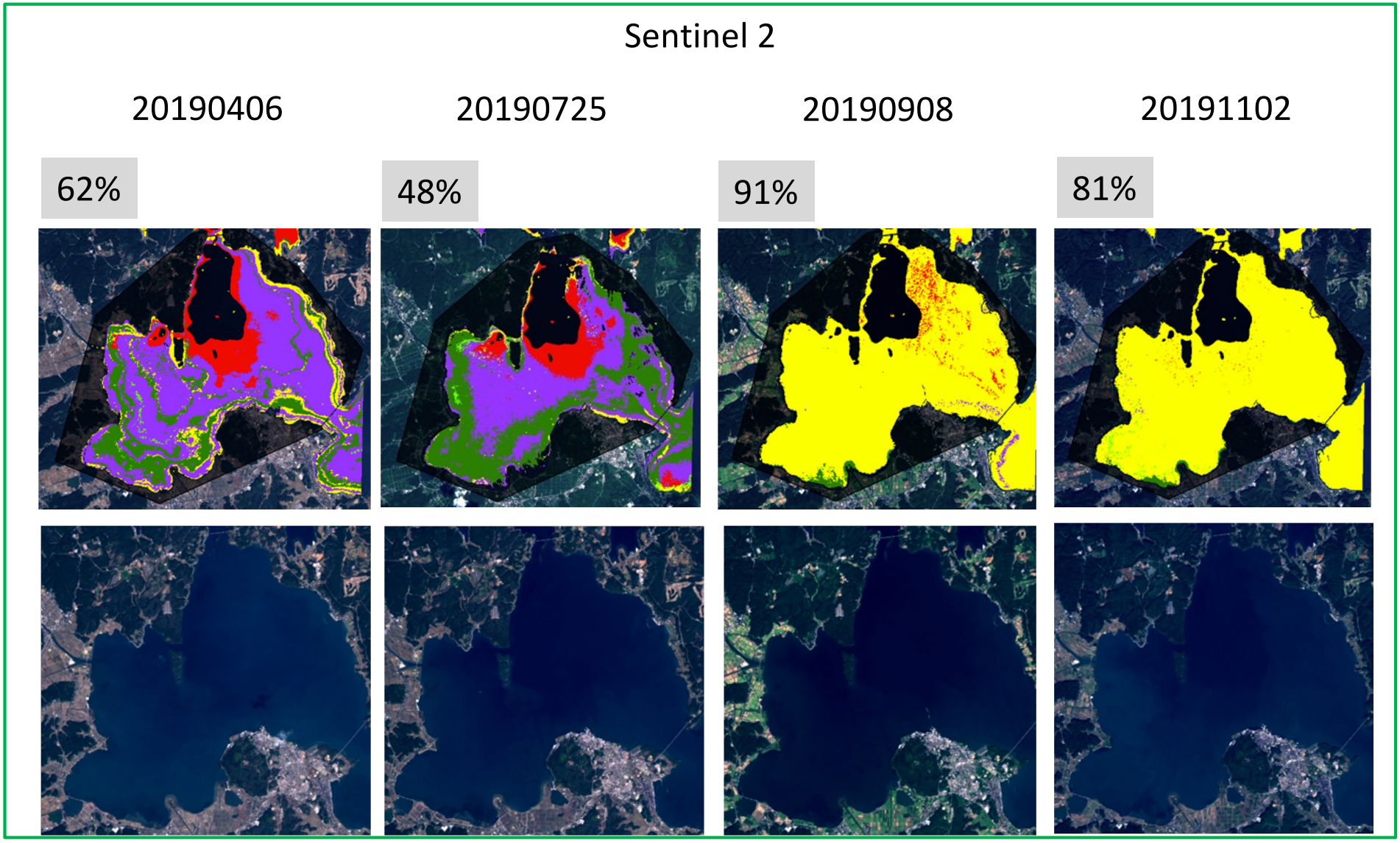




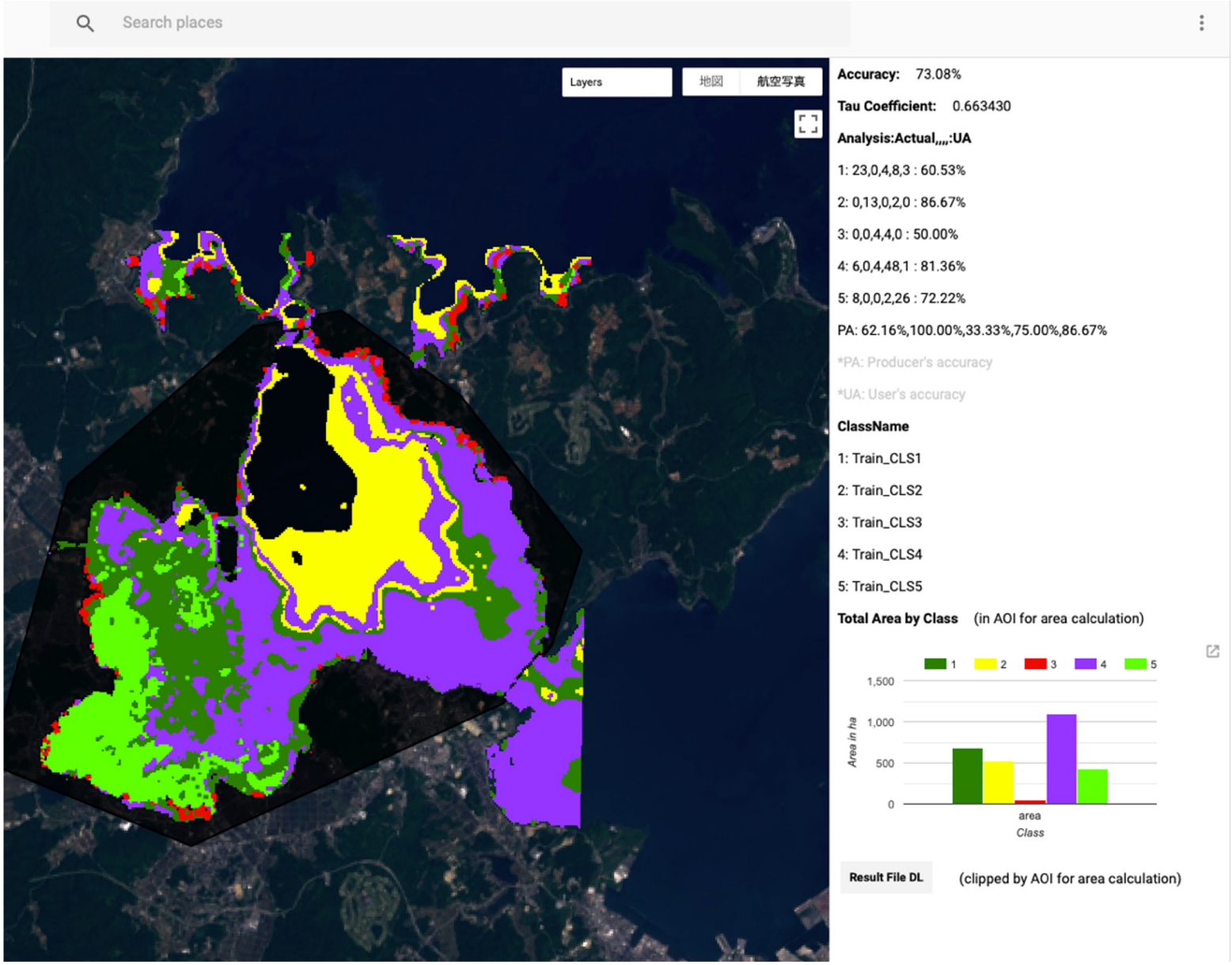
Mapping seagrass in 2015



Mapping seagrass in 2019



Estimating seagrass distribution



In situ water temperature

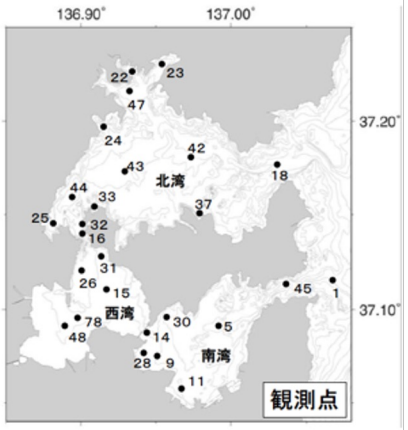
七尾湾水温・クロロフィル・溶存酸素情報

第2号
2015年8月20日発行

所　　属　石川県水産総合センター
担 当 者　技術開発部　奥野
連 絡 先　TEL 0768-62-1324　FAX 0768-62-4324

【概要】

- ８月１８日に七尾湾の観測点および養殖場海域（右図）で観測を行いました。
- 水温は、表層で２８～２９℃台、水深１０ｍで２６～２８℃台でした。
- ｸﾛﾛﾌｨﾙは、表層および水深５ｍで高めでした。
- 溶存酸素量は、前月より減少したものの、貧酸素水（溶存酸素量 2.0mg／L 以下）の発生は確認されませんでした。
- 水産総合センターでは今後も観測を行い、毎月１回情報提供する予定です。



（１）湾別観測結果

①　平均水温(℃)

	水深 1m（表層）	水深 5m	水深 10m	水深 20m
北 湾	28.8 平年差－0.2 前月差＋2.6	28.5 平年差＋0.4 前月差＋4.0	27.4 平年差＋0.4 前月差＋3.9	24.9 平年差－0.4 前月差＋3.6
西 湾	28.5 平年差－0.2 前月差＋1.7	28.7 平年差＋1.0 前月差＋4.4	26.9 平年差＋0.9 前月差＋4.3	－
南 湾	28.5 平年差－1.0 前月差＋2.2	28.3 平年差＋0.2 前月差＋3.8	27.1 平年差＋0.3 前月差＋3.6	24.8 平年差－0.1 前月差＋3.5

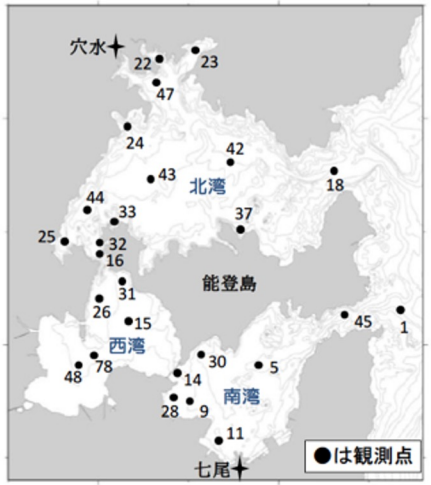
七尾湾水温・クロロフィル・溶存酸素情報

第49号
2019年8月9日発行

石川県水産総合センター　海洋資源部
連 絡 先　TEL 0768-62-1324　FAX 0768-62-4324

【概要】

- 8月7日に右図に示した位置（計26点）で観測しました。
- 水温は、水深10 mで27～28 ℃台で、前月（7月16日）から4.2～6.0 ℃上昇しました。同水深の過去3年平均との差は+0.4～+2.3 ℃でした。
- クロロフィル濃度は、水深10 mで0.5～2.0 μg/Lで、過去3年平均との差は－1.2～+0.2 μg/Lでした。
- 溶存酸素量は、6～7 mg/L台でした。水深10 mの値はいずれの湾も例年より高めでした。

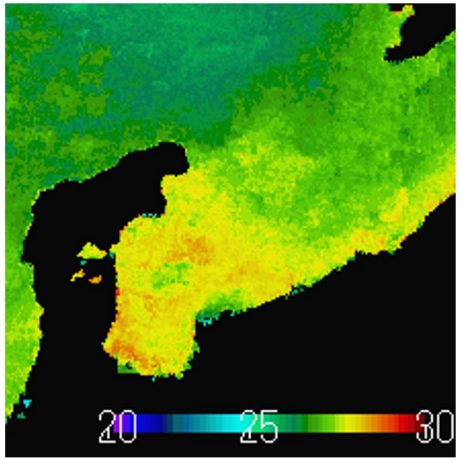
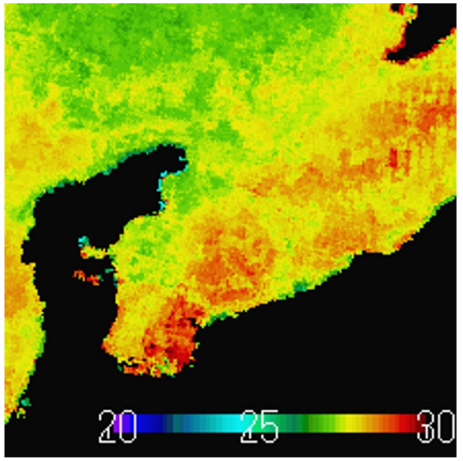
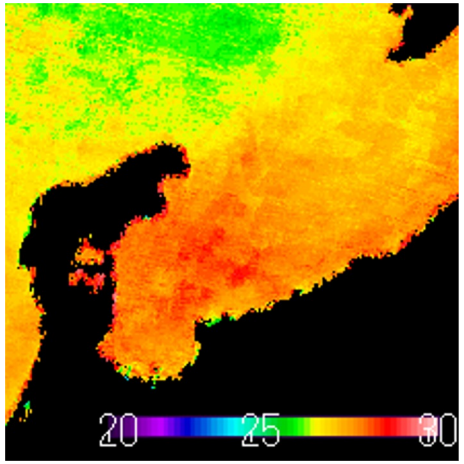
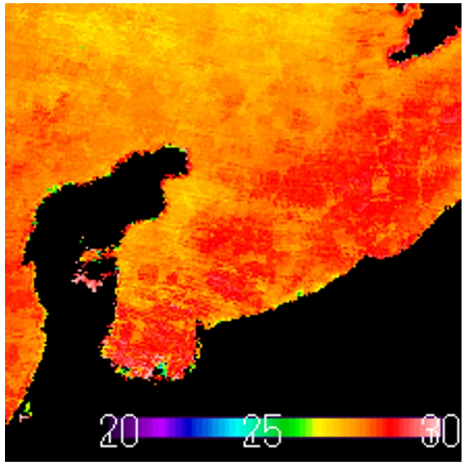


(1)　観測結果

①　平均水温(℃)

	水深1m（表層）			水深5m			水深10m		
	今回	前月差	過去3年平均差	今回	前月差	過去3年平均差	今回	前月差	過去3年平均差
湾全体	30.3	5.7	1.0	29.5	6.3	0.8	28.5	5.9	1.9
北湾	30.1	5.6	0.9	29.3	6.2	0.9	28.8	4.2	2.3
西湾	30.8	5.8	1.1	29.8	6.2	0.7	27.9	6.0	2.2
南湾	30.3	5.5	0.8	29.6	6.3	0.6	27.7	4.9	0.4

Sea Surface Temperature detected by satellite sensors

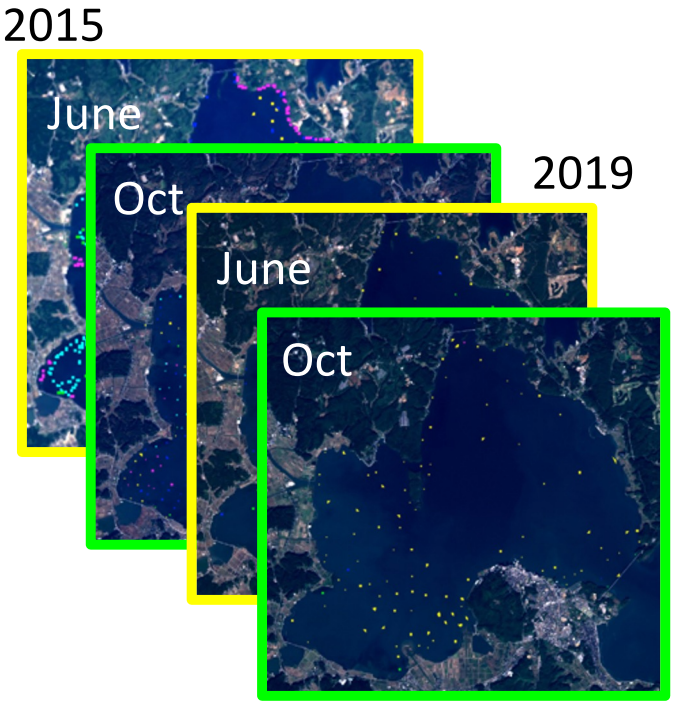
	2015 Aug	2019 Aug
MODIS Auqa		
VIIRS		

Summary

- A large scale seagrass die-off possibly due to high summer temperature was observed in 2019 but not in 2015

- Classification of seafloor with both Landsat 8 OLI and sentinel 2 MSI showed high accuracy except April and July 2019

Field data screening to study interannual change of seagrass



CLS1 Dense Seagrass

CLS 5 Seagrass with Seaweed

CLS1: Seagrass

CLS2 Sand-Mud

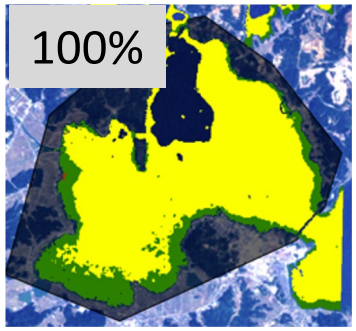
CLS 4 Sparse

CLS2: Sandy bottom

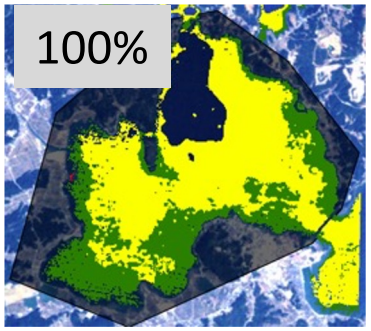
CLS3 Seaweed

CLS3: Seaweed

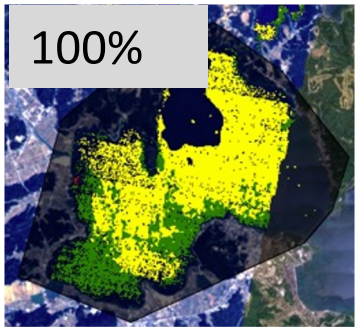
Inter-annual change of seagrass distribution in Western Nanano Bay



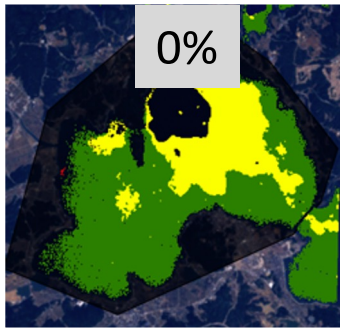
1994 Mar



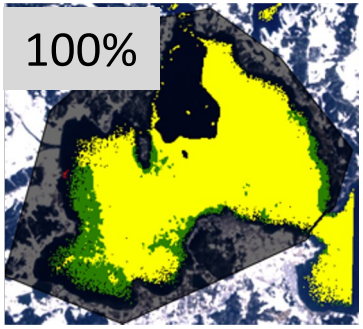
1996 Mar



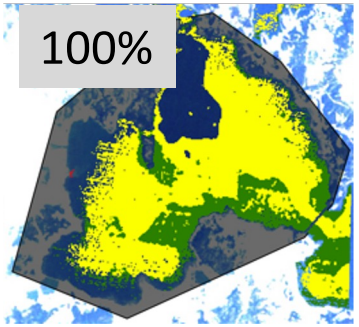
1997 Mar



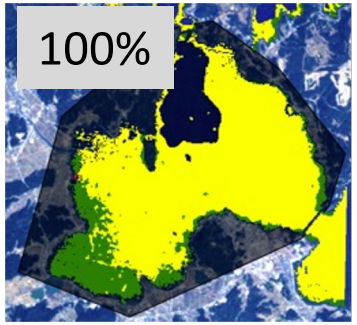
2000 Mar



2001 Mar



2004 Feb



2008 Mar

CLS1: Seagrass

CLS2: Sandy bottom

CLS3: Seaweed

Further readings

- Seagrass Mapper User's Manual (ver1.0)
- Seagrass Trainer User's Manual (ver1.0)
- Appendix (ver1.0) (Seagrass Mapper/Seagrass Trainer)

Demonstration for classification of seafloor in Nanao Bay

- Specify “sample_nanao_1506” in Asset folder name and load it.

- Use Landsat OLI image taken on Jun 1, 2015 and run classification