25 Years of PICES:
Celebrating the Past, Imagining the Future
November 2-13, 2016

Session 1: Multiple factors affecting the dynamics of shallow-water corals and other organisms

First report on the annual gametogenesis of high-latitude corals *Alveopora japonica*(Eguchi, 1968) and *Oulastrea crispata* (Lamarck, 1816) on Jeju Island, Korea

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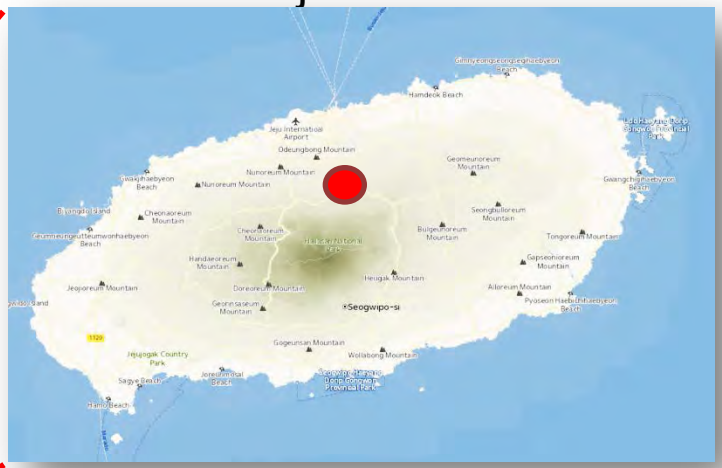
< Korea map >

< Jeju Island >



< Jeju University >

Contents

01 Introduction & Objective

- ✓ Global warming -> SST(Surface Sea temperature) has been increased
  - – **0.41℃ for the past 30yrs** / **1.29℃ increase since 1968 in Korea**
- ✓ Several coral species have migrated towards higher-latitude (Yamano *et al.* 2011)
- ✓ Increased **subtropical species** in marine ecosystem of Jeju Island

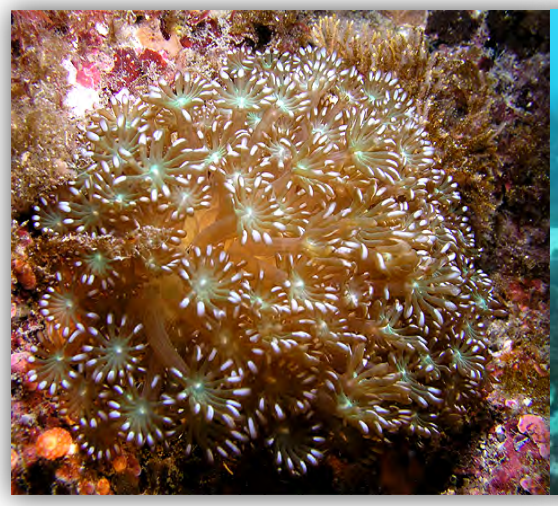
< Seaweed based >

< Coral based >

- ✓ In this study, **annual reproductive cycle and reproductive strategy of two Scrolactininan corals, *Alveopora japonica* and *Oulastrea crispata*,** were analyzed

01 Introduction & Objective

Alveopora japonica



<Alveopora japonica>

<Community of coral>

kingdom: Animallia
phylum: Cnidaria
class: Anthozoa
order: Scleractinia
family: Acroporidae
genus: ***Alveopora***

- ✓ In shallow rocky foreshores, usually nested among algae and soft corals
- ✓ Hemispherical shape, small and less than 40 mm in diameter
- ✓ A hermaphroditic brooding coral with oocytes and spermaries developing on separate mesenteries of the polyp (Harii et al., 2001)

01 Introduction & Objective

<Oulstrea crispata>

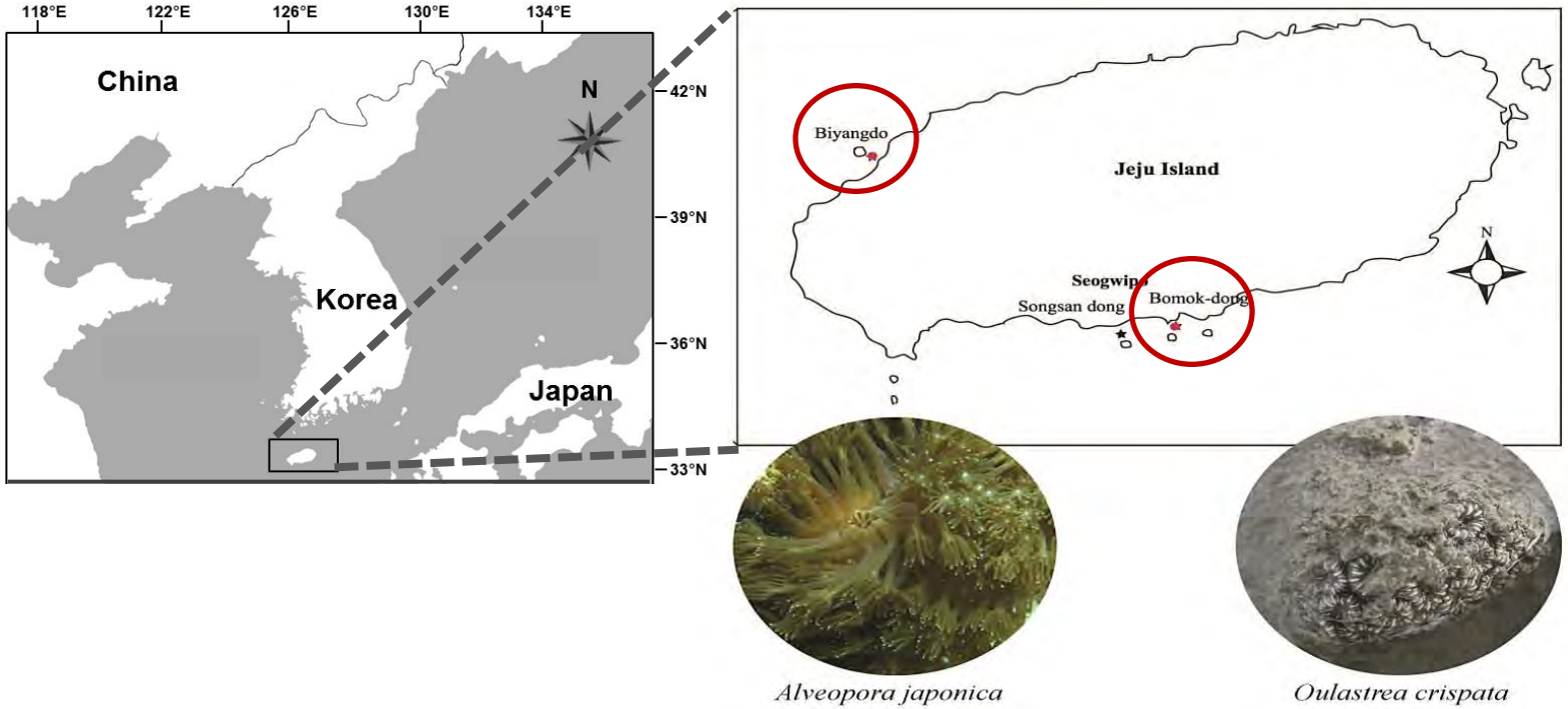
<Community of coral>

Oulastrea crispata

kingdom: Animallia
phylum: Cnidaria
class: Anthozoa
order: Scleractinia
family: Acroporidae
genus: ***Oulastrea***

- ✓ In murky water and at low tide, colonies size about 10-15cm
- ✓ A hermaphroditic coral with oocytes and spermaries developing on same mesenteries of the polyp (Lam, 2000)
- ✓ A broadcast spawner and planula brooder (Lam, 2000)

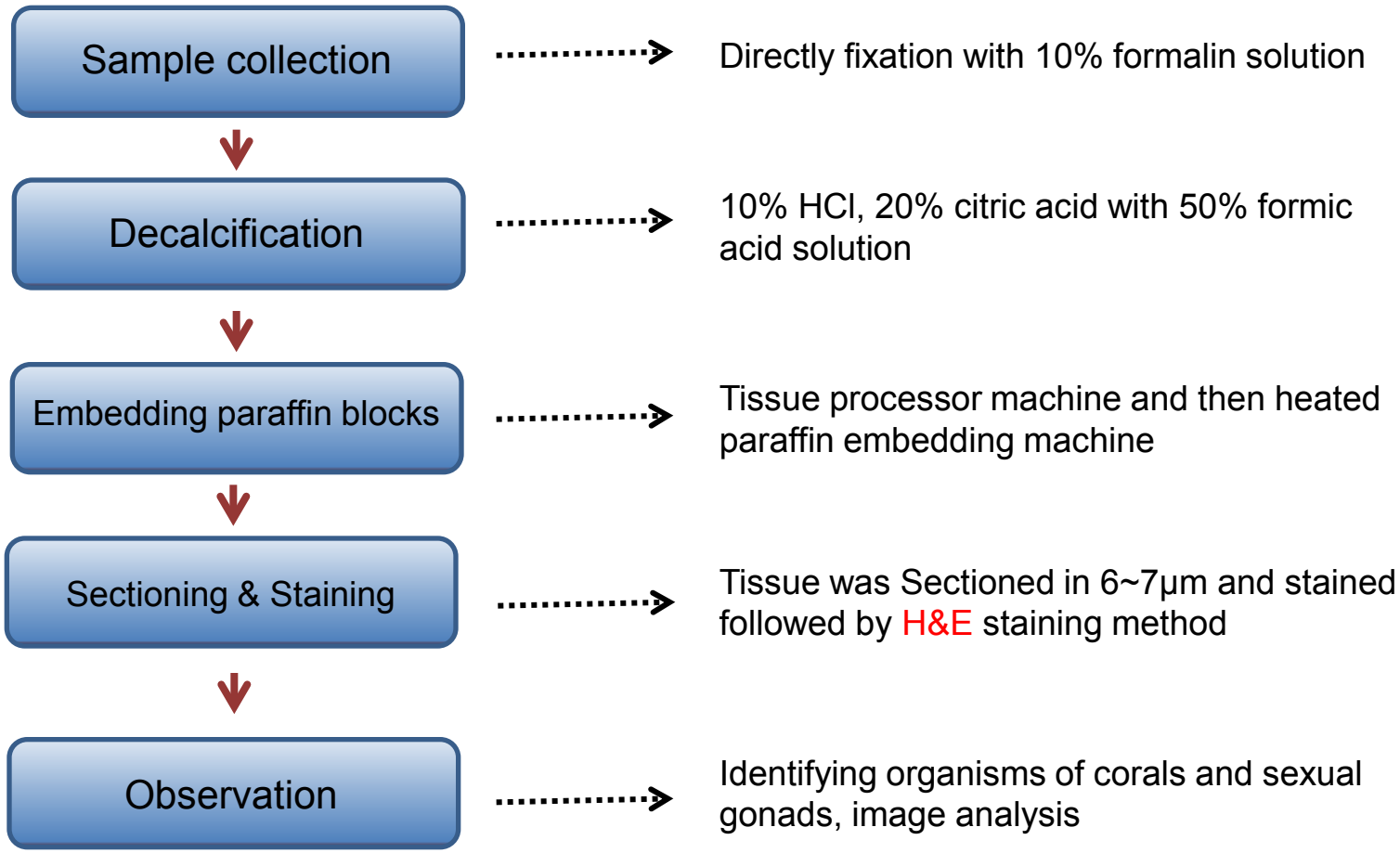
02 Material and method



- Sampling period : January ~ December in 2015
- Location : **North** (Geumneung) and **South** (Bomok), 5-10m depth
- Target species : ***Alveoprora japonica & Oulastrea crispata***
- Sampling frequency : Over than 5 colonies for each specie **Monthly**

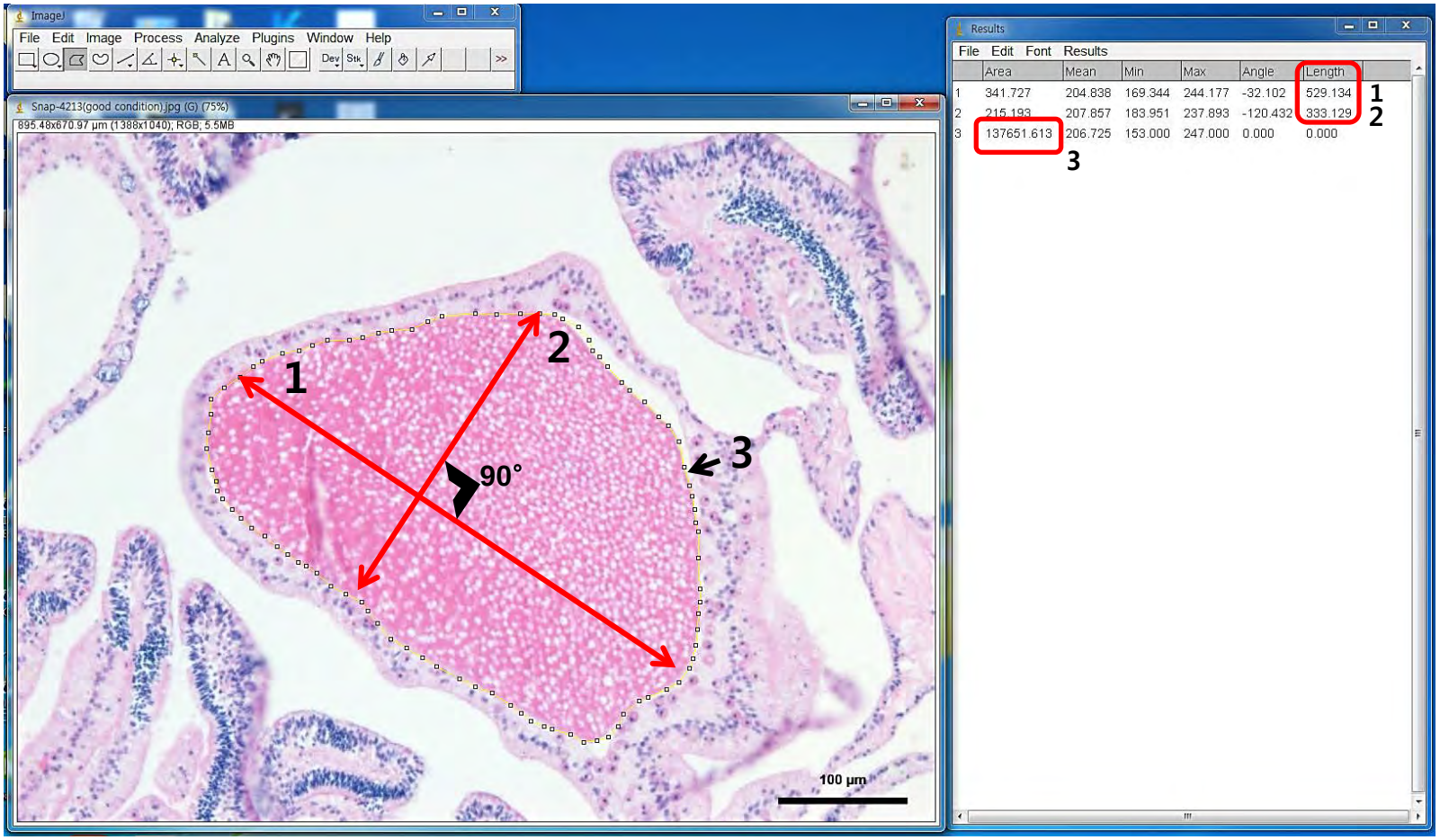
02 Material and method

- **Standard Histological work for coral research**



02 Material and method

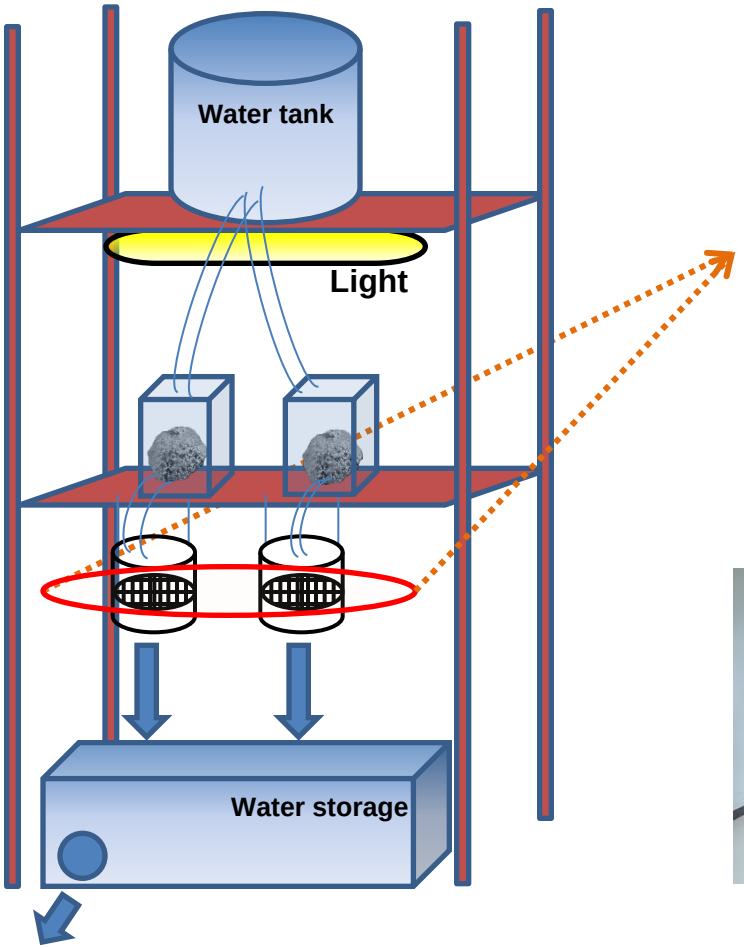
- **Image analysis by "Image J"**



1. Maximum diameter, (um) **2. Perpendicular diameter,** (um) **3. Surface are** (um^2)

02 Material and method

- **Planulae observation**



<Flow-out aquarium>

(200μm mesh)

Collecting larvae (with 200μm mesh)

2% glutaraldehyde

50, 70, 90, 95, 100% Ethanol for dehydration

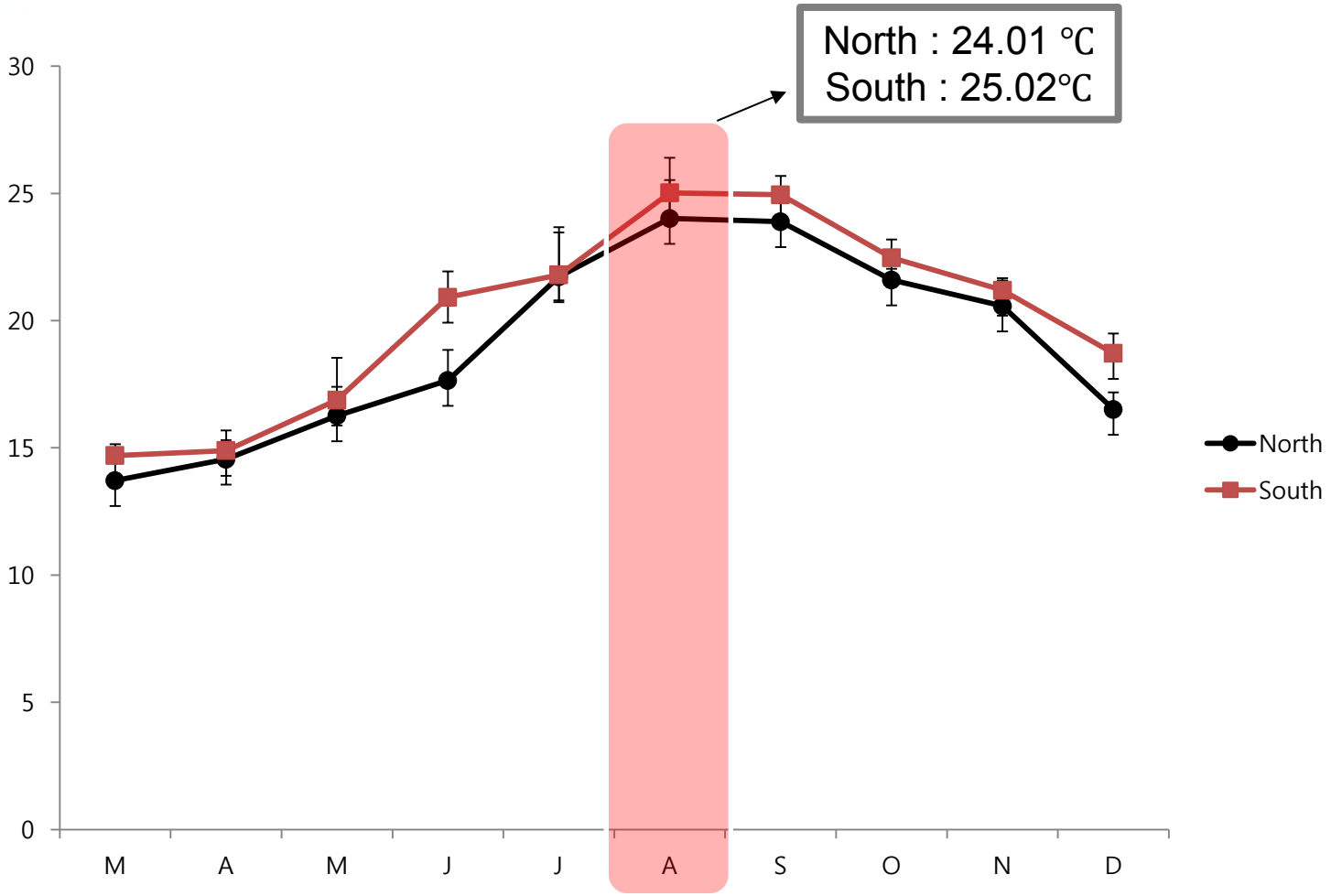
30, 50, 70, 100% Isoamyl acetate for substitution

Vacuum dry, coating

ZEISS Supra 55VP, Korea Basic

<SEM picture process>

03 Result (SST of sampling sites)

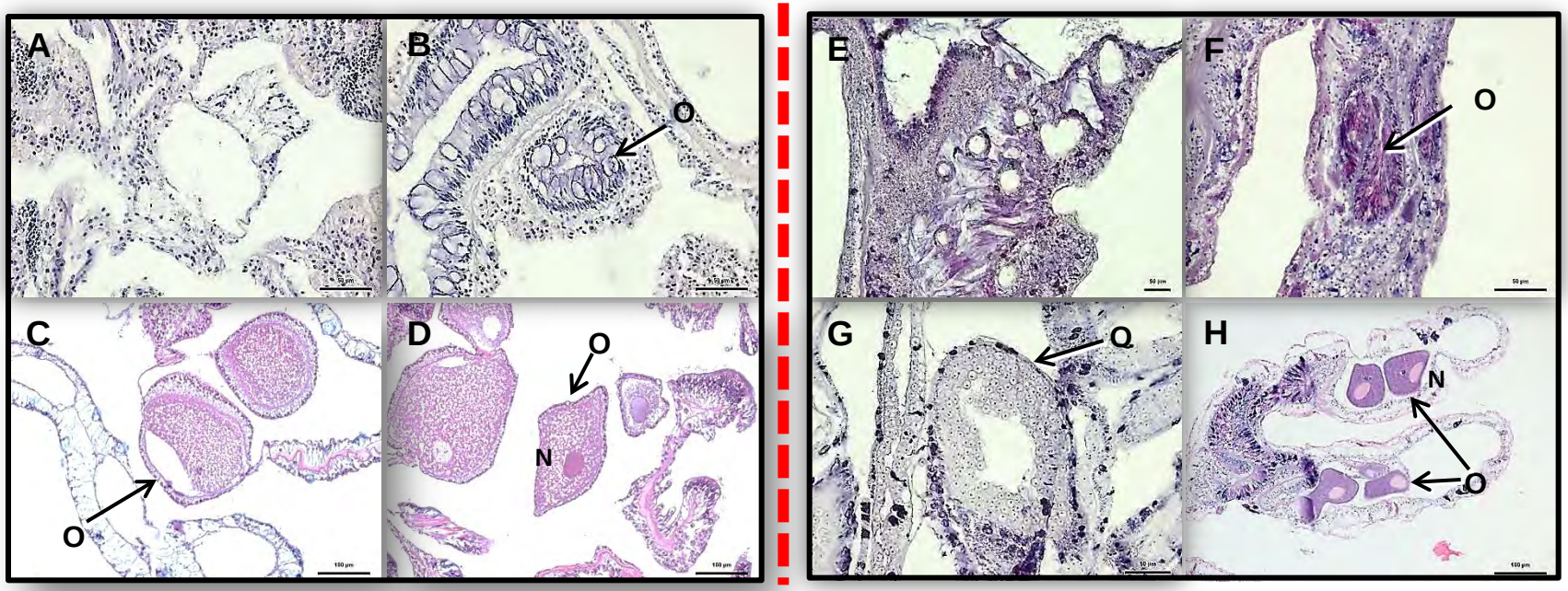


- SST(Surface Sea Temperature) : 13 ~ 25.02℃

03 Result (*A. japonica & O. crispata* Oogenesis)

Alveopora japonica

Oulastrea crispata

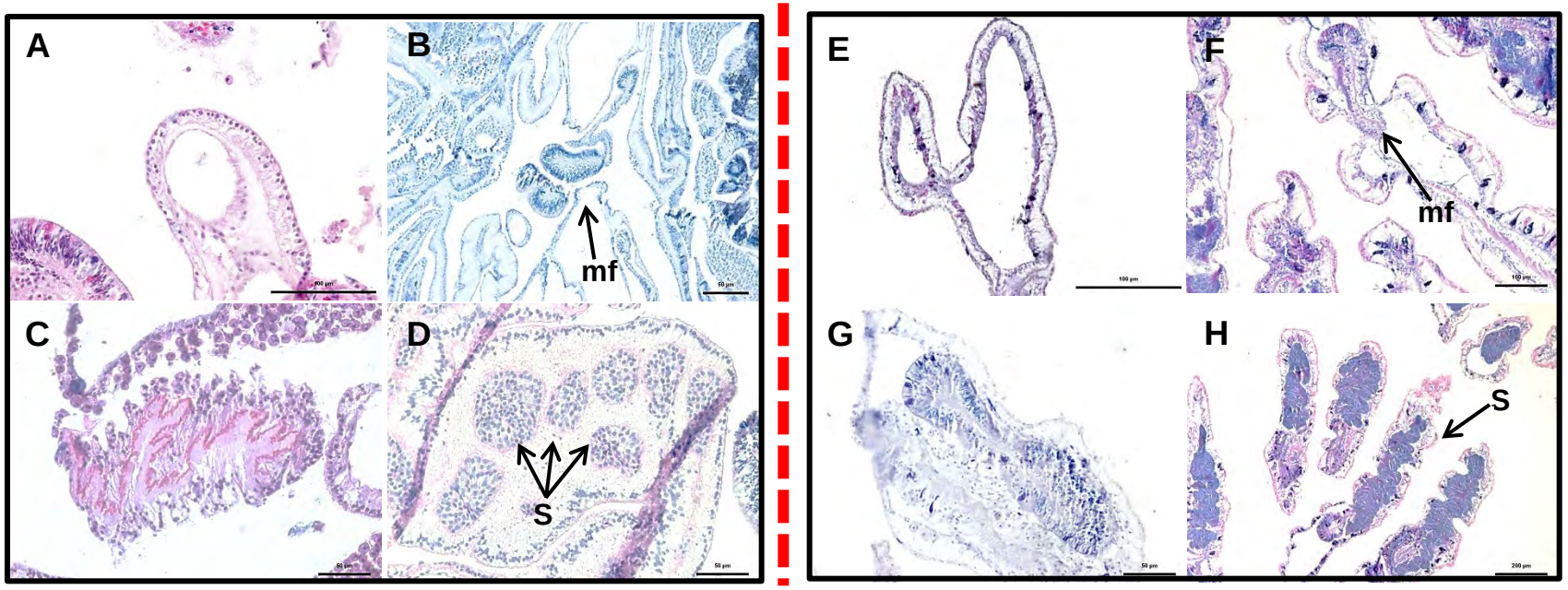


- (A) **Stage 1**(Empty stage) in mesoglea(Scale bar=50μm). (B) **Stage 2**, early development of oocyte(Scale bar=50μm). (C) **Stage 3**, developing oocyte(Scale bar=100μm). (D) **Stage 4**, mature oocyte(Scale bar=100μm).
- (E) **Stage 1**(Empty stage) in mesoglea in January(Scale bar=50μm). (F) **Stage 2,** early development of oocyte(Scale bar=50μm). (G) **Stage 3**, late development of oocyte(Scale bar=50μm). (H) **Stage 4**, Mature oocyte(Scale bar=100μm). N: nucleus, O: oocyte.

03 Result (*A. japonica* & *O. crispata* Spermagenesis)

Alveopora japonica

Oulastrea crispata

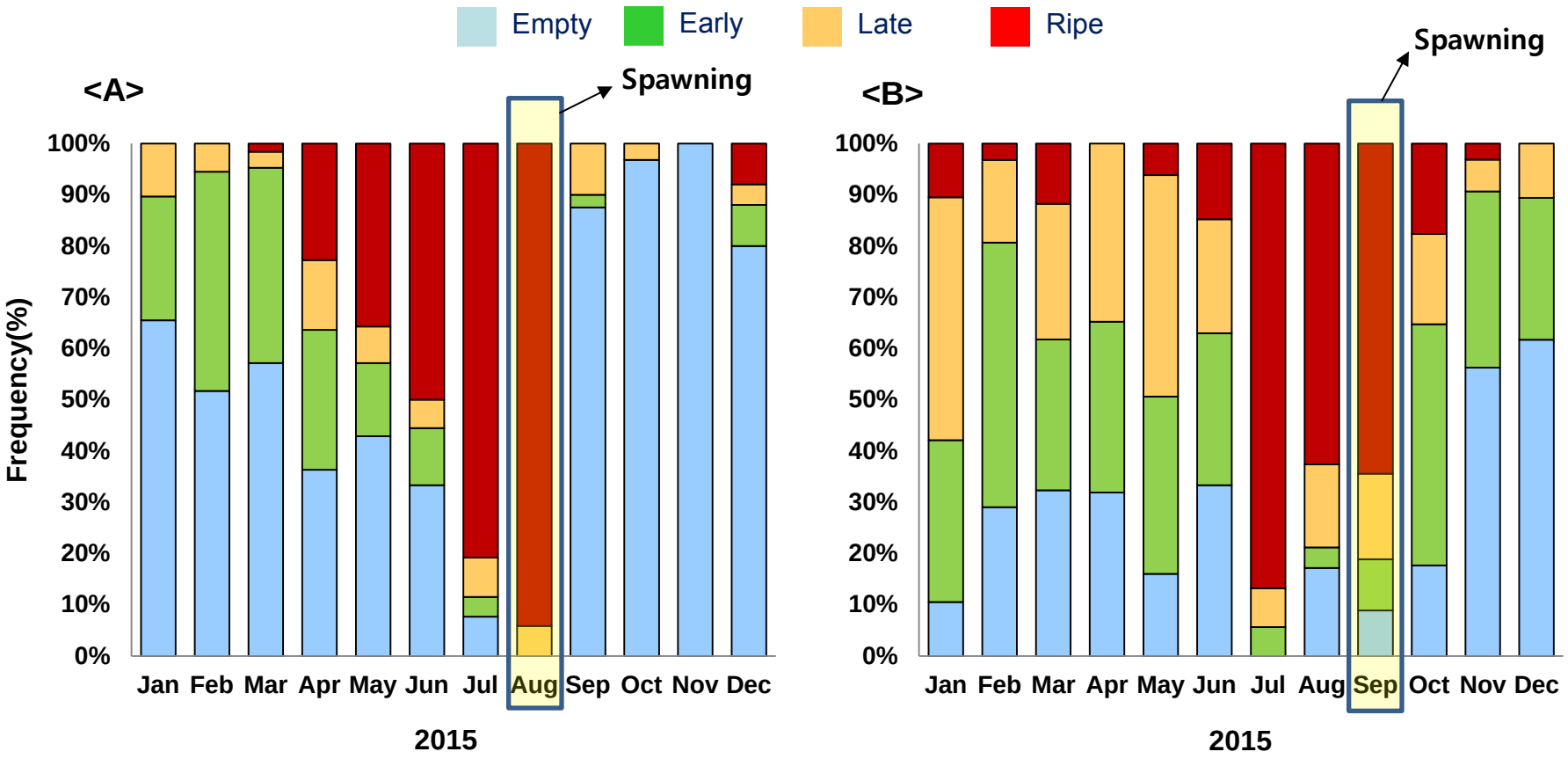


- (A) **Stage 1**(Empty stage)(Scale bar=100μm) (B) **Stage 2**, Primordial spermary(Scale bar=50μm)
  (C) **Stage 3**, Developing spermary(Scale bar=50μm) (D) **Stage 4**, Mature spermary(Scale bar=50μm)

- (E) **Stage 1** in mesoglea(Scale bar=100μm) (F) **Stage 2**, Primordial spermary(Scale bar=100μm)
  (G) **Stage 3**, Developing speramry(Scale bar=50μm) (H) **Stage 4**, Mature spermary(Scale bar=200μm)
  mf: mesenterial filament, S: spermary

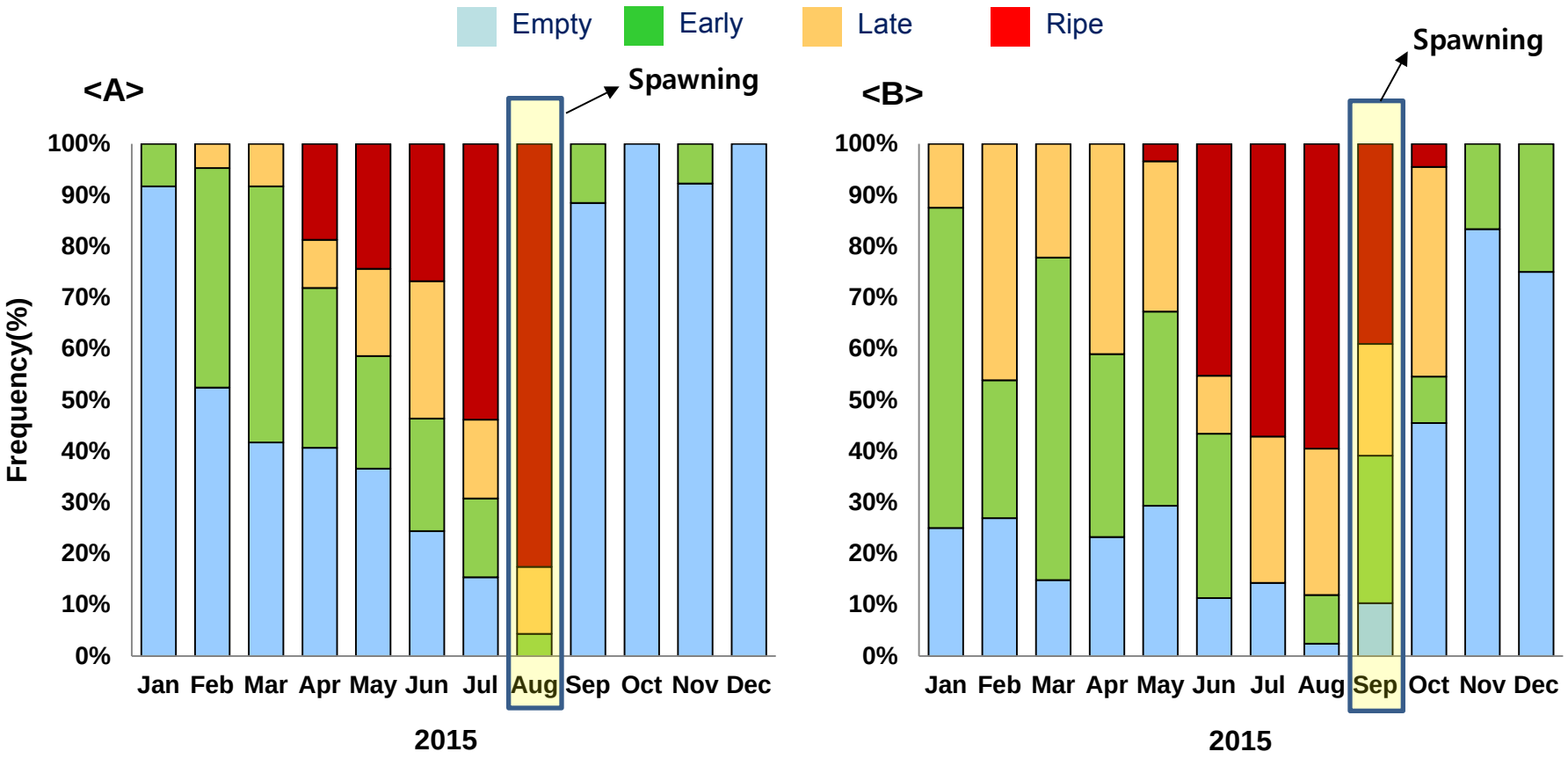
03 Result

- **Frequency of reproductive stages** of *A. japonica* from North, (A) Oocyte, (B) Spermary



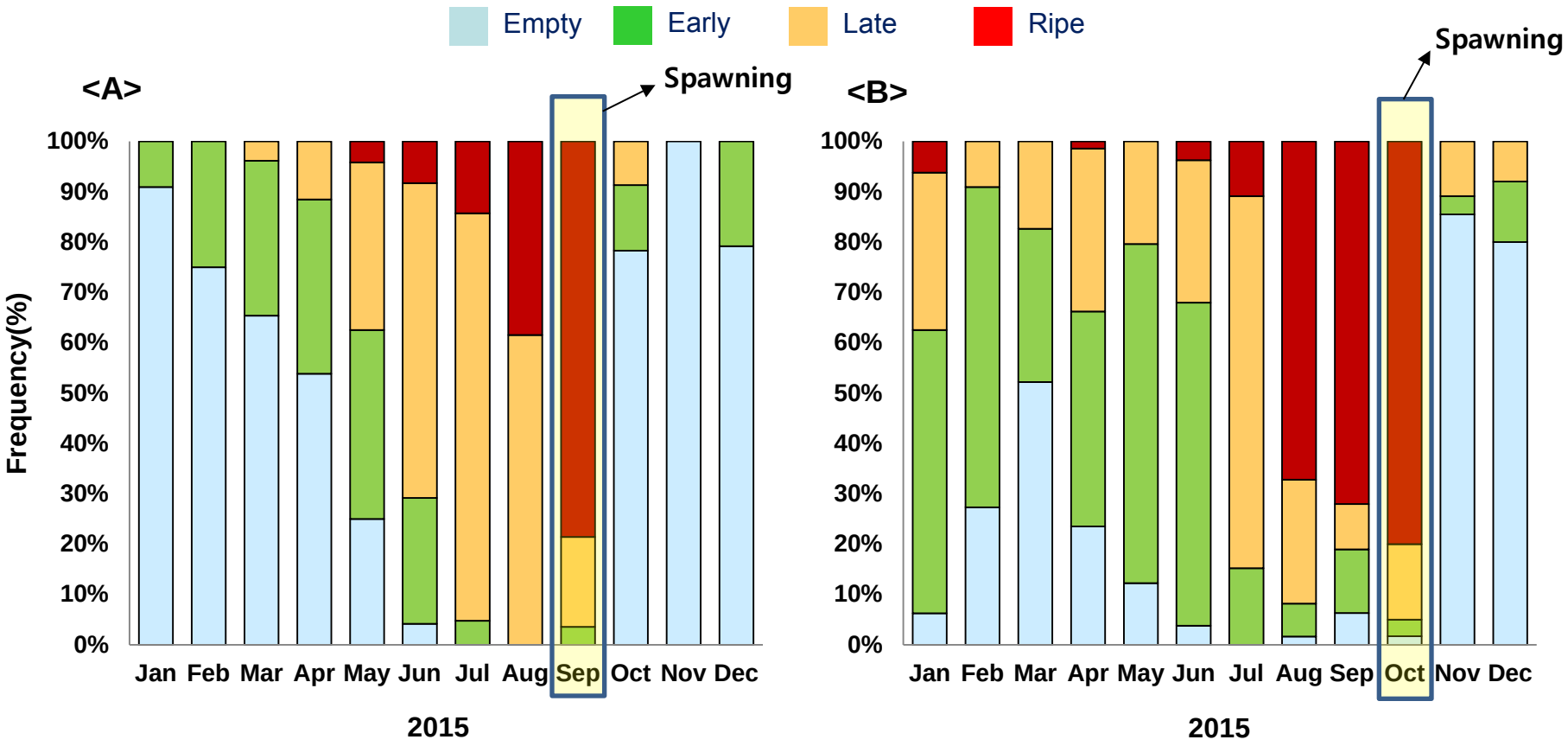
03 Result

- **Frequency of reproductive stages of *A. japonica* from South, (A) Oocyte, (B) Spermary**

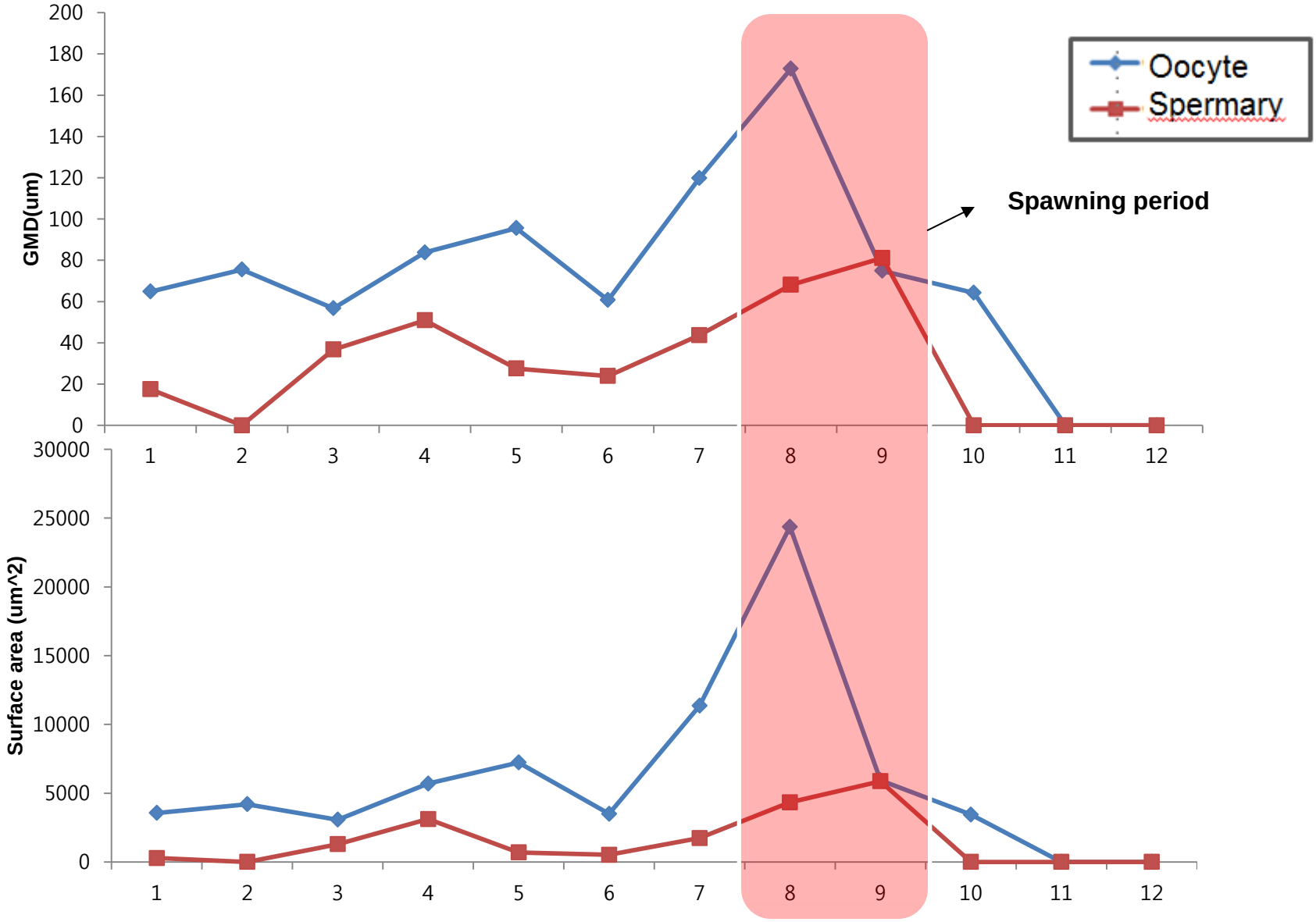


03 Result

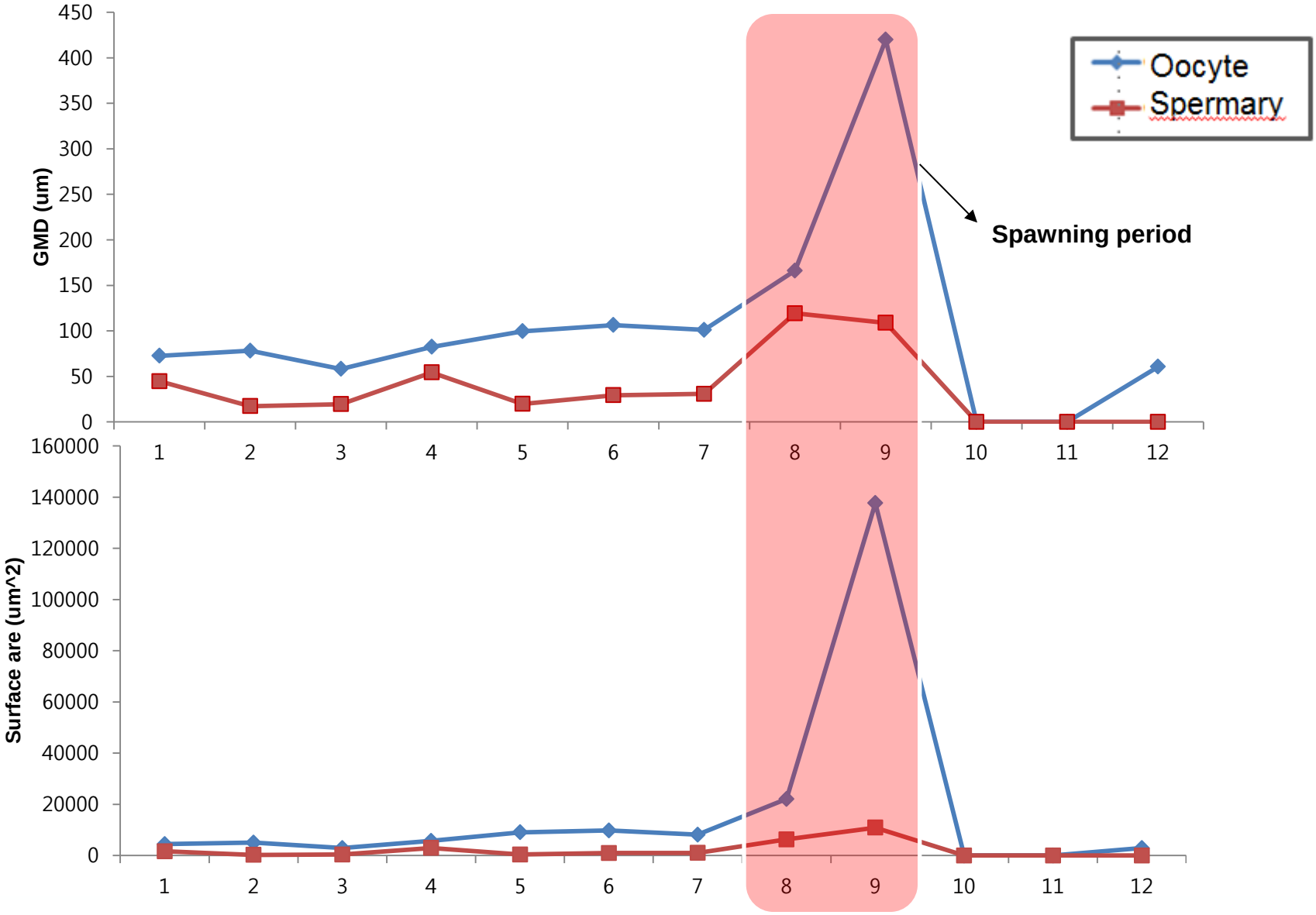
- **Frequency of reproductive stages of *O. crispata* from South, (A) Oocyte, (B) Spermary**



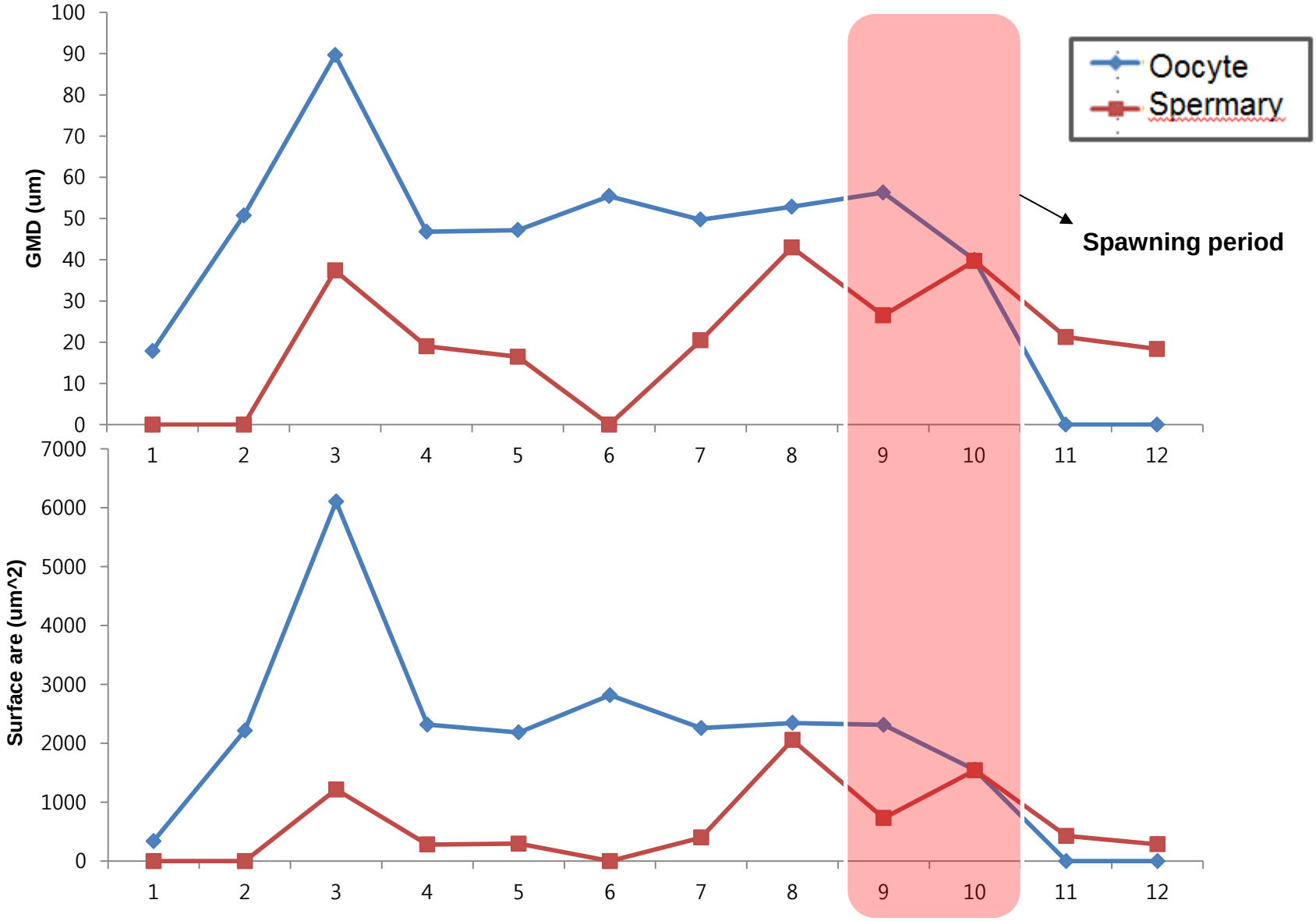
03 Result (North, GMD & SA of *A. japonica*)



03 Result (South, GMD & SA of *A. japonica*)

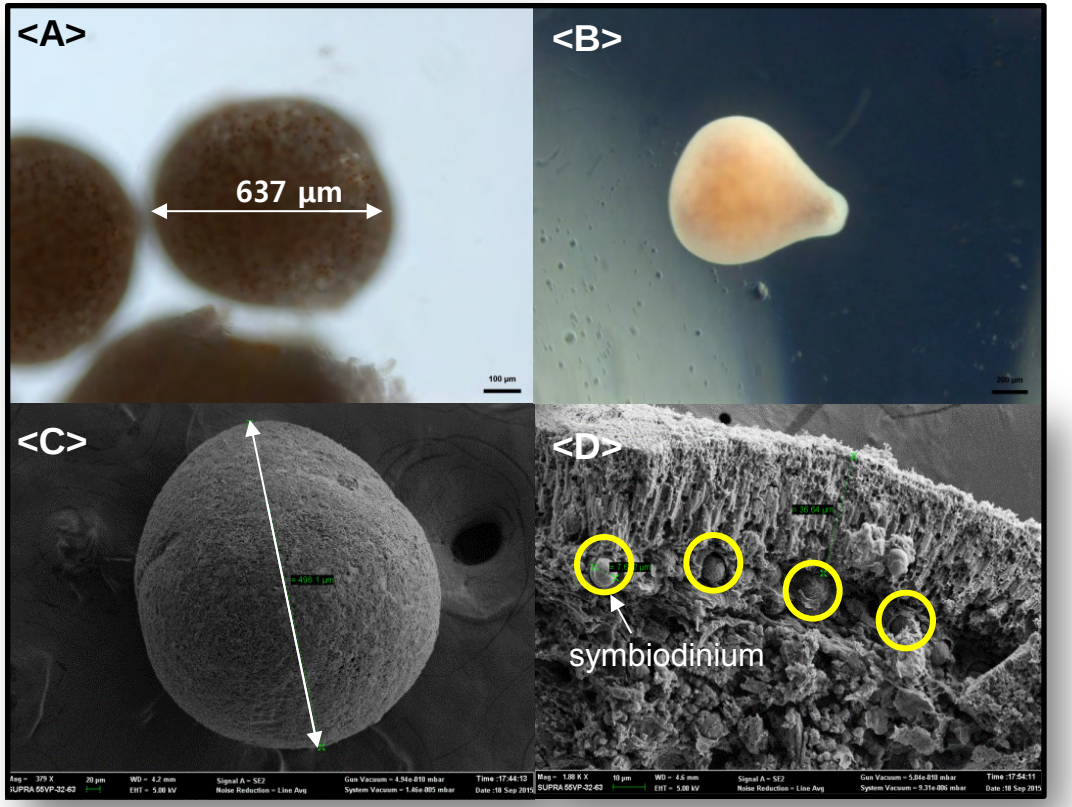


03 Result (South, GMD & SA of *O. crispata*)



03 Result

- **Planulae of *A. japonica* (South)**



- From July and Aug *A. japonica* samples
- Size : About 600~700μm for each
- Ability to mobile (Swimming)
- **Symbiodiniums** which facilitate photosynthesis were found at endotherm

<A>,<B>, Pictures by digital optical microscope, (Scale bar= 100μm, 200μm),
<C>,<D> SEM picture of Planulae,(Scale bar= 20μm, 10μm)

04 Summary

- ✓ Slightly difference in maturation period between *A. japonica* from North and South

- ✓ <In the North> Oocytes: March ~ August
  Spermaries: May ~ July

- ✓ <In the South> Oocytes: April ~ August
  Spemaries: May ~ August, September

- ✓ Planulae of *A. japonica* were collected from July to August (at South site)
- ✓ The average size - 600μm, possessed motility

- ✓ <For *O. crispata*> Oocytes: May ~ September
  Spermaries : May ~ October

05 Discussion

- ✓ *A. japonica* and *O. crispata* are a hermaphroditic brooding coral with oocytes and spermaries developing on separate mesenteries of the polyps
- ✓ Seasonal patterns of gametogenesis were shown from those species
- ✓ Gonial mitosis occurring in late January
- ✓ The major spawning of those two species appeared to followed a period of rising the water temperature in September in Jeju Island
- ✓ More research on physiology and ecology of those species are required in various area
- ✓ Long-term environmental monitoring is also necessary to prepare for climate changes

Thank you

ありがとうございます。

谢谢您。

Merci.

شكرًا

Благодарю вас

La ringrazio!

감사합니다

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