2022 Symposium: Small Pelagic Fish: New Frontiers in Science and Sustainable Management
Session S2 16:30-16:50
Nov 8, 2022, Lisbon, Portugal

Interannual Variations in Egg Diameter of Two Mackerel Species in the Western North Pacific

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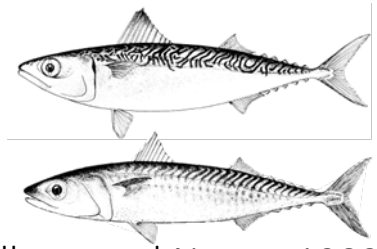
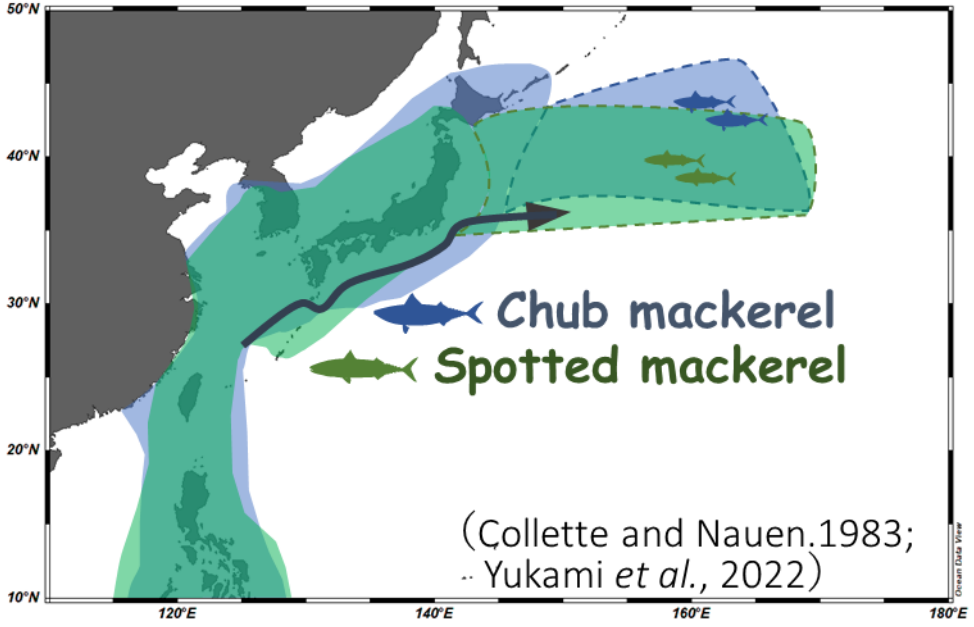
Introduction

Chub mackerel (*Scomber japonicus Houttuyn, 1782*)
Spotted mackerel (*S. australasicus Cuvier, 1831*)



(Collette and Nauen.1983)

- **Geographical Distribution**



- **Important fisheries target**

purse seines, trap nets, scooping net and others

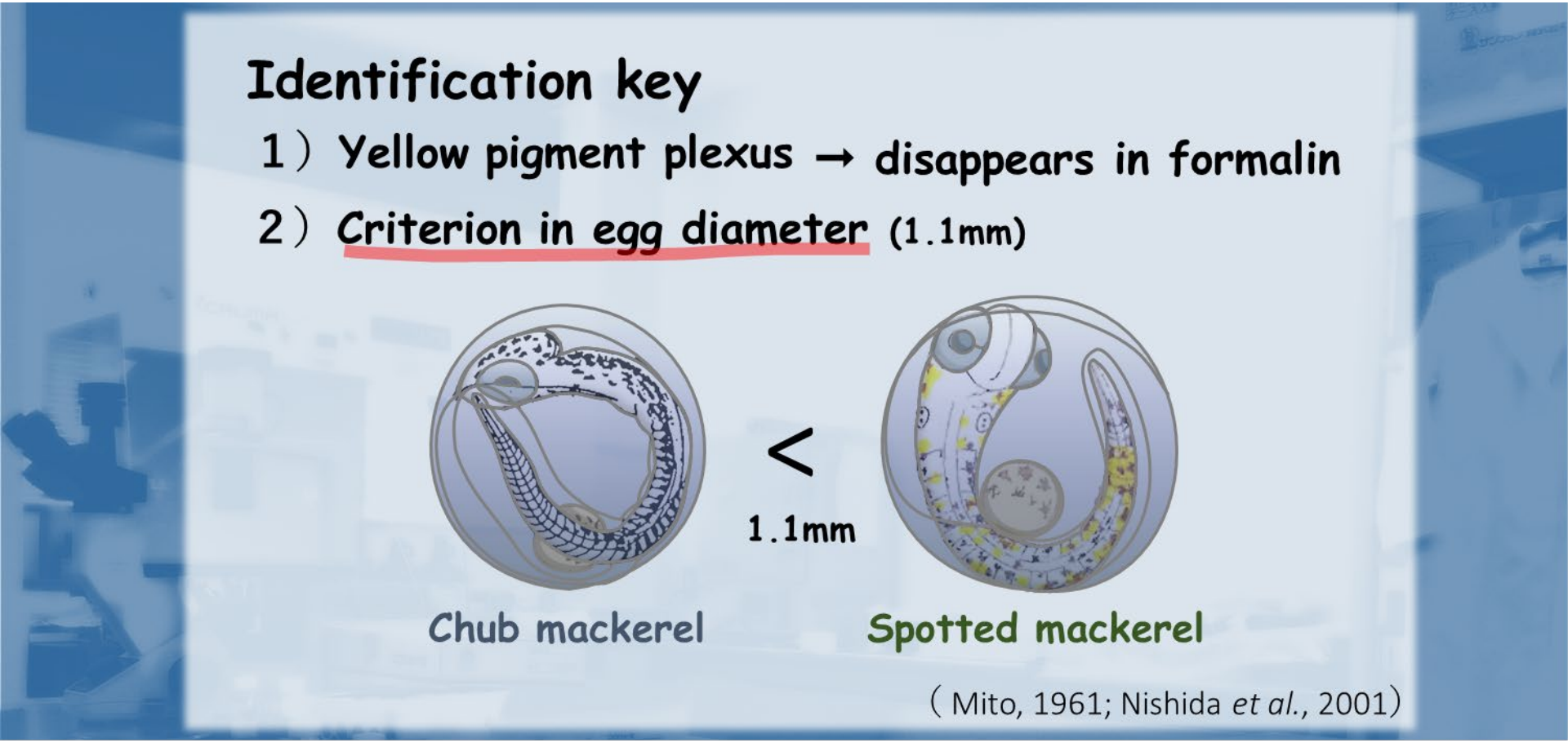
Japan is a major consumer

390,000 tons in 2021

(Japan Fisheries Agency, 2022)

They need to be clearly discriminated in stock surveys.

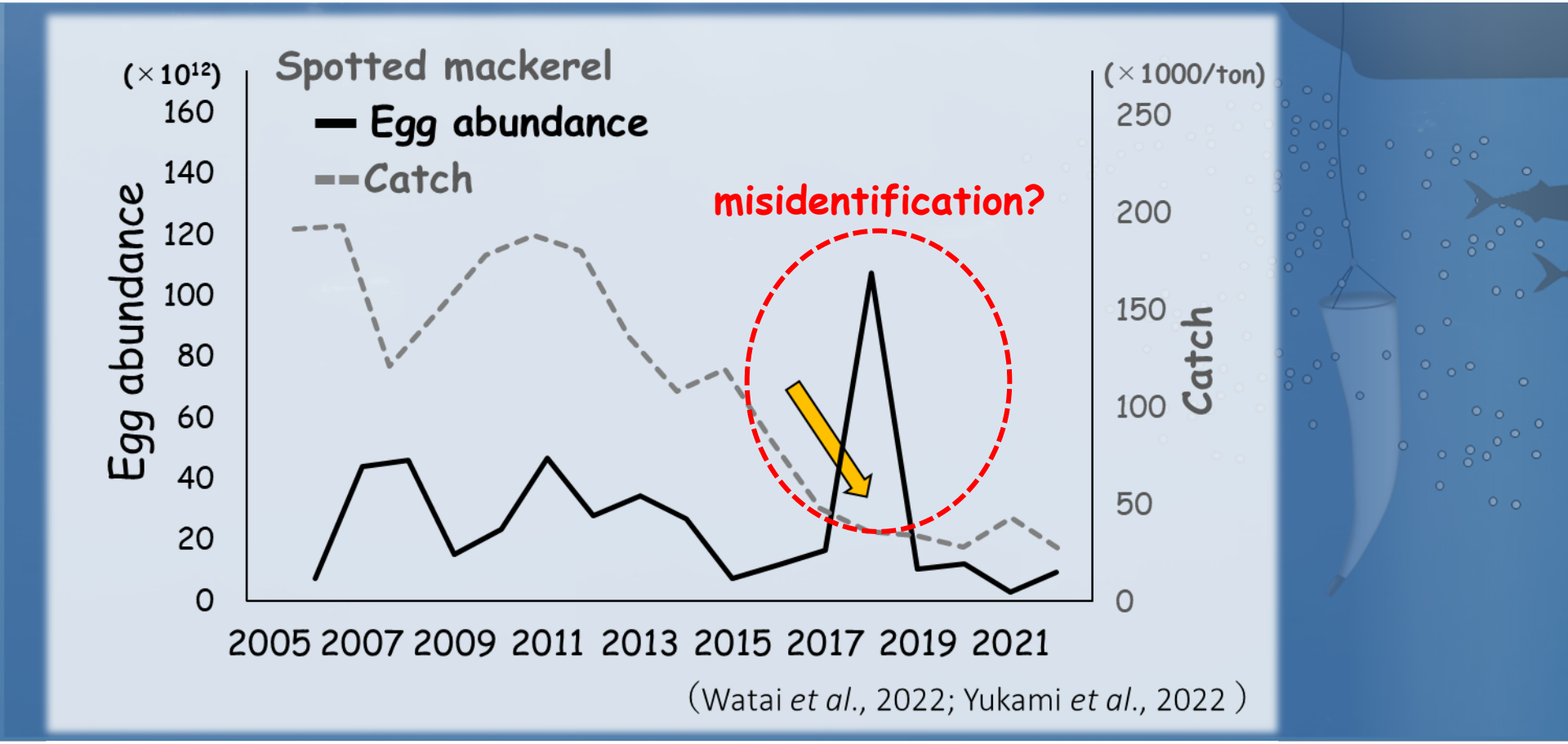
Egg Identification Traits



Some fish egg diameters are likely to change under a variety of environmental conditions.

(Ware, 1977; Miller1995; Cambers and Waiwood, 1996; Morimoto, 1998)

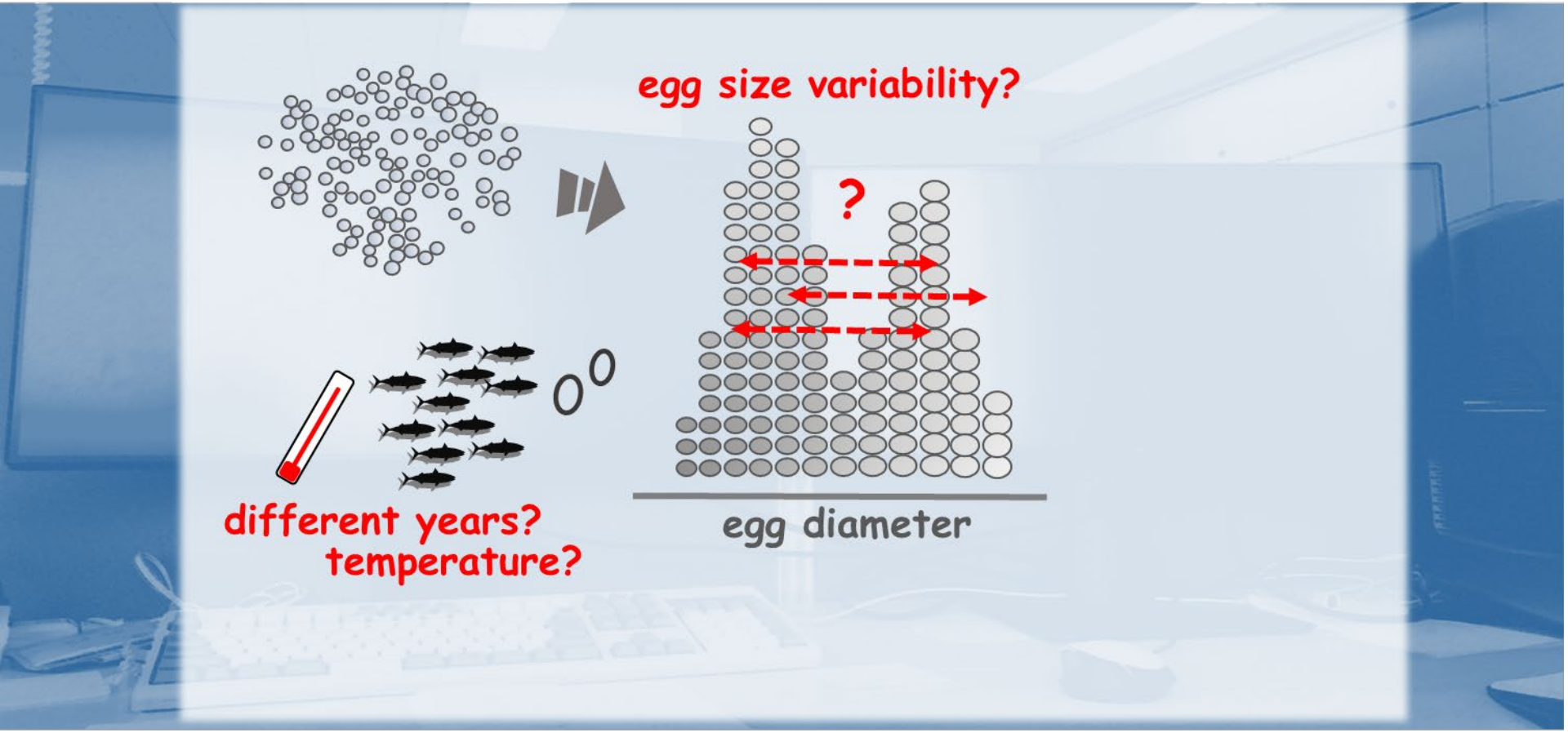
Annual egg abundances of Spotted mackerel



- The criterion for identifying egg diameter among species has not always been applied.

Objectives

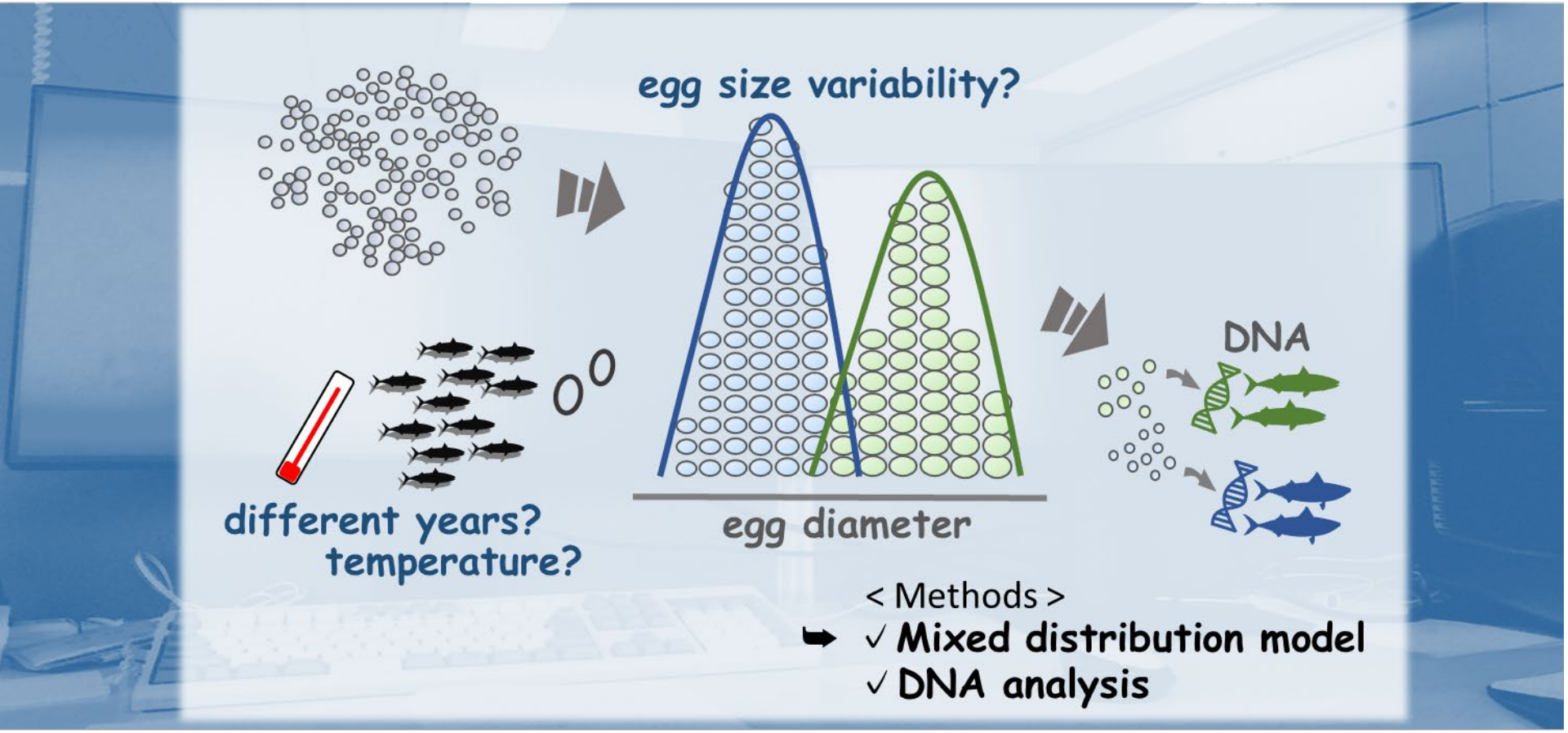
Examine egg size variability, and explore identification traits for different year and temperature conditions



➥Develop methods for quantitative species identification from variable egg size data

Objectives

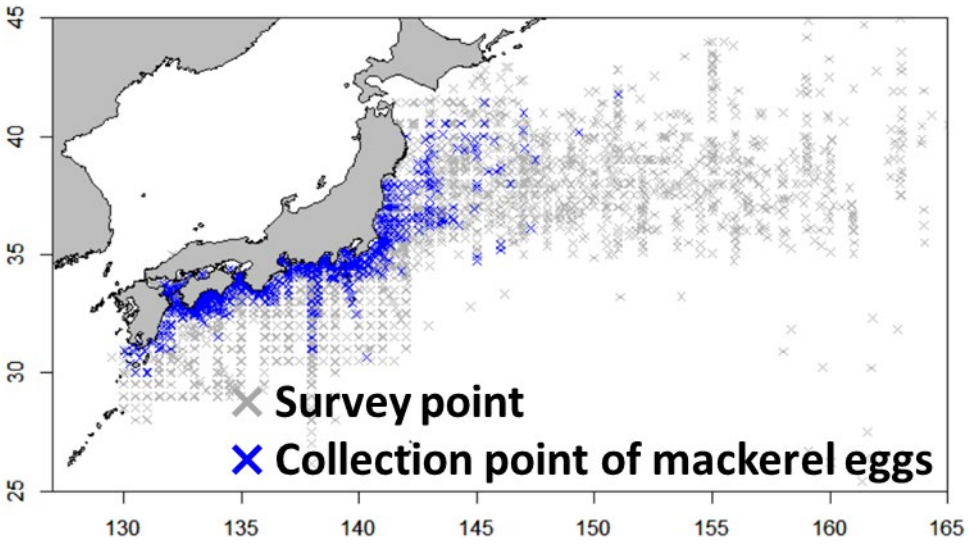
Examine egg size variability, and explore identification traits for different year and temperature conditions



➥Develop methods for quantitative species identification from variable egg size data

Materials and Methods

Egg sampling: North Pacific Standard net

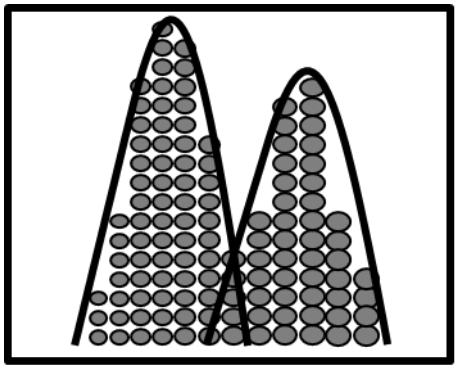


- 2006-2022 (monthly)
- Depth: max150 m → surface
- Specifications:
  Diameter: 0.6 m
  Mesh size: 0. 335 mm
- Fixation: 5% formalin
- Identification: morphological characteristics
- Measurement: micrometer in 0.025 mm (n=**37515**)

Materials and Methods

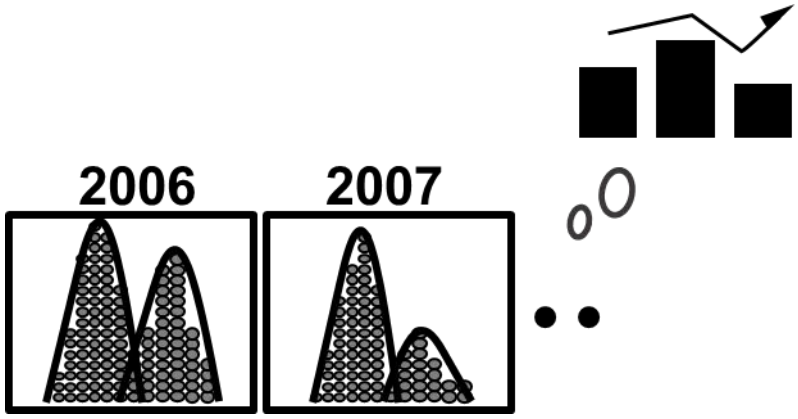
Mixture distribution model

- Applied a **Gaussian mixed model (GMM)** to the egg diameter distribution
- Selecting the number of groupings by the information criterion **BIC**

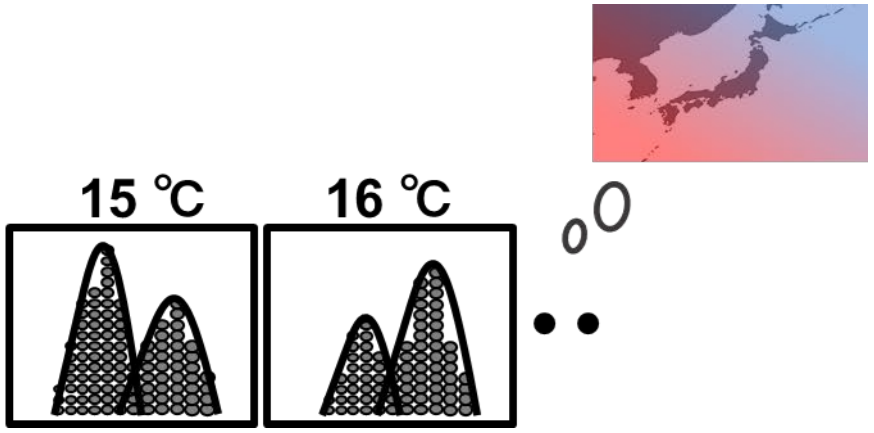


Egg diameter distribution data

"Year class"



"Sea surface temperature (SST) "



Materials and Methods

Verification by DNA analysis

- February and March of 2020-2022
- Specimens: 219 eggs were collected using North Pacific Standard net from 17 stations

- DNA barcode sequence analysis

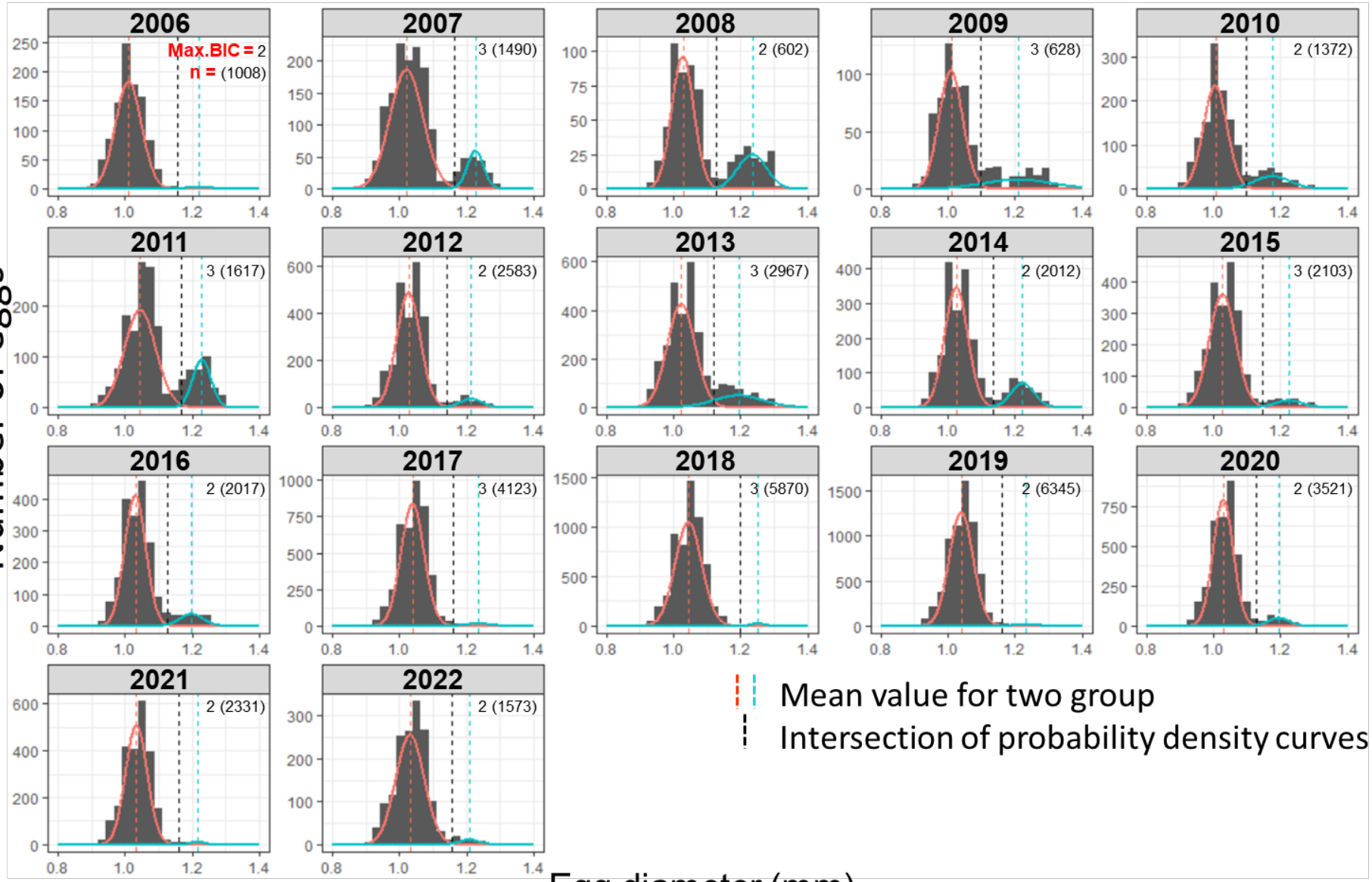
Extracted using TE buffer

→ A set of universal primer pairs targeting the mitochondrial gene was used to amplify the 12S rRNA genes (Miya *et al.* 2015).

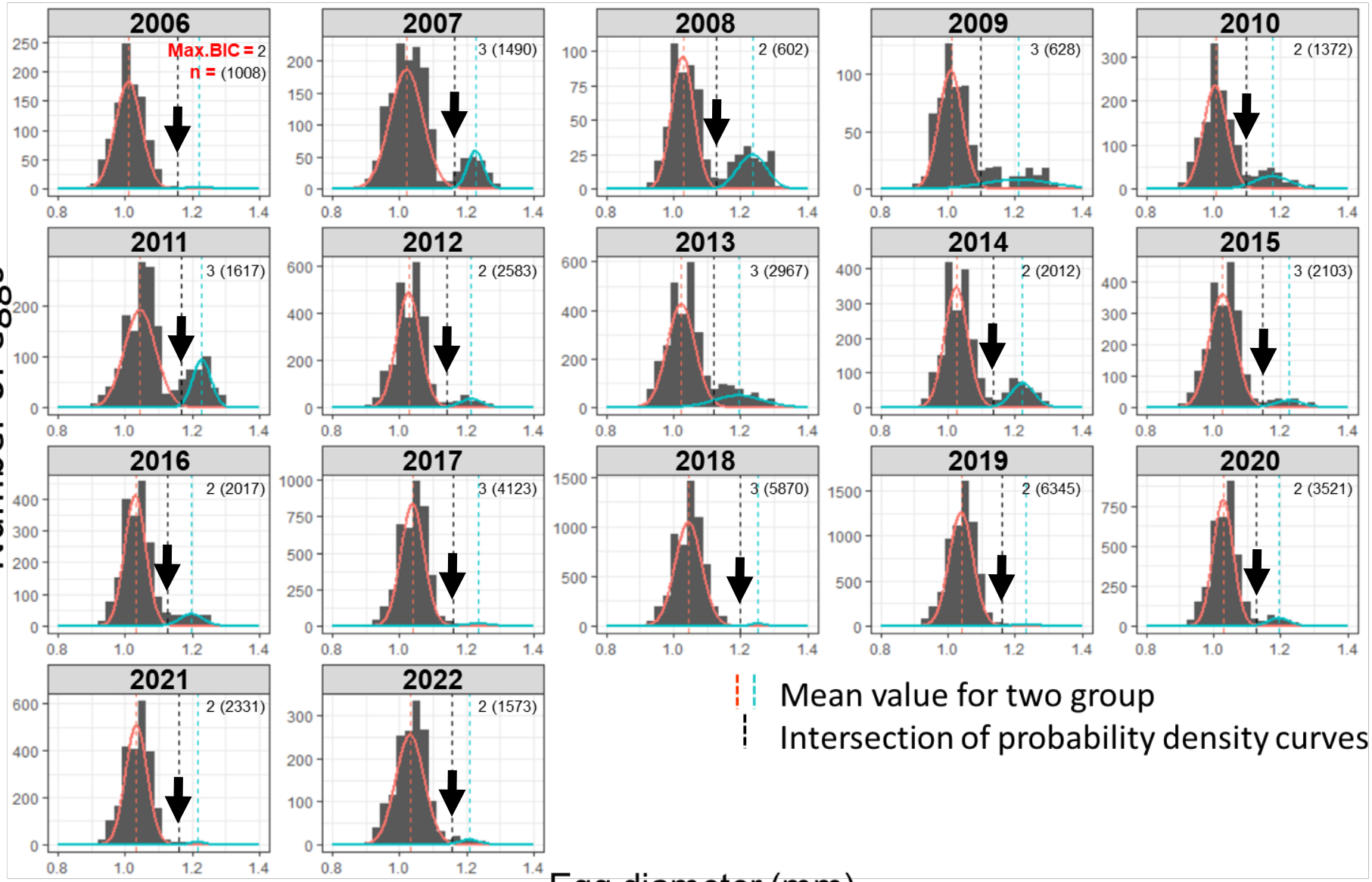
→ Massively parallel paired-end sequencing on the MiSeq platform

Results

"Year class" classifications by GMM



"Year class" classifications by GMM



Results

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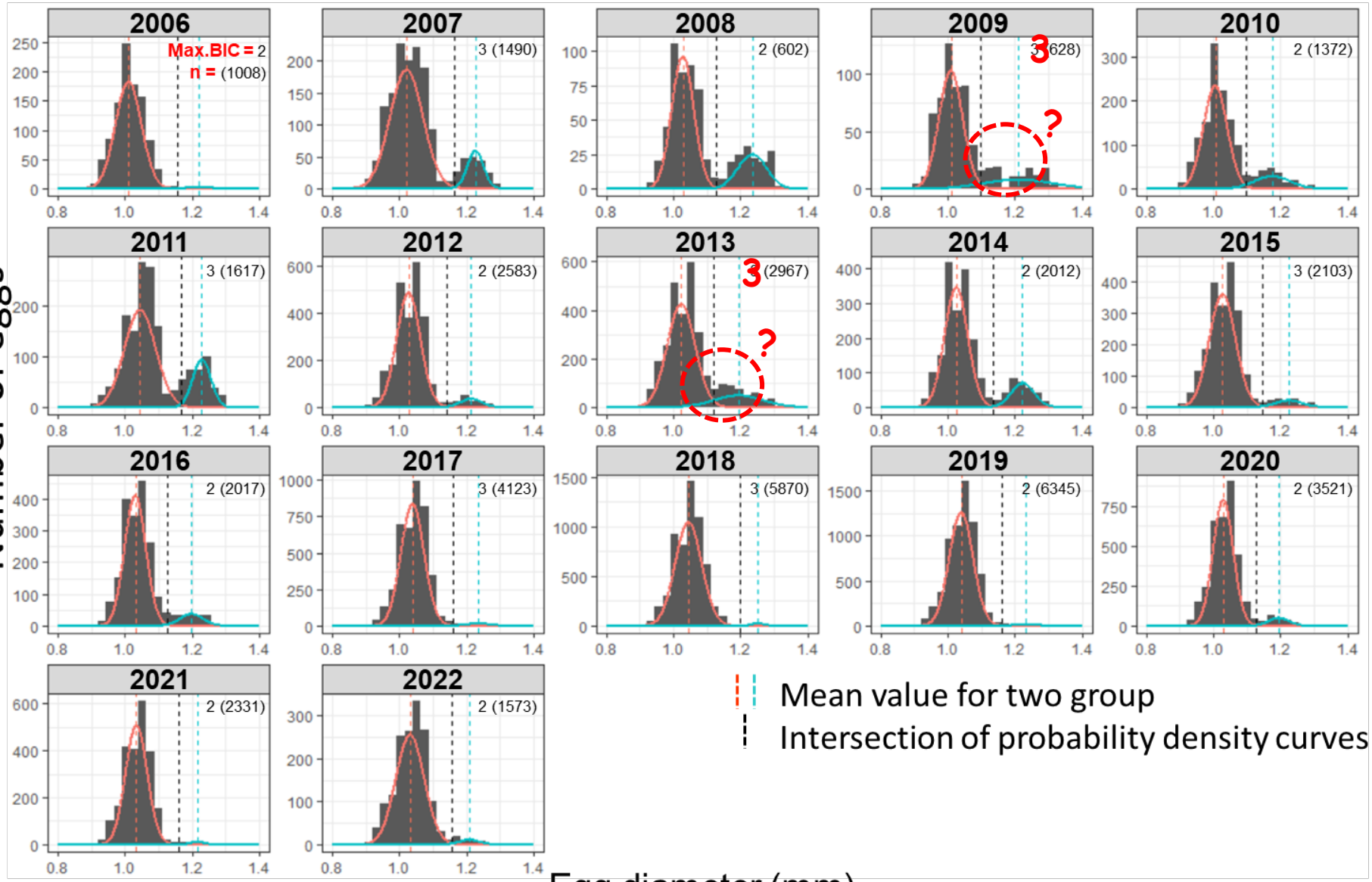
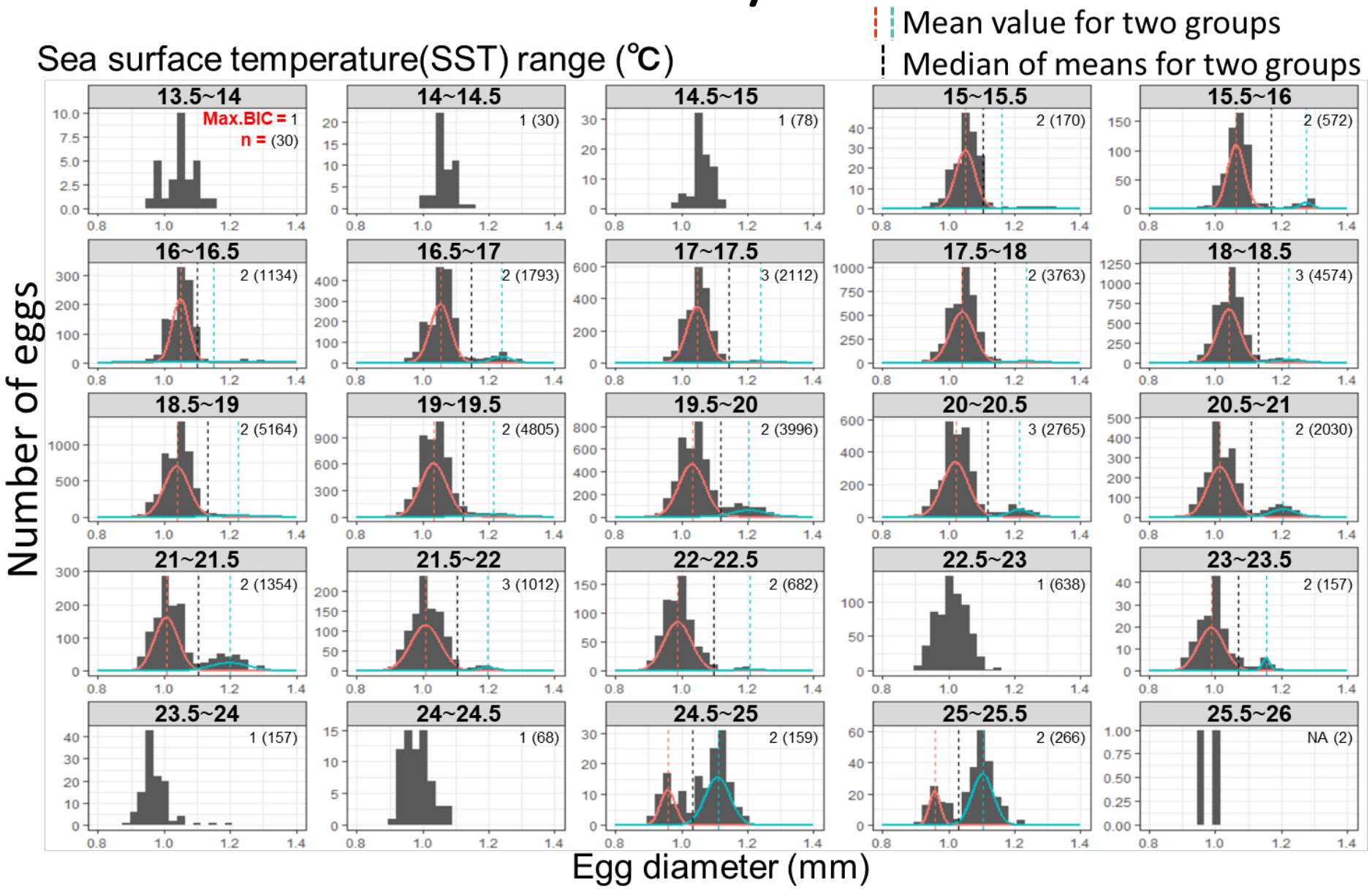


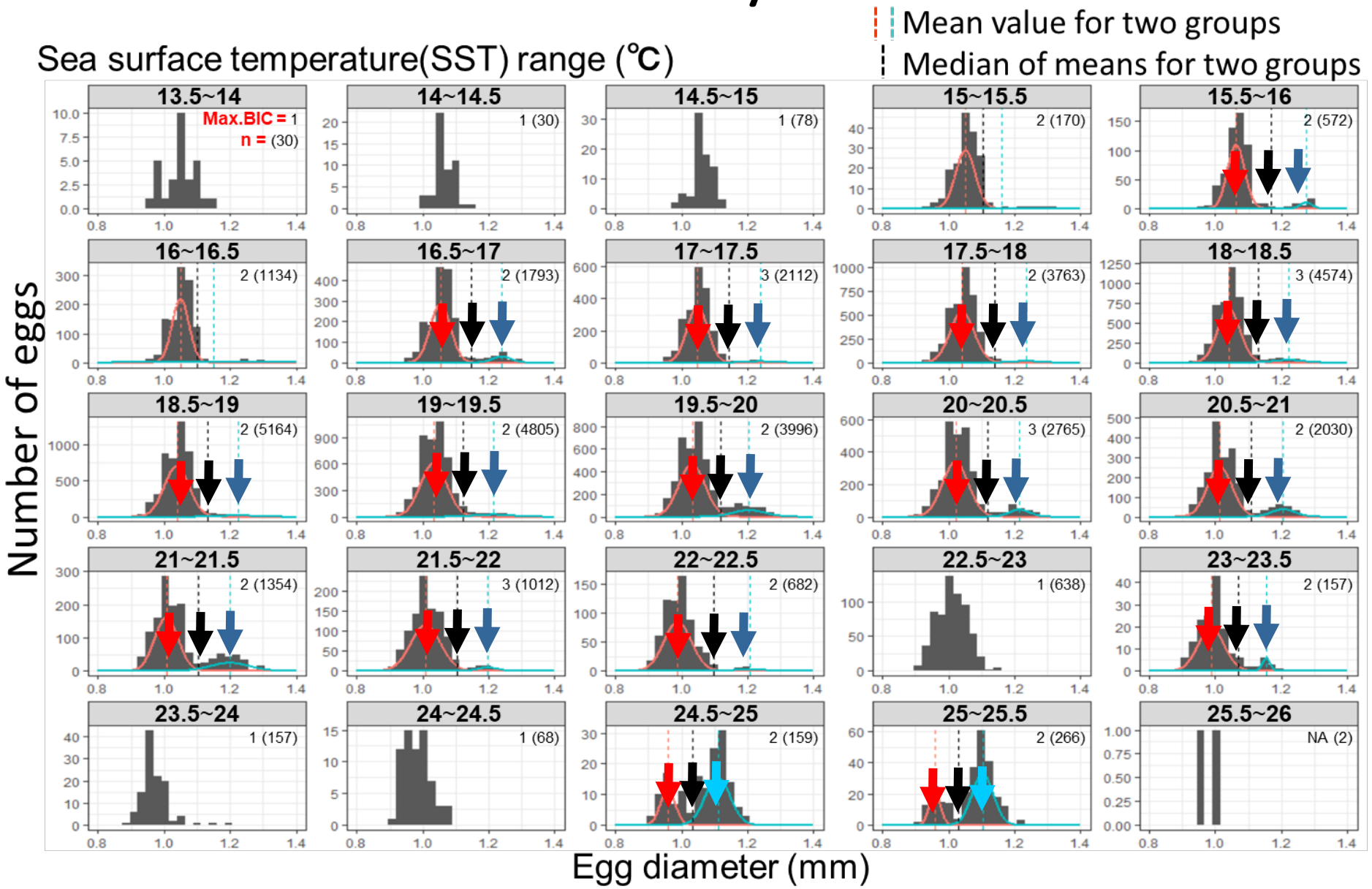
Results

"SST class" classification by GMM



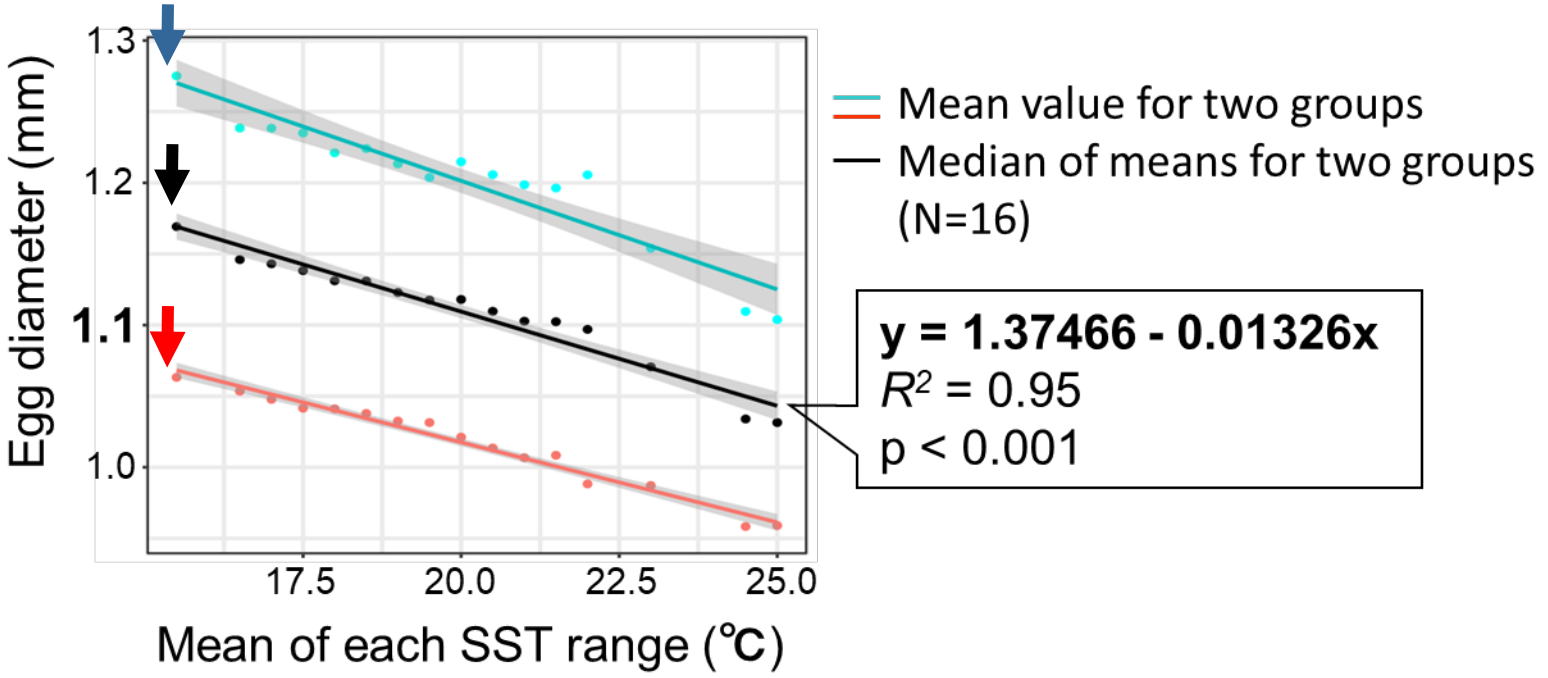
Results

"SST class" classification by GMM



Results

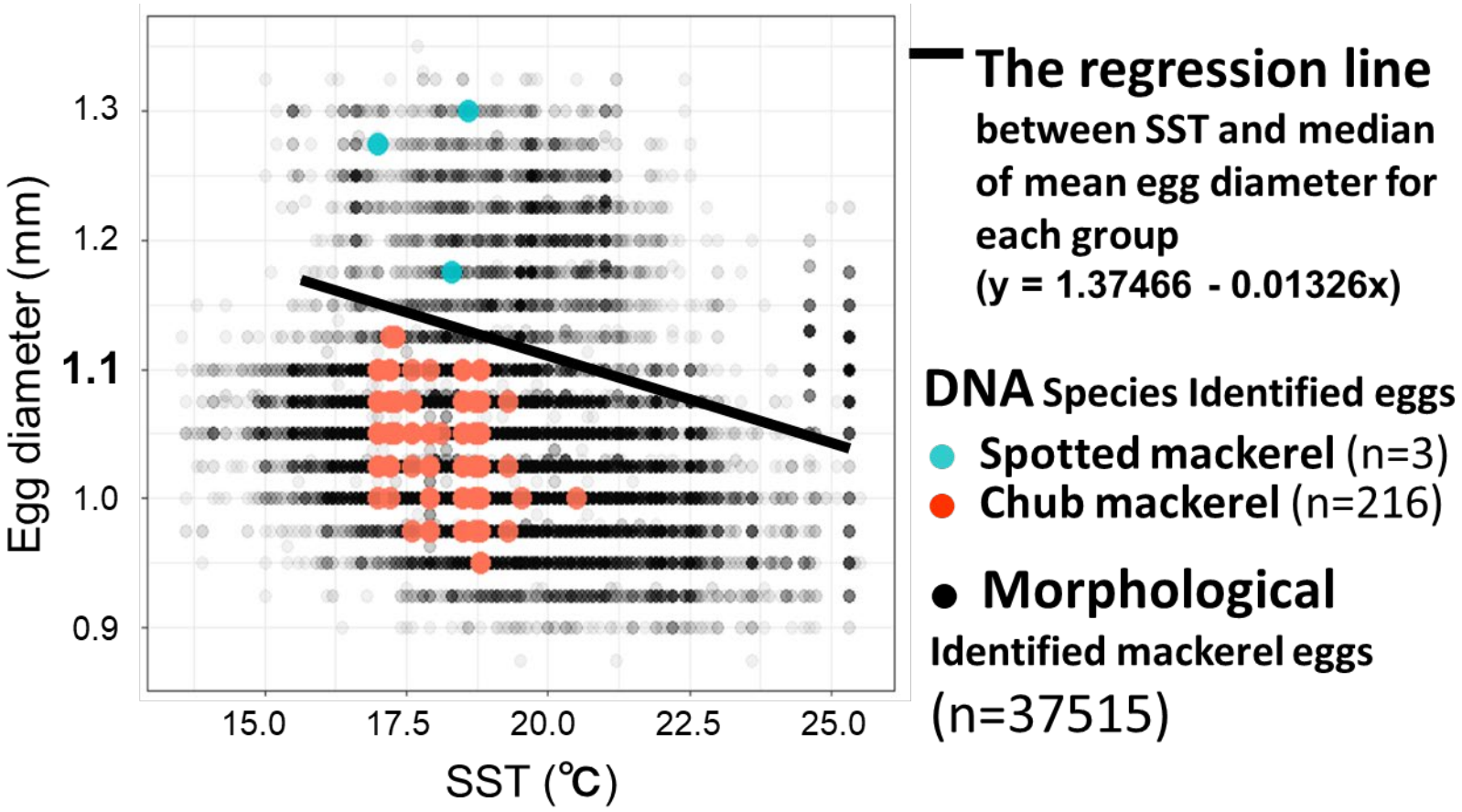
Relationship between SST and median of mean egg diameter for two groups



The relationships between the mean SST and the mean egg diameter were clearly expressed by a negative linear function for both two groups.

Results

Verification by DNA species identification



The regression line works as a criterion to discriminate eggs of chub mackerel (smaller) and spotted mackerel (larger).

Discussion

Temperature effects on egg diameters

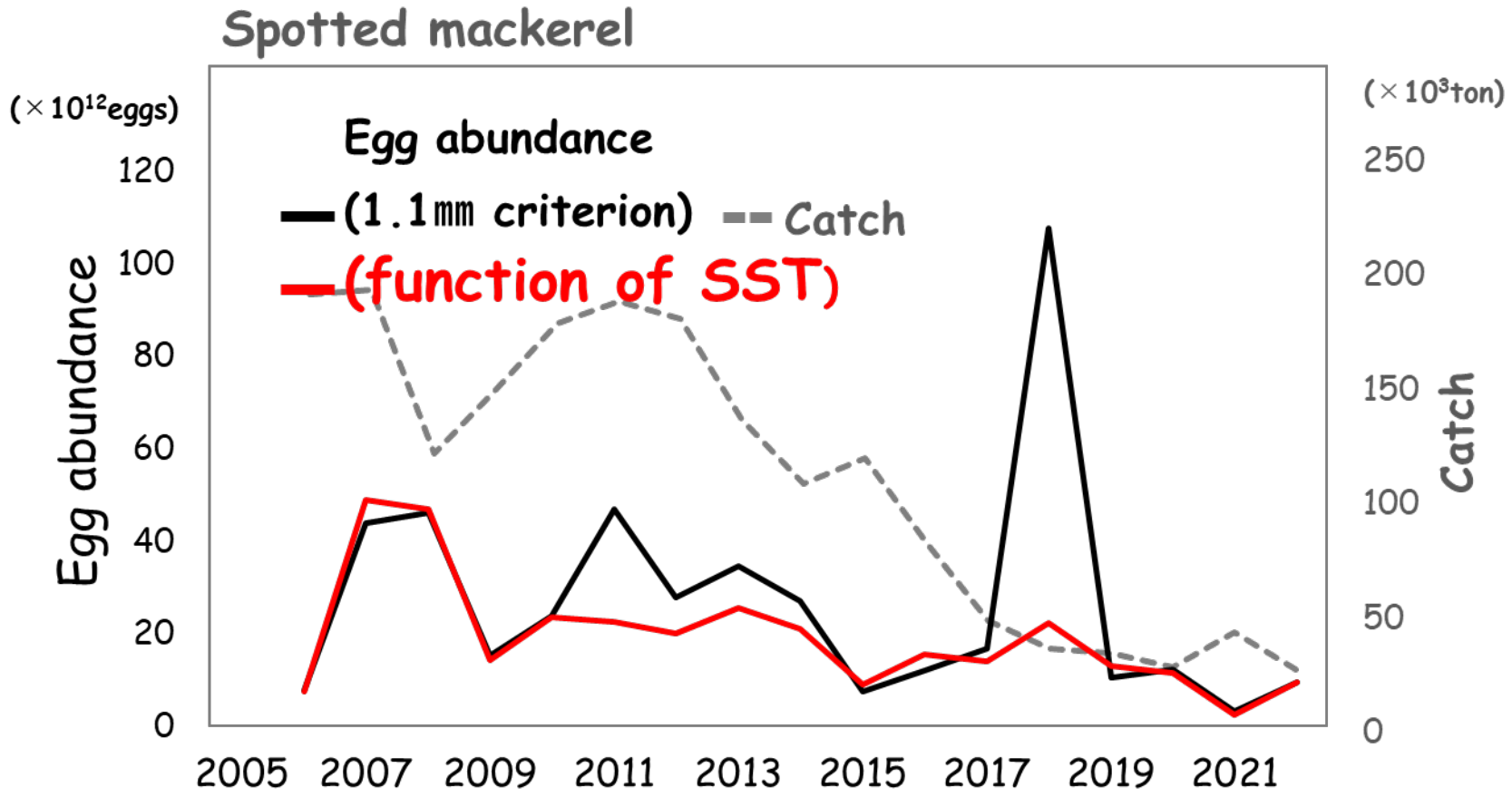
The present study found a negative effect of water temperatures on egg diameter

- The egg diameter was expressed as a clear function of SST, making it possible to broadly express the spatiotemporal variation of the discrimination criterion.

Application of results

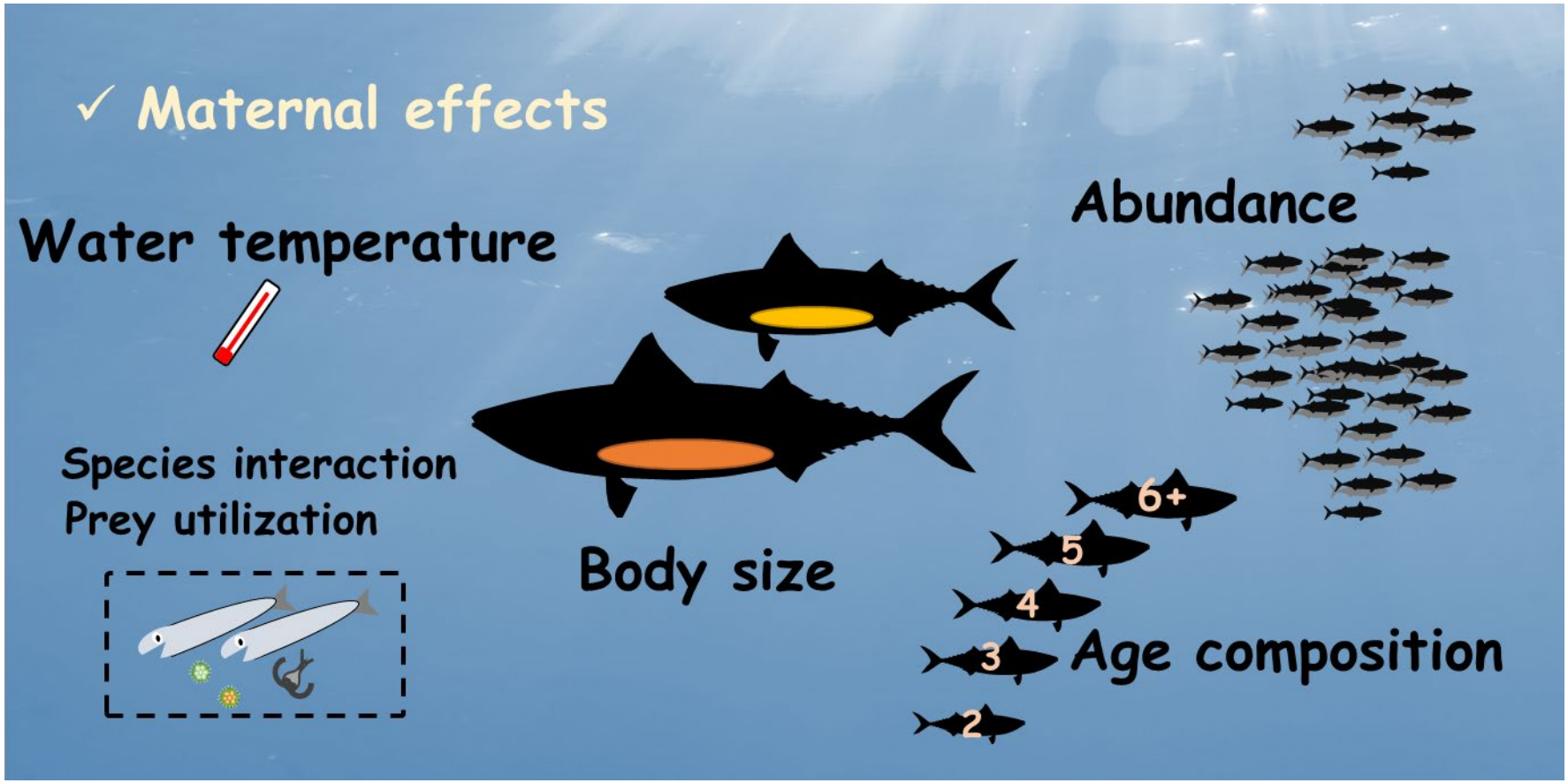
Classification using the SST function

The present study provides a new discrimination criterion as a function of SST.



Further studies

Effects of spawning stock biomass (abundance, age composition, body size)



Thank you for your attention