Environmental predictors of habitat suitability and spatial distribution of Indo- Pacific bottlenose dolphin (*Tursiops aduncus*) in Jeju waters

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Background – Indo- Pacific bottlenose dolphin *(Tursiops aduncus)*

Geographic range of *Tursiops aduncus* (IUCN)

Background – Jeju Population

- A single stock

- 110 population size

- Endemic

- Sighted within 500m from the coastline

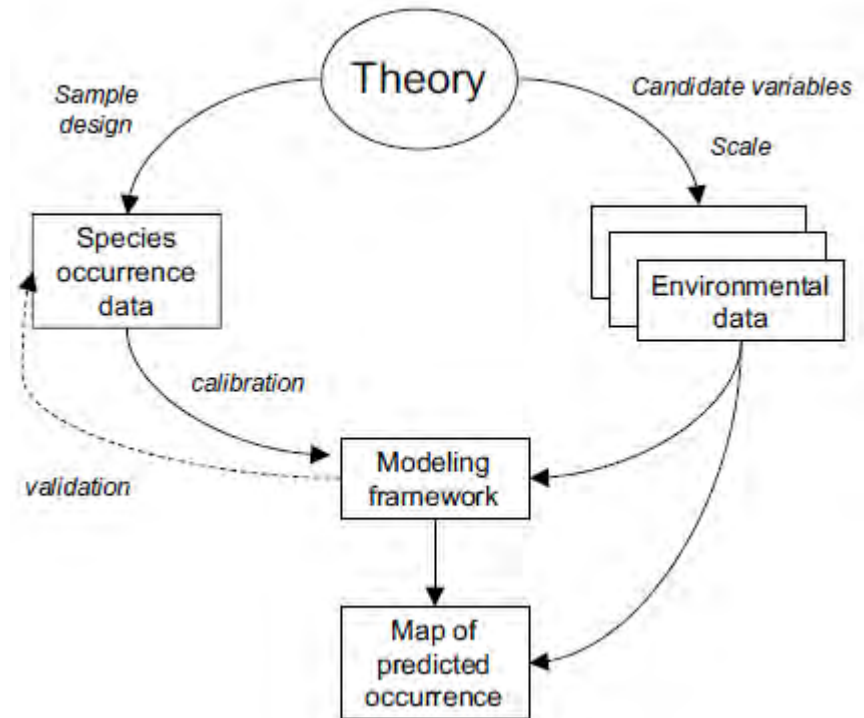- Korean government designated "Marine Protected Species" in 2012

Objective

1) Understanding the environmental variables determining *Tursiops aduncus*' s spatial distribution

   - *What is determinant of spatial distribution?*

2) Detection of potential distributional areas and undiscovered populations in study area

   - *Where is the potential habitat in the East China Sea?*

3) Inter-annual distribution in Jeju waters

   - *What kind of environmental predictors are related to the inter-annual distribution?*

Method – Species Distribution Models(SDMs)

- **Species Distribution Models(SDMs)** estimate the relationship between species records at sites and the environmental and spatial characteristics of those sites.
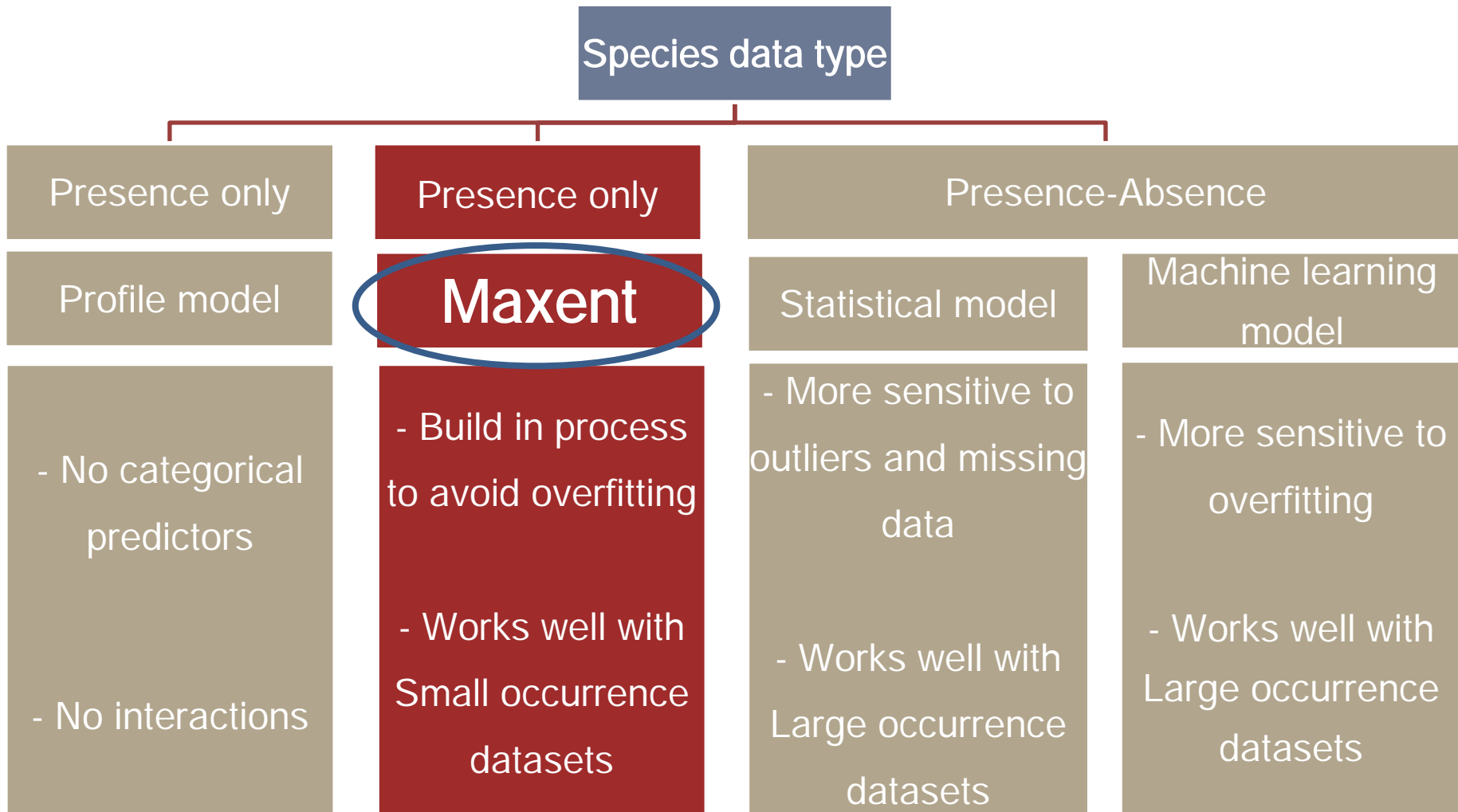

- **Applications**

✓ Conservation and reserve planning

✓ Species invasion

✓ Future projections of climate changes

(Franklin, 2009)

Algorithm selection

Species data type		

Presence only	Presence only	Presence-Absence	
Profile model	**Maxent**	Statistical model	Machine learning model
- No categorical predictors - No interactions	- Build in process to avoid overfitting - Works well with Small occurrence datasets	- More sensitive to outliers and missing data - Works well with Large occurrence datasets	- More sensitive to overfitting - Works well with Large occurrence datasets

- Continues & Categorical data
- Interactions between variable

Input data

1) Response variables: GBIF(639), OBIS(430), JEJU(76) prevalence data

   - Temporal resolution : 2002~2016

2) Explanatory variables:

GBIF — Global Biodiversity Information Facility

OBIS — Ocean Biogeographic Information System

   - Temporal resolution   min)

- GBIF data
- OBIS data
- CRI data

IUCN

THIS STUDY

Known distribution range (IUCN)

Suitable Habitat

IUCN

Range map(IUCN)

THIS STUDY

Suitable Habitat

① Jeju
② Mikura
③ Amakusa - shimoshima
④ Ogasawara Island
⑤ Penghu

Suitable Habitat

- **Model Evaluation**

Average Sensitivity vs. 1 - Specificity for Tursiops_aduncus
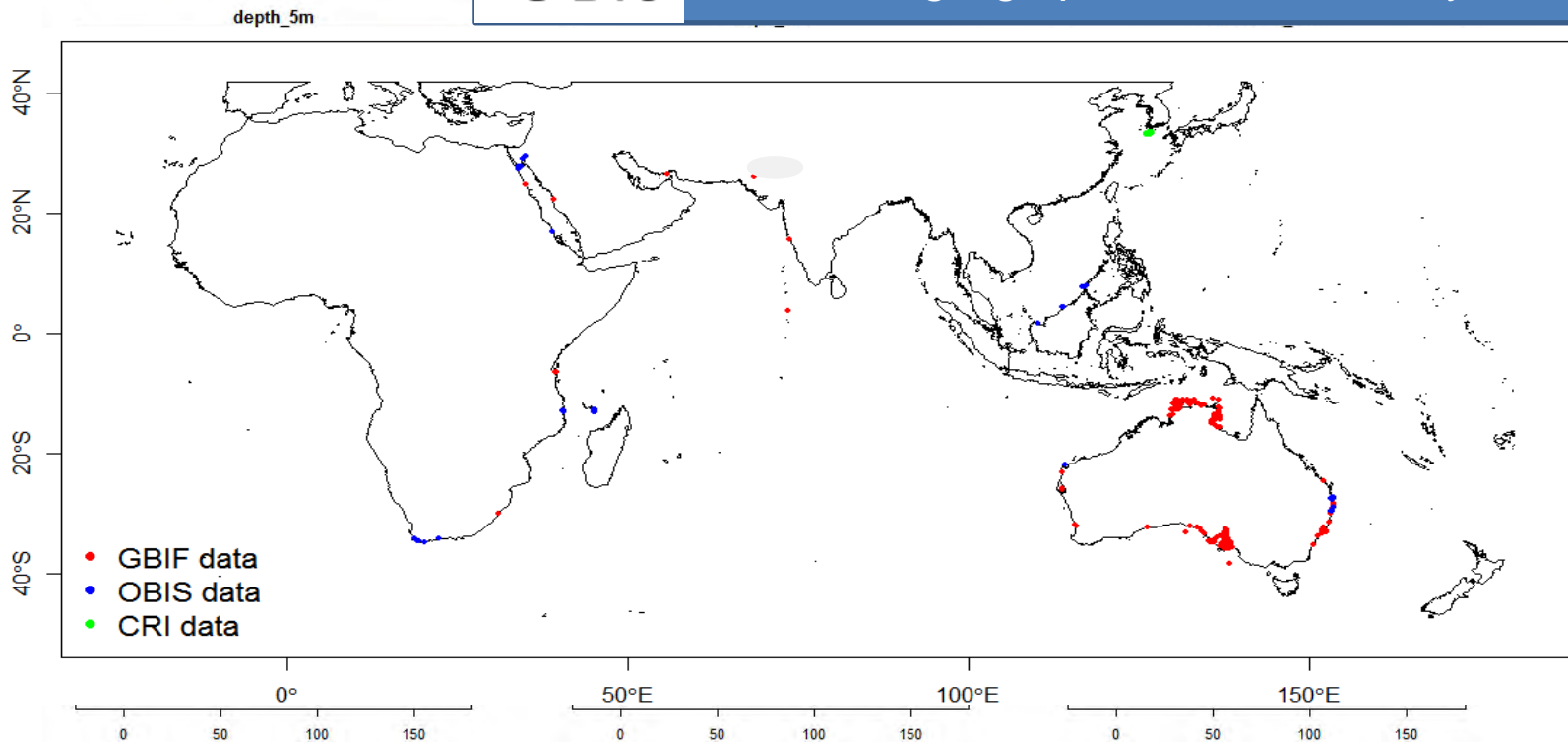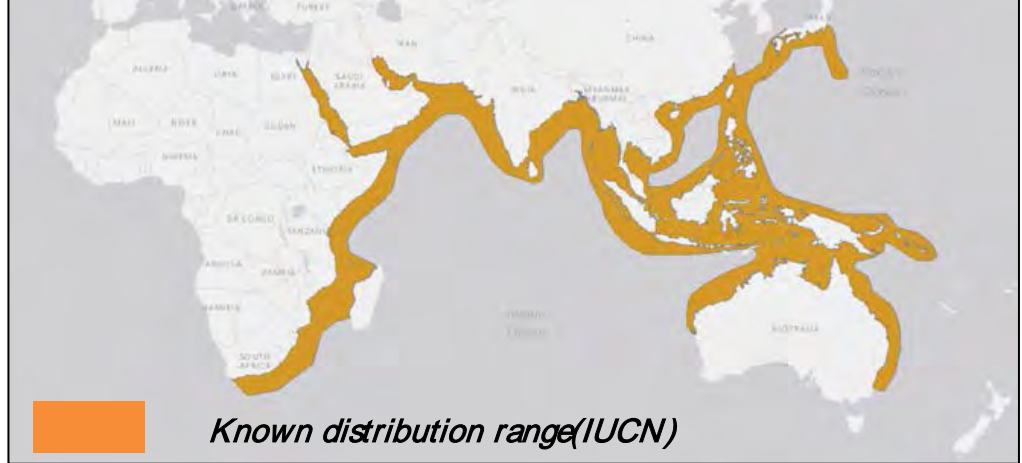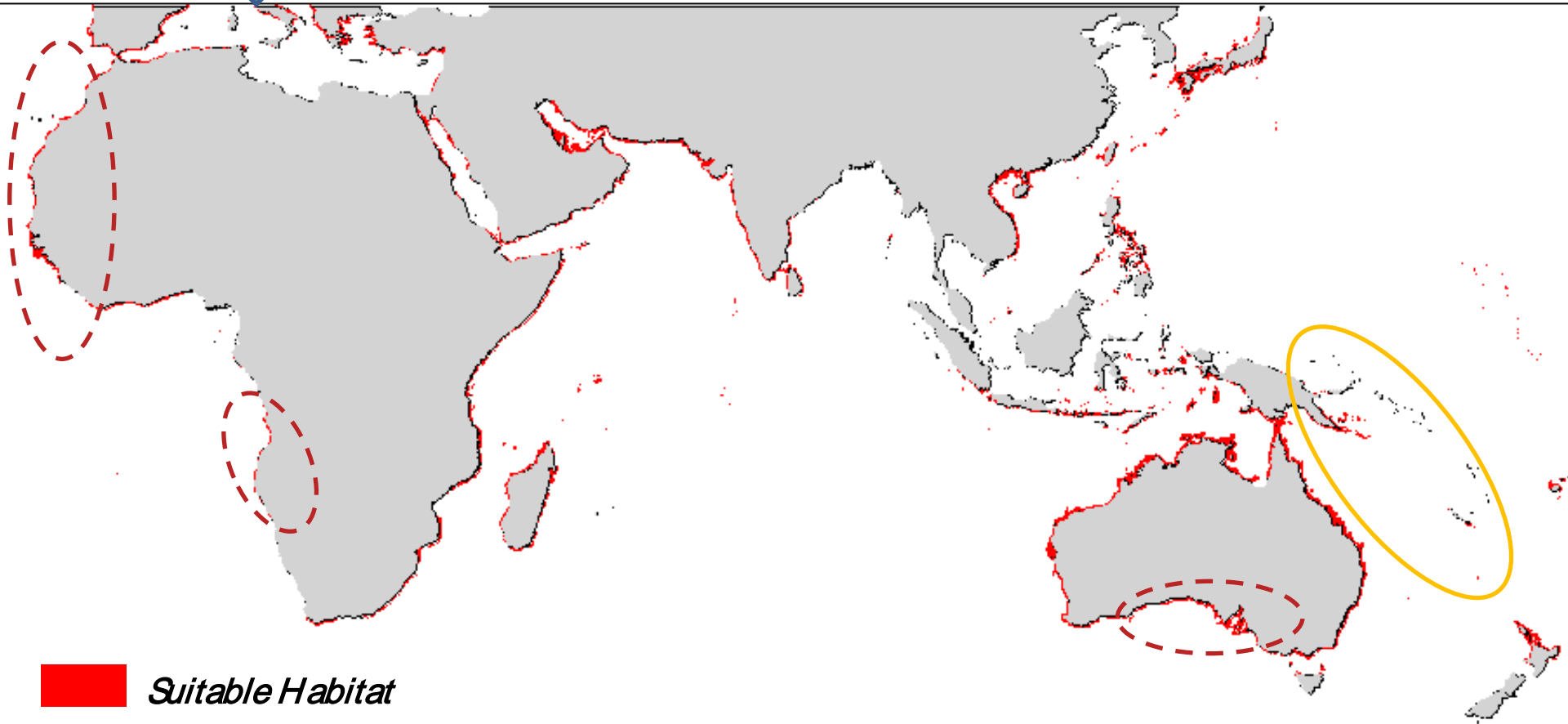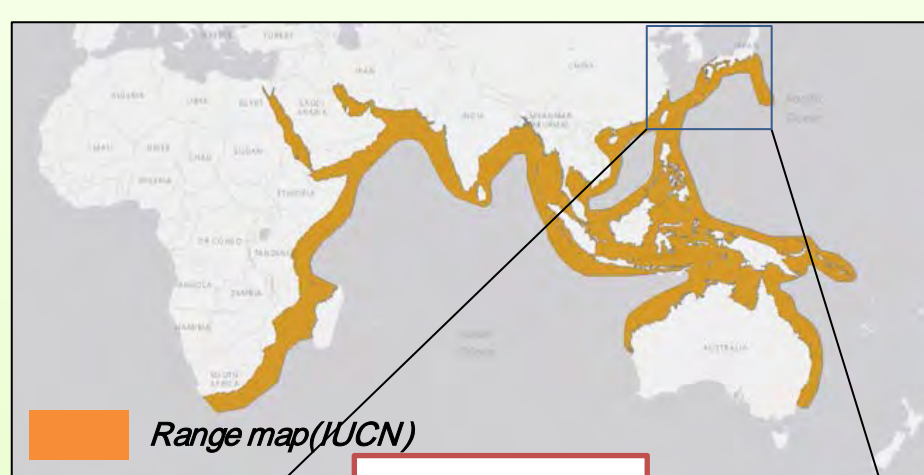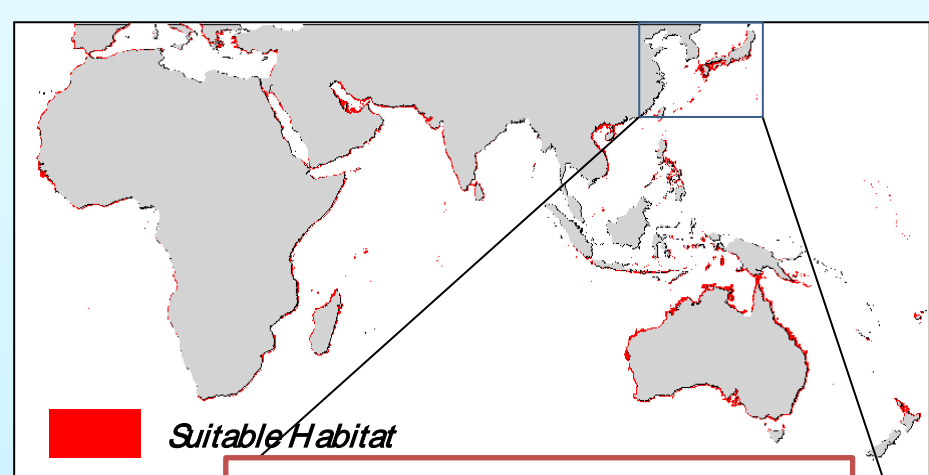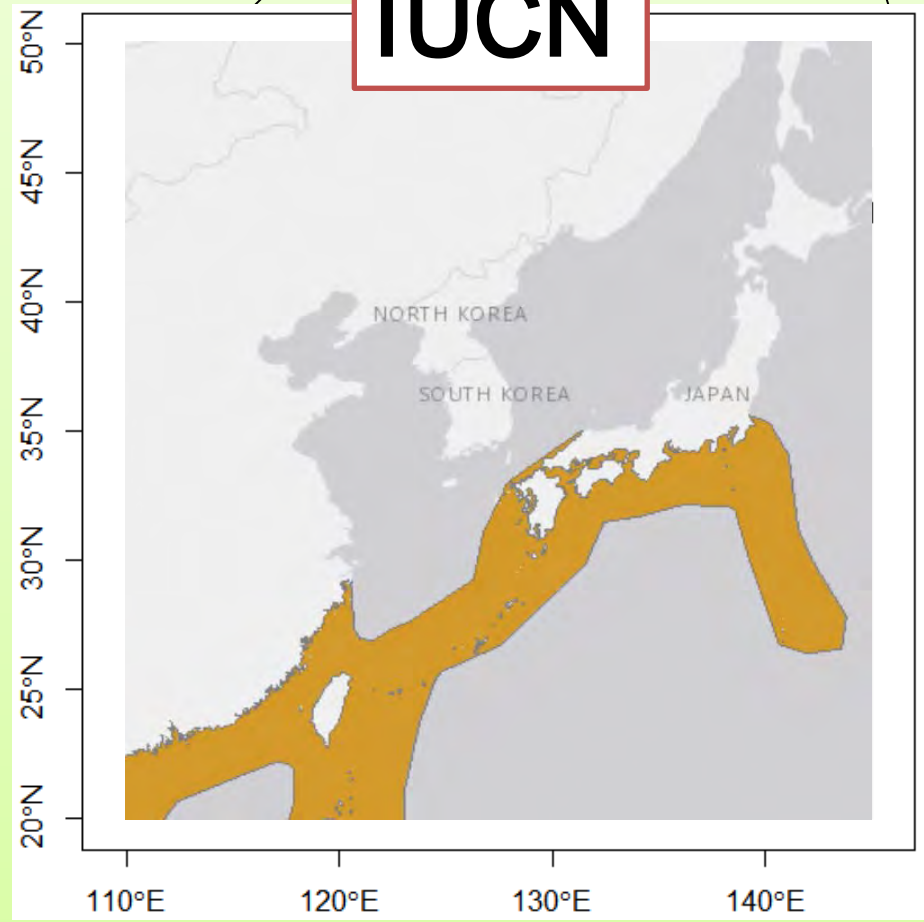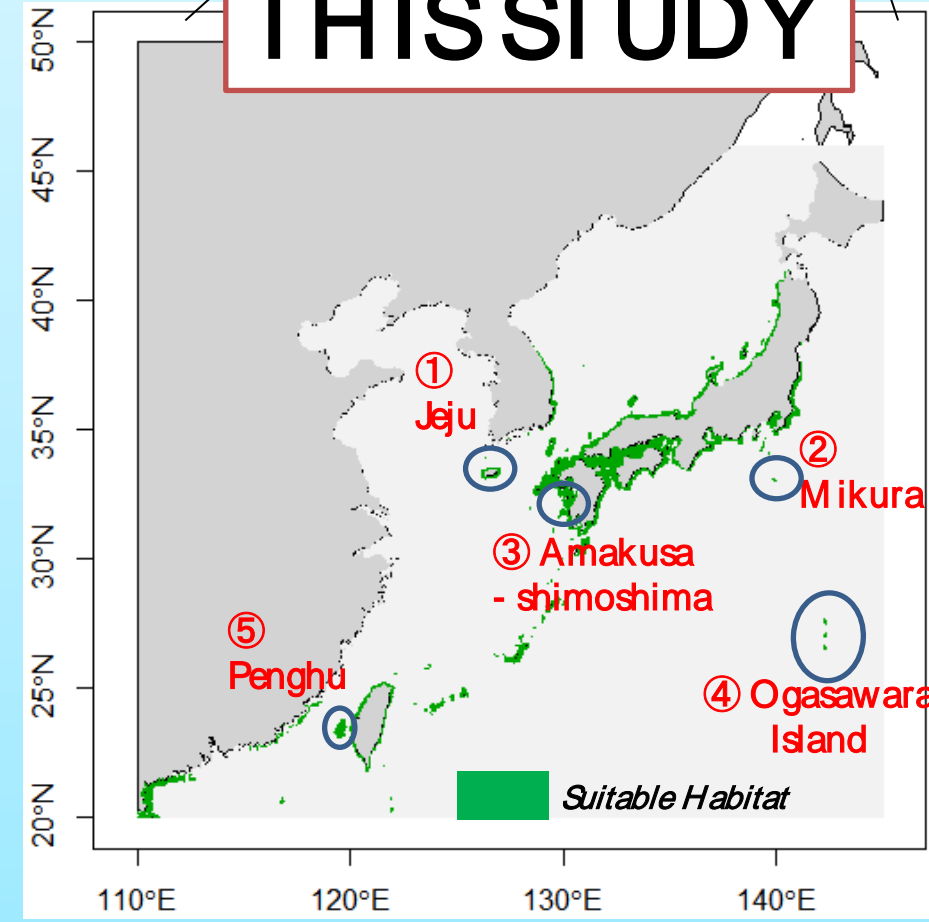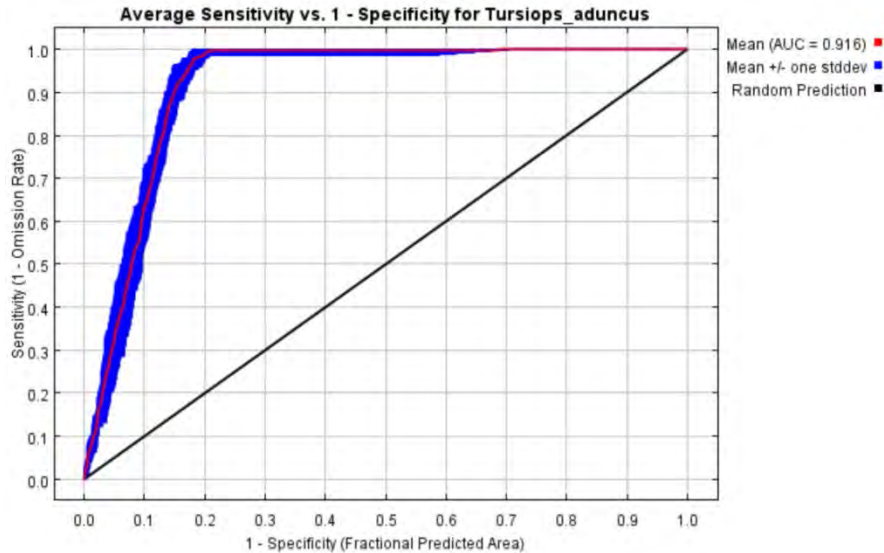
ROC: Receiver Operating Characteristic curve
AUC: Area under curve
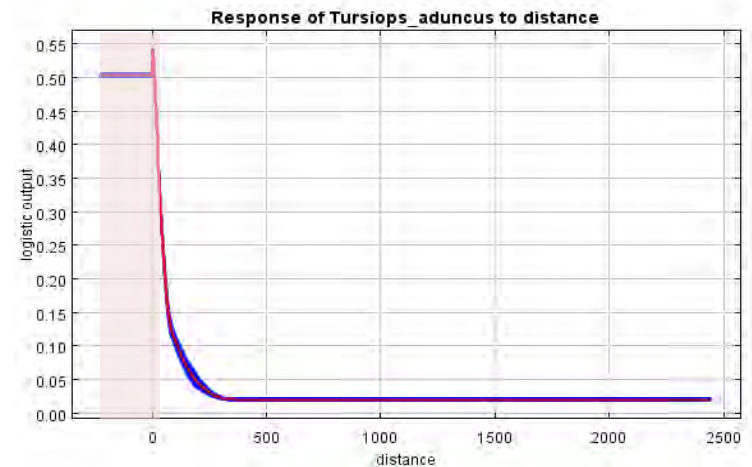
AUC = 0.916

AUC > 0.5 Higher Predictive Power
AUC = 0.5 Random Chance
AUC < 0.5 Worse than Random

- **Response Curve**
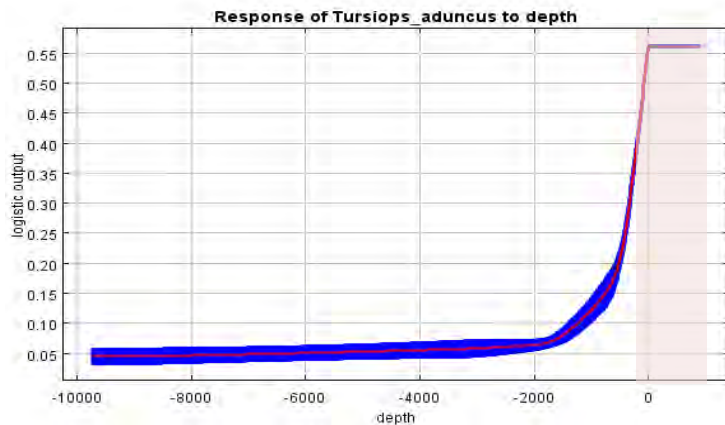
Response of Tursiops_aduncus to depth

Response of Tursiops_aduncus to distance

62.9 %   28.8 %

The detectability of dolphin in the Northwestern part of Jeju waters
near Hankyung-myeon has been decreasing and there were no dolphin sightings near Han-lim coast since 2012.

(Kim et al, 2015)

- **Input data**

1) Response variables: Jeju data

   - Period 1 (28)

   - Period 2 (49)
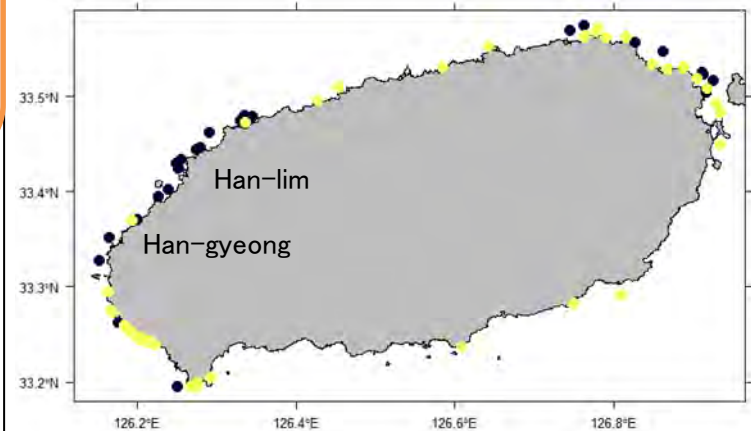
● Period 1 (2007-2011)
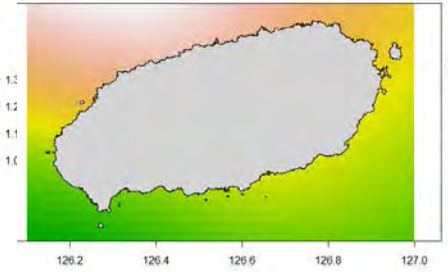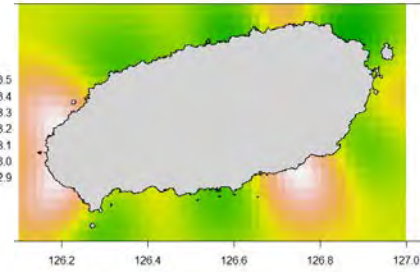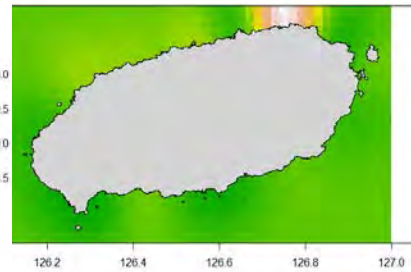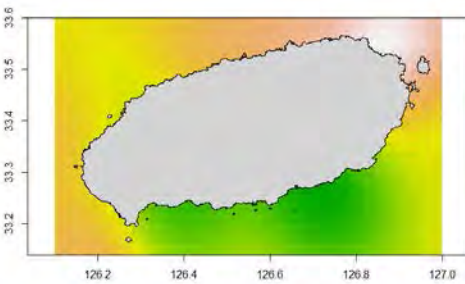● Period 2 (2012-2016)
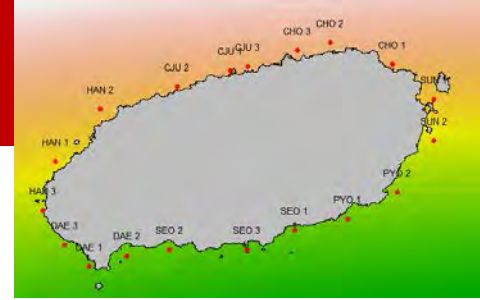
2) Explanatory variables :

- Kriged in-situ data (mean SST, SSS, pH, Chl-a) from 19 sampling stations
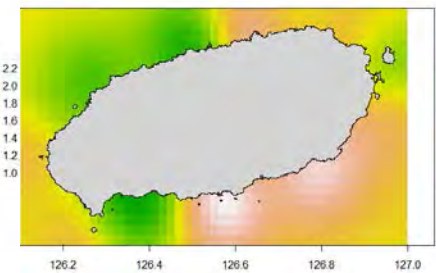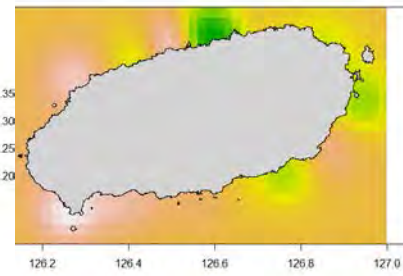
- Period 1 (2007 ~ 2011), Period2 (2012~2016)

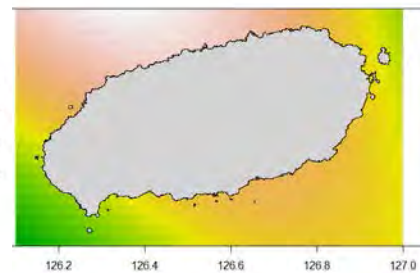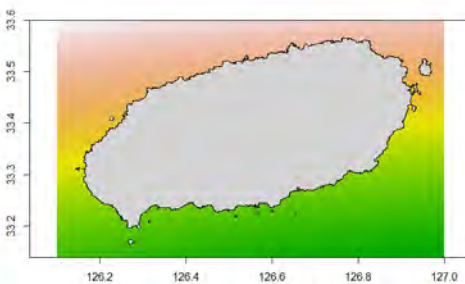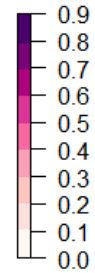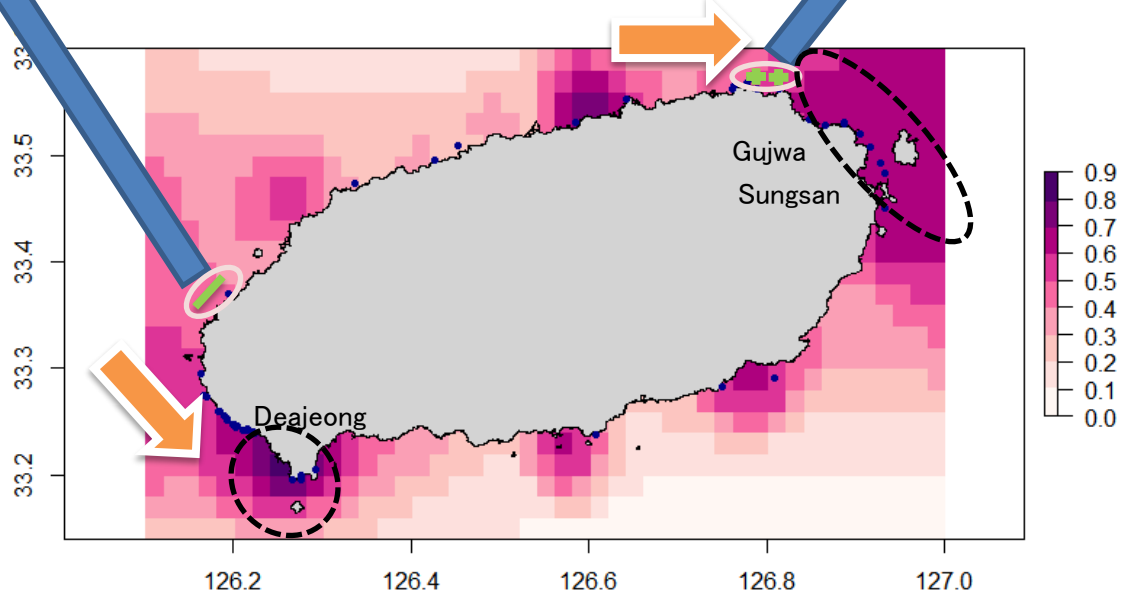| meanSST | meanSSS | meanChl-a | meanPh |

Period 1 (2007 ~ 2011)

Period 2 (2012 ~ 2016)

istribution changes in betwe

Period 1(2007-2011)

Han-gyeong

Jo-cheon
Gujwa

Period 2(2012-2016)

Gujwa
Sungsan

Deajeong
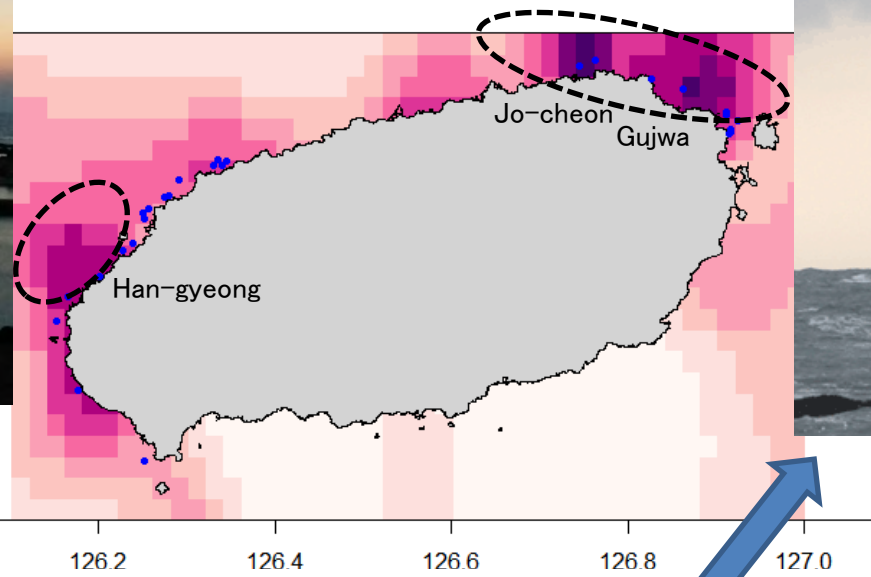
Conclusion

- The determinants for suitable habitat of *Tursiops aduncus* were a water depth and the distance from shore.

- After 2012, the distribution patterns of Jeju population moved toward to south and east.

- Spatial range of annual mean Chl- a, SST, pH and SSS was not primary predictor to explain the shifted distribution of Jeju population after 2012.

Considerations and Future study

- Additional predictors should be added.

    - Anthropogenic impact variables(Location of wind generator and aquaculture)

    - Bottom topography

- Survey effort

- Compare the result with other Algorithms(GAM etc.)

    - Presence/Absence data

Thank you for your attention!