Breeding phenology and diet shift of seabirds in South Korea

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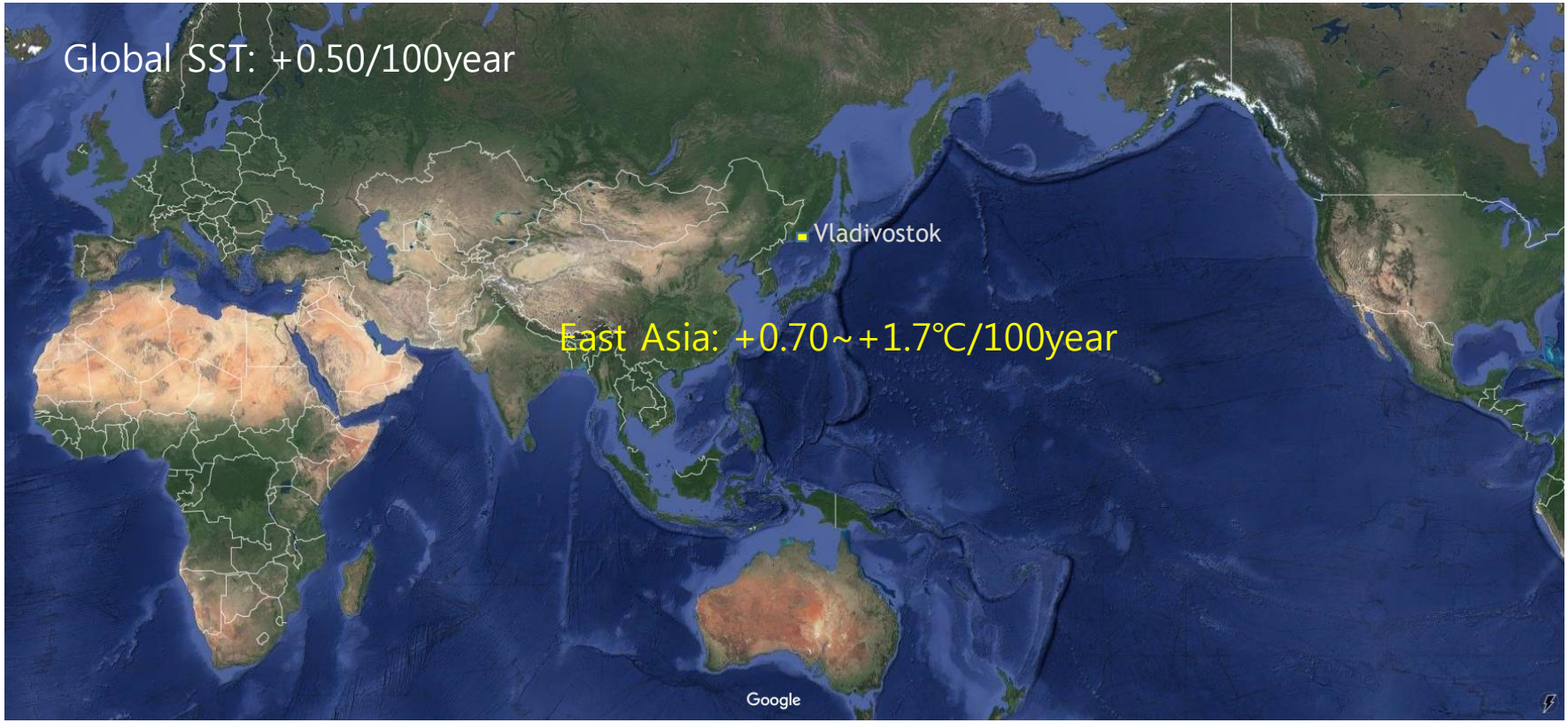
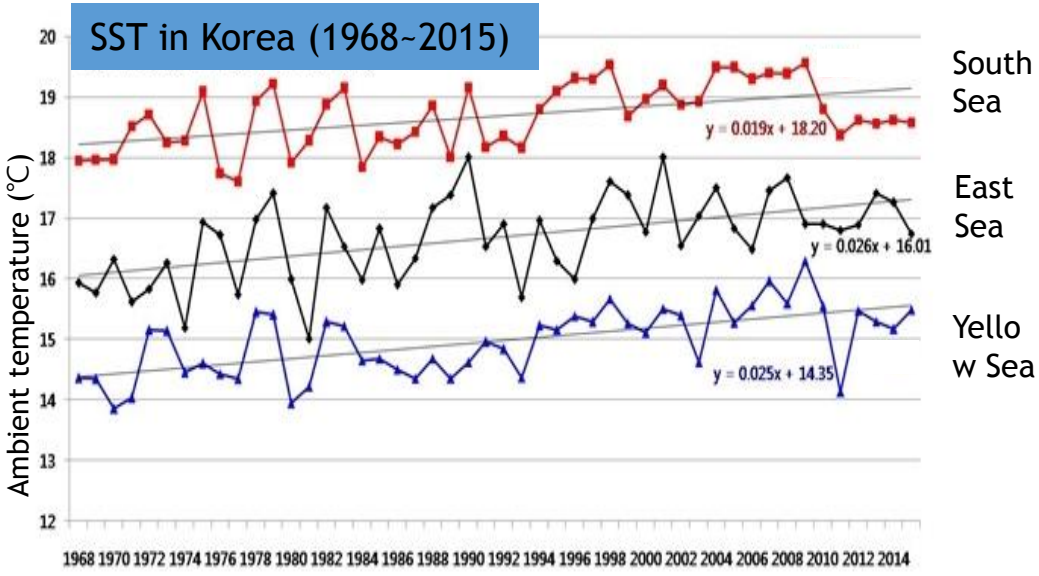
Introduction

- Sea surface temperature(SST) in East Asia is increasing more rapidly than in global oceans



Introduction

- Marine environment change has been detected in South Korea
- Sea temperature has increased as 1.2℃ for past 47 years
  (South sea: 1.0℃, East Sea: 1.34 ℃; Yellow Sea: 1.18 ℃)
- Marine ecosystem has been changed as well
  (e.g. fish species and distribution)

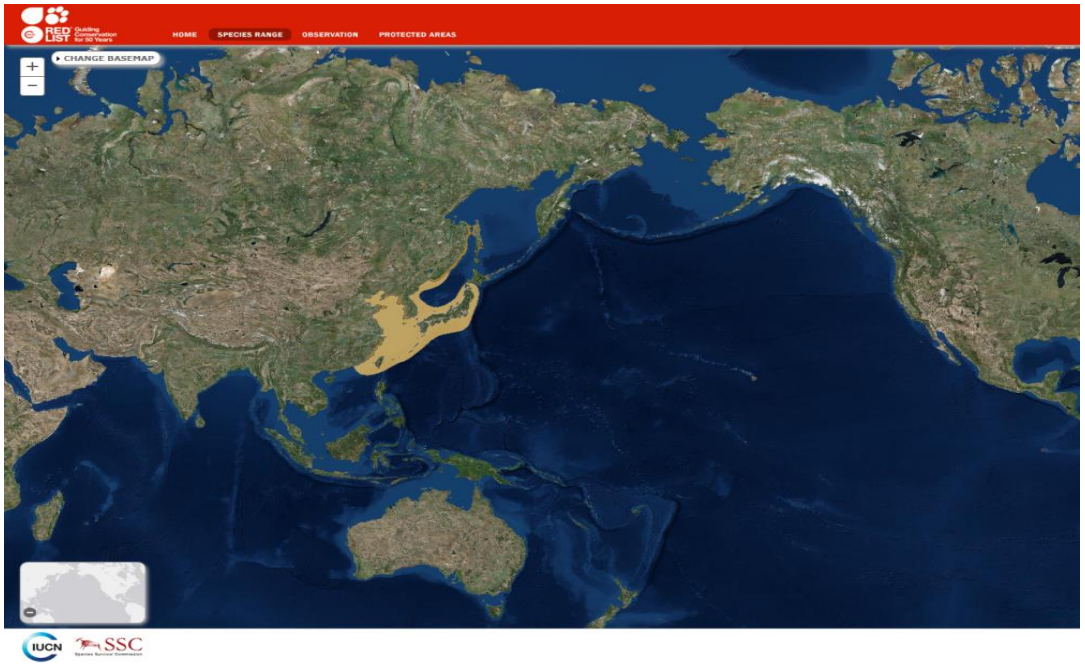


Objectives

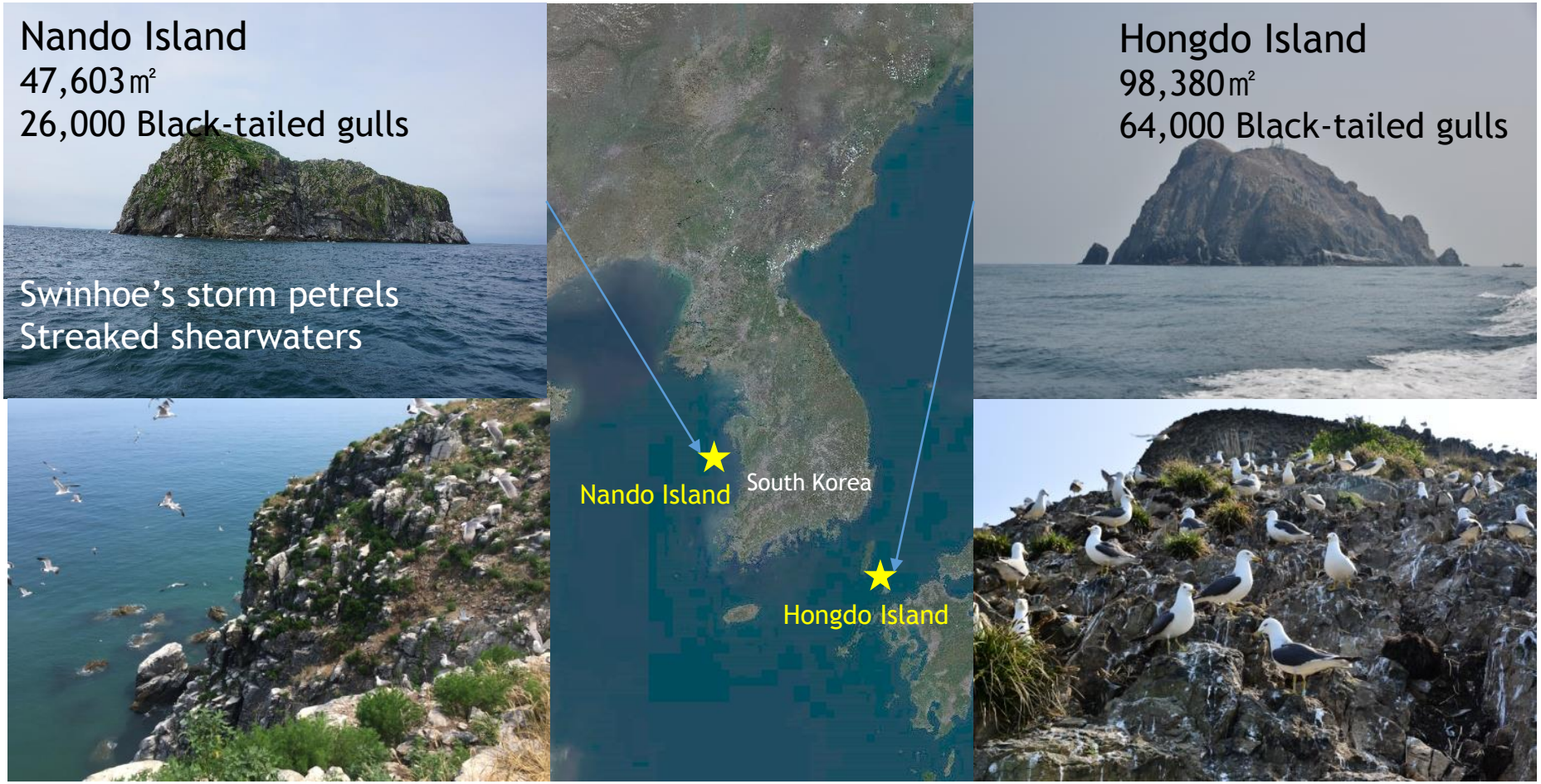
- To investigate the change of breeding pheonology and performance of Black-tailed gulls(BTGs) in South Korea

Study species

- Black-tailed gulls *Larus crassirostris* (BTGs)
  - medium sized (body mass: 450~600g)
  - distribute in China, Russia, Taiwan, Japan and Korea
  - opportunistic predator (fish, squid, shrimp and etc.)

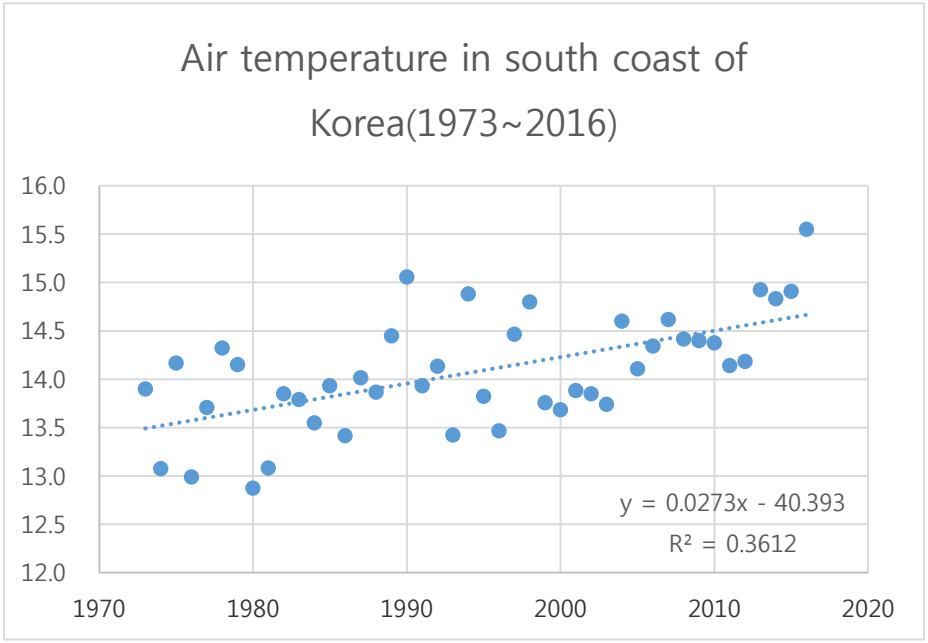


Study sites


Nando Island
47,603㎡
26,000 Black-tailed gulls
Swinhoe's storm petrels
Streaked shearwaters
Nando Island
South Korea
Hongdo Island
Hongdo Island
98,380㎡
64,000 Black-tailed gulls

Study sites

- Air temperature and SST has been increased near Hongdo Island
  : air temperature increased as 1.7 ℃ (1973 to 2016)
  sea surface temperature (SST) increased as 1.8 ℃ (1996 to 2016)



Methods

- Breeding phenology of BTGs on Hongdo and Nando Island
  - took a photo of breeding colony using Time laps cameras
  - monitored the first date of settlement on breeding colony (Hongdo Island: 2011~2017/Nando Island: 2016~2017 by cameras)
  - observation (2003) in breeding colonies
- Breeding performance of BTGs on Hongdo Island
  - estimated breeding population from 2011 to 2017
  - investigated clutch size and egg volume from 1998 to 2017

Methods

- Annual variation of gull diet during breeding season
  - collected regurgitates of gulls in April to August (2002, 2003, 2012~2016)
  - recorded species and observation frequency of prey items

- Trophic level change
  - analyzed carbon and nitrogen stable isotope ratios ($\delta^{13}C$, $\delta^{15}N$) of chick feathers

- Annual variation of fish population
  - the data of “Fish Catch” near Hongdo Island (1998 to 2016) by local fishery cooperative association from NFRDI

Results

- Breeding started on 1 April in 2017 on Hongdo Island

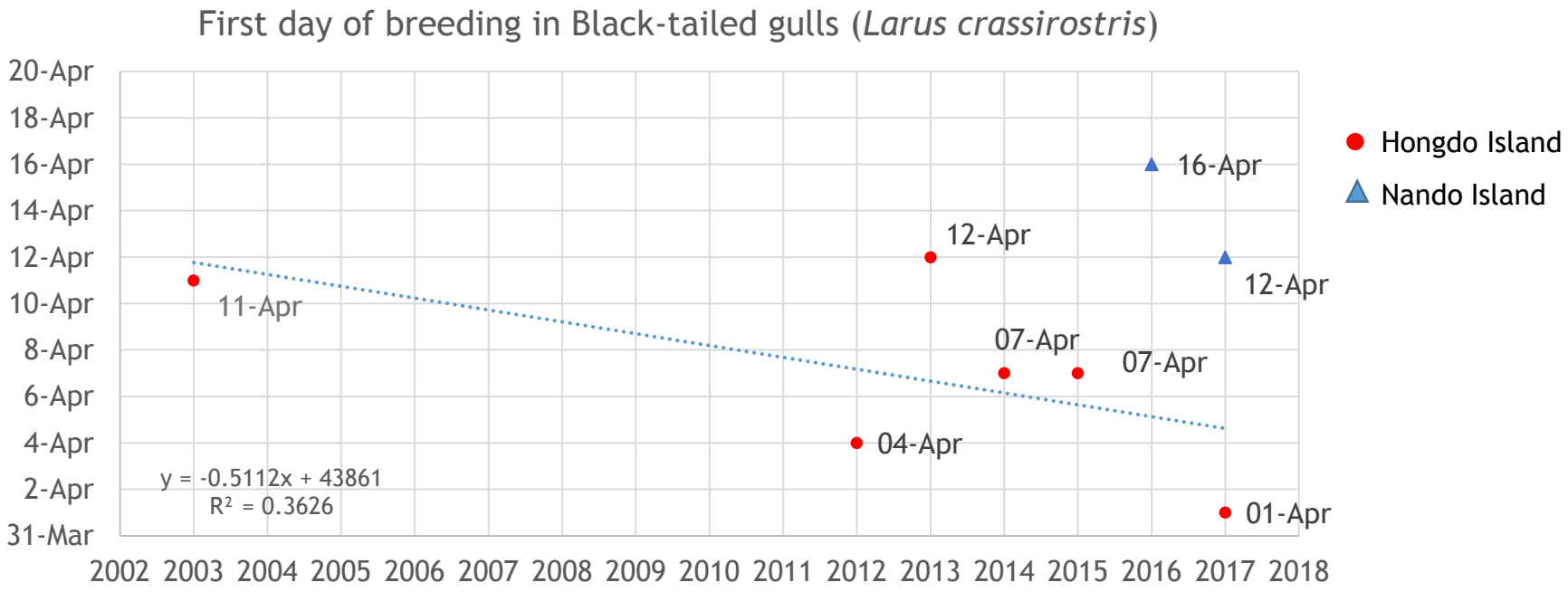
Results

- Breeding started on 16 April in 2017 on Nando Island

Result

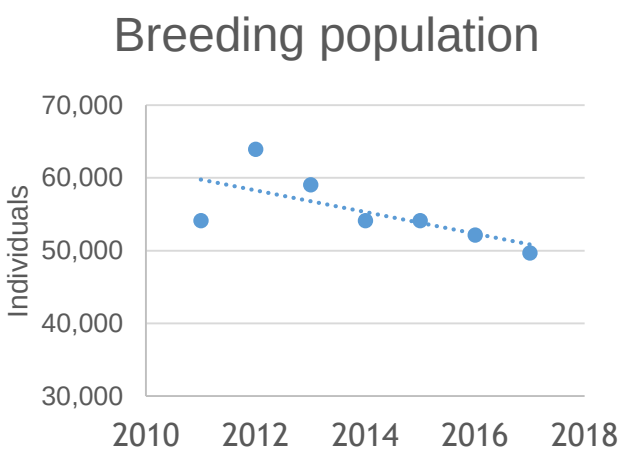
- Breeding phenology of BTGs
  - Early breeding in 2017

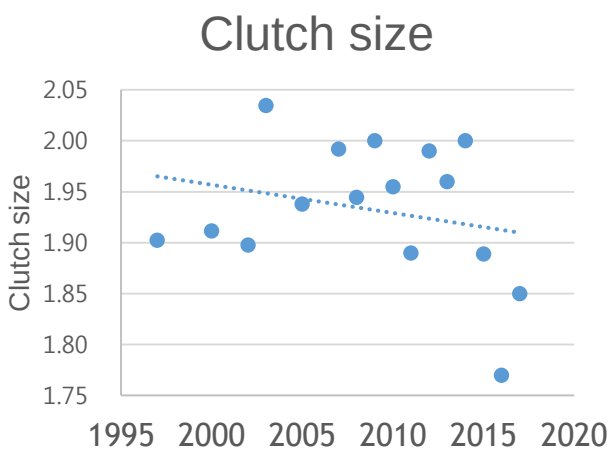
    (Hongdo Island: 6 days /Nando Island: 2 days earlier than in 2016)

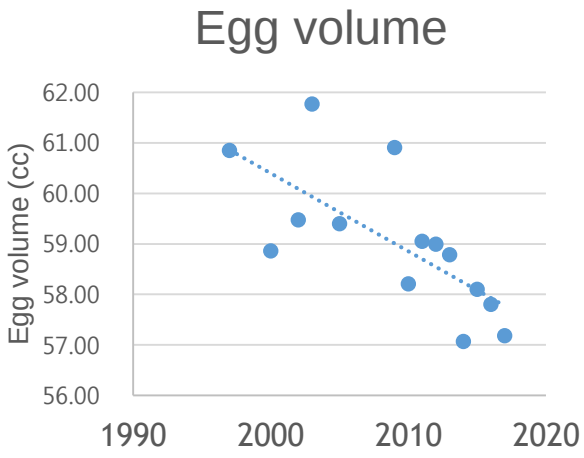


Results

- Breeding population, clutch size and egg volume of BTGs have declined on Hongdo Island



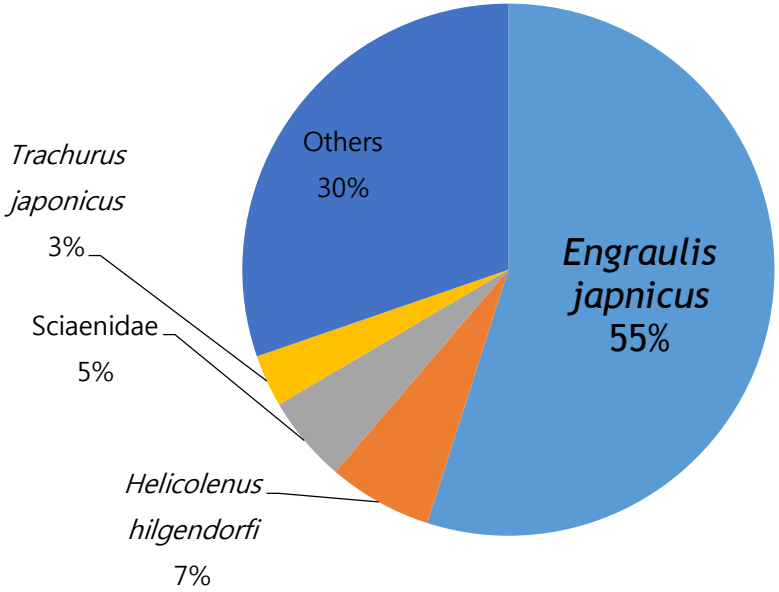




What are the causes of these declines on Hongdo?

Results

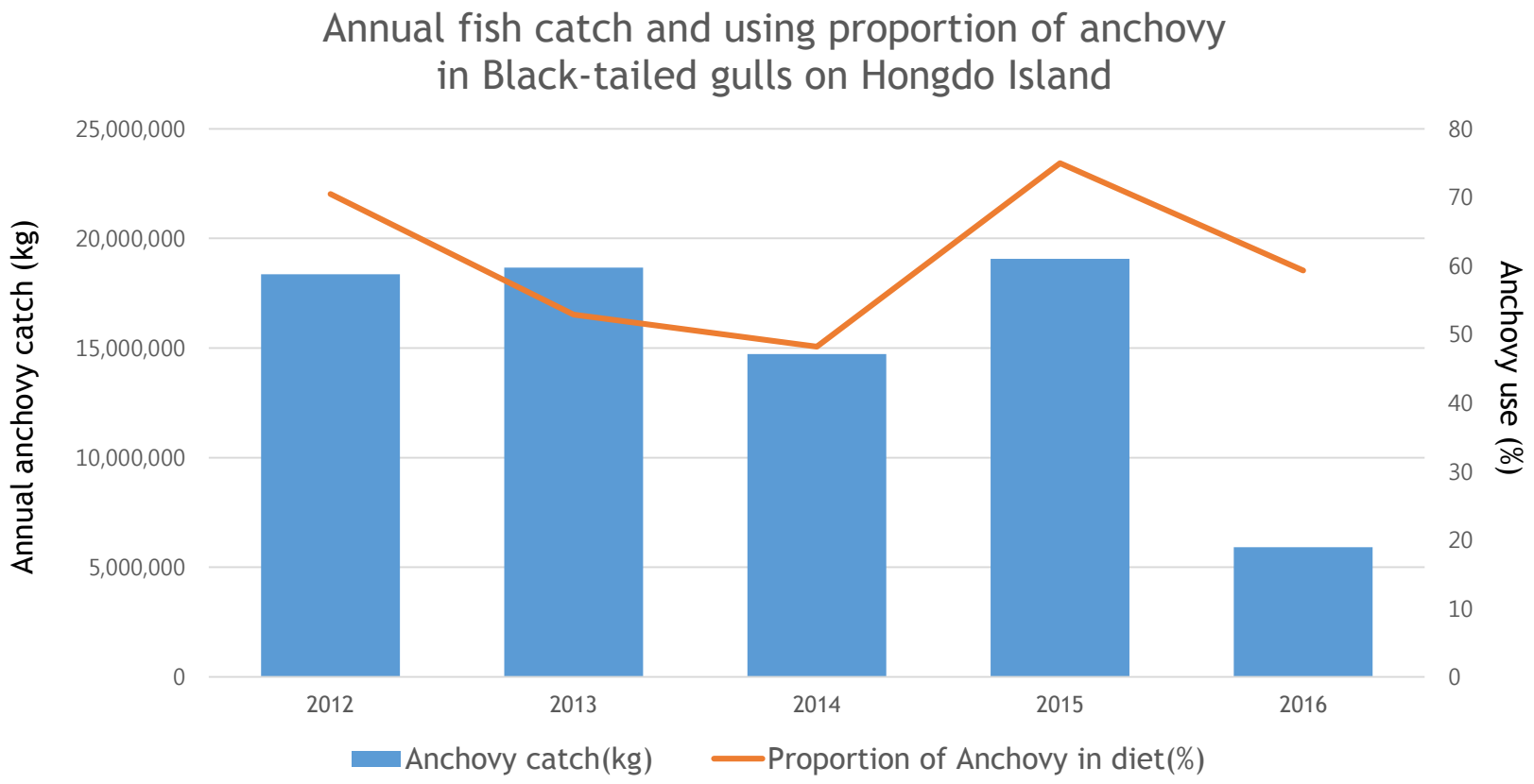
- Diet of Black-tailed gulls during the breeding season
  : mainly Japanese anchovies on Hongdo (2002, 2003, 2012~2016)



(KNPS 2016, KIM et al. 2013)

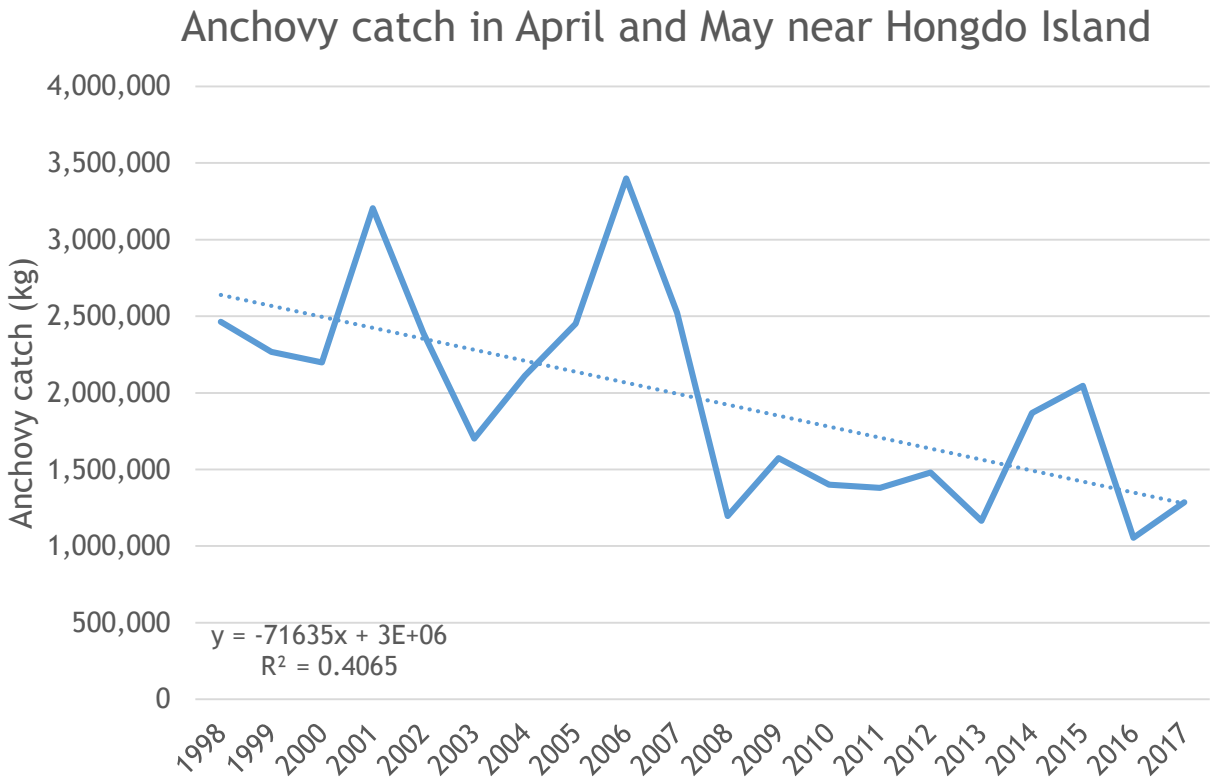
Results

- Diet use of BTGs reflected the anchovy population during the breeding period in each year



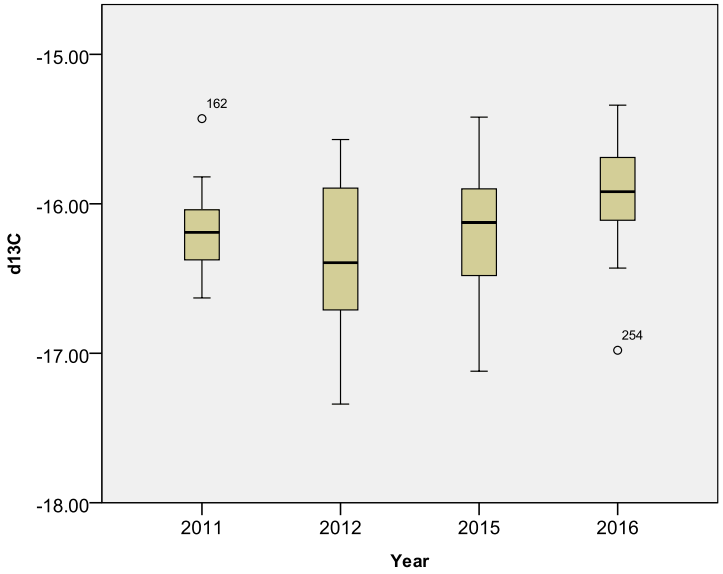
Results

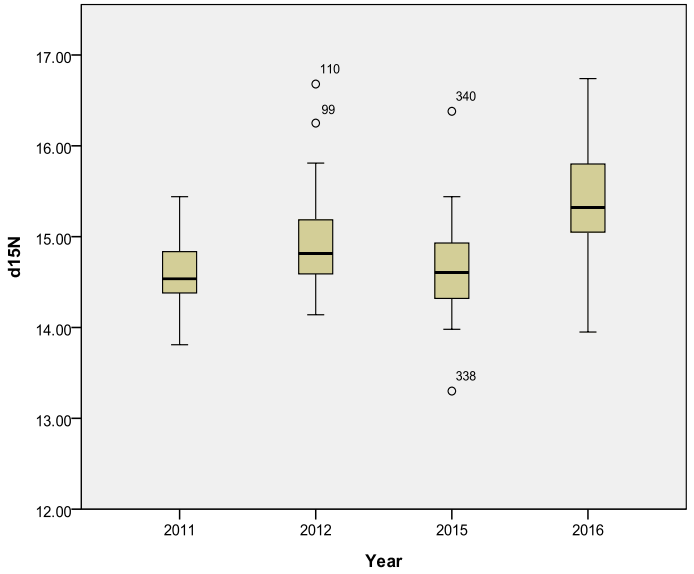
- Anchovy population has been declined in April and May(laying period of BTGs) near Hongdo Island (1998~2017)



Results

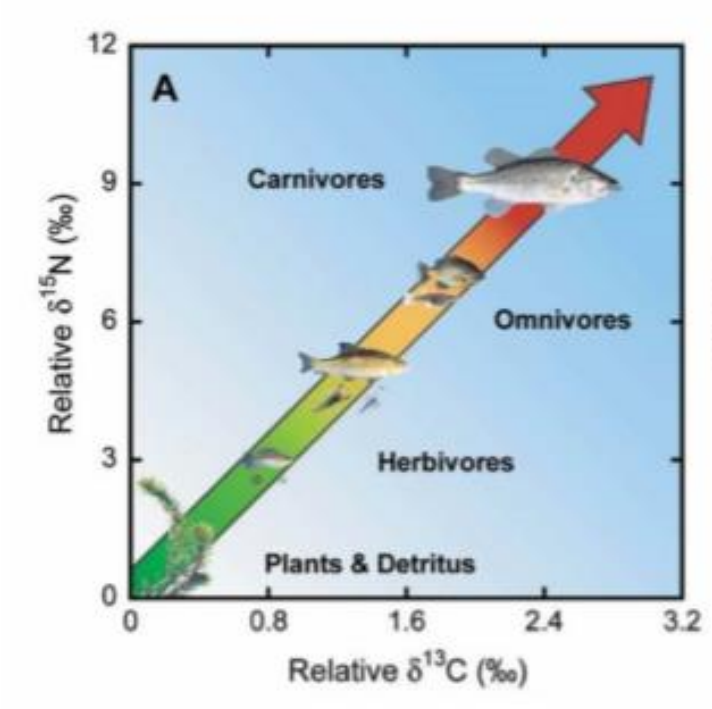
- δ^{13} C and δ^{15} N of chick feathers tended to increase

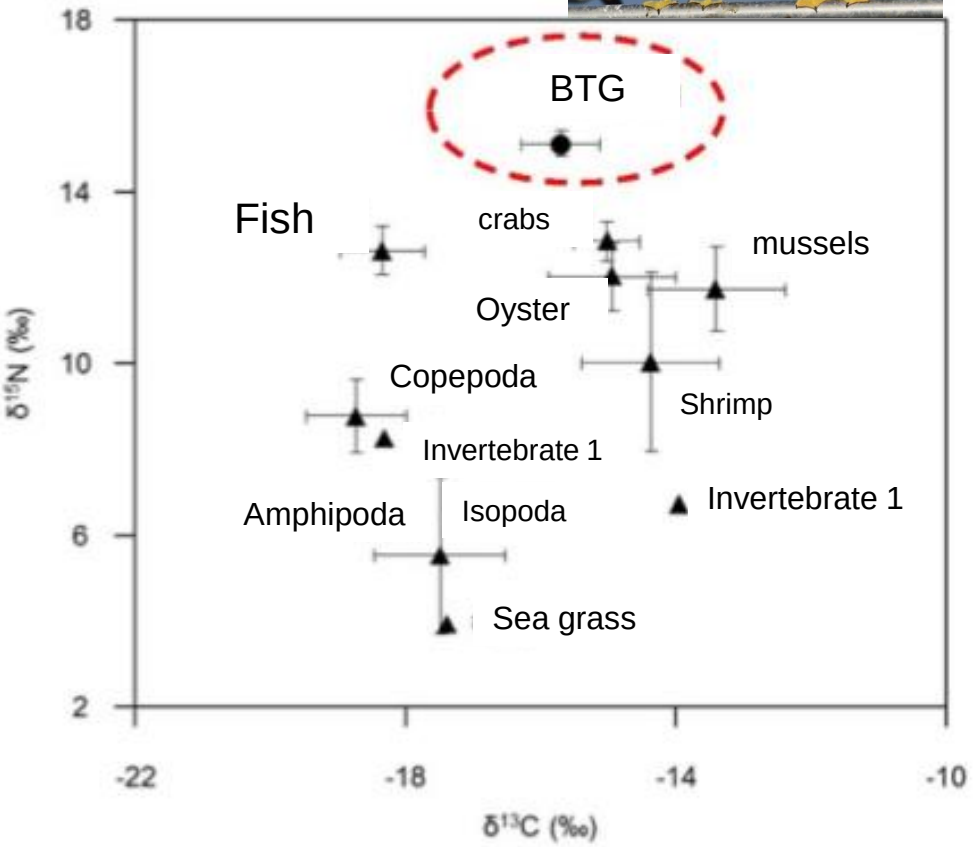




Results

- δ^{15} N and δ^{13} C of chick feathers





USGS, http://sofia.usgs.gov/publications/fs/2004-3138

Conclusions

- Early breeding might relate to other factors rather than prey availability
- Fish availability during laying period may affect breeding performance of BTGs
- Seasonal variation of anchovy population near Hongdo Island might be a factor to constrain early breeding performance of BTGs