

# Seabird monitoring and the Barents Sea ecosystem

Per Fauchald

Norwegian Institute for Nature  
Research, Tromsø



# SEAPOP

## Seabird population management and petroleum operation

- Norwegian national seabird mapping and monitoring program
- Started 2005
- Co-ordination of existing and future monitoring effort
- Organized by NINA, NP and the University of Tromsø
- Funded by Ministry of the Environment, Ministry Petroleum and Energy and the Oil Industry



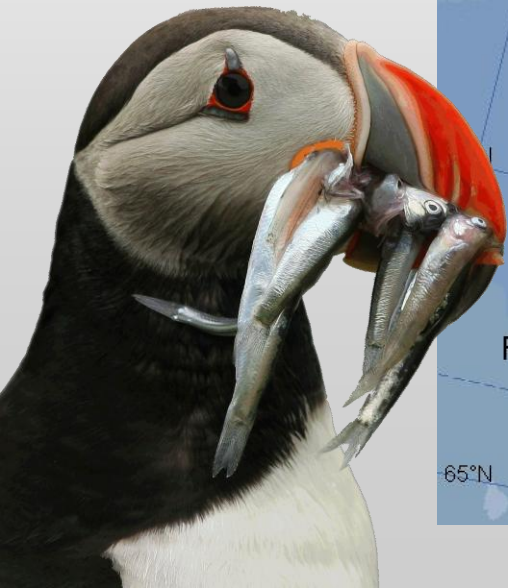
## Three main pillars

1. Mapping seabirds offshore and along the coast
2. Monitoring seabird populations
3. Monitoring diet, reproduction and adult survival

# Monitoring key sites



- Population size
- Survival
- Reproduction
- Diet





# Seabirds at sea

- Counting seabirds from boats (strip transect sampling)
- Collaboration with the Institute of Marine Research:
  - Barents Sea ecosystem survey
  - Norwegian Sea ecosystem survey
  - Norwegian Coast ecosystem survey
- Funded by SEAPOP and the Research Council of Norway



# Seabirds at sea

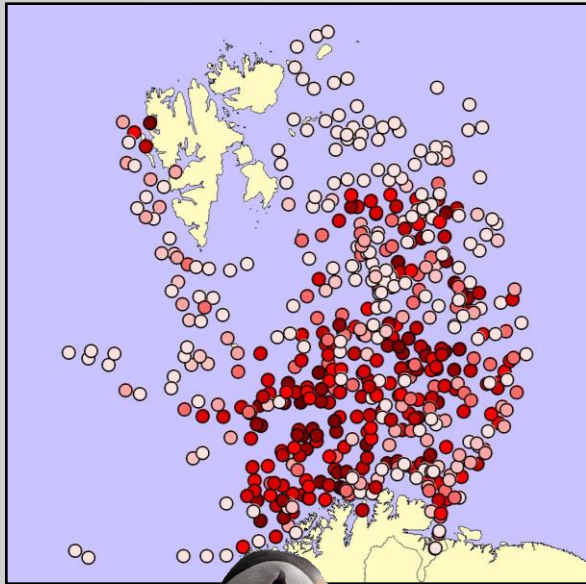
A large colony of seabirds, likely gulls, is seen swimming on the open ocean. The birds are scattered across the water, with a dense group on the left and more dispersed individuals towards the right. The sky is overcast with grey clouds, and the horizon is visible in the distance.

## Main objectives

- Mapping seabird habitats
- Trophic interactions with other ecosystem components
- Monitoring seabird populations at sea

# Barents Sea ecosystem survey

## Generalized additive modelling



**GAM model:**

**Puffin ~ factor(Year)**

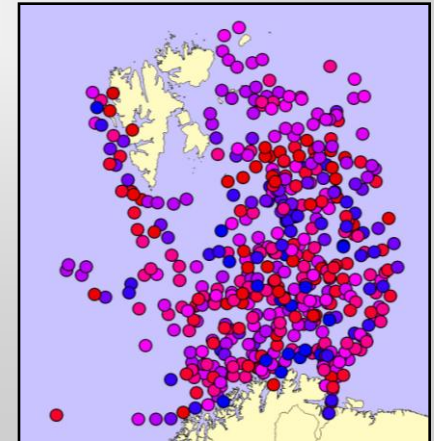
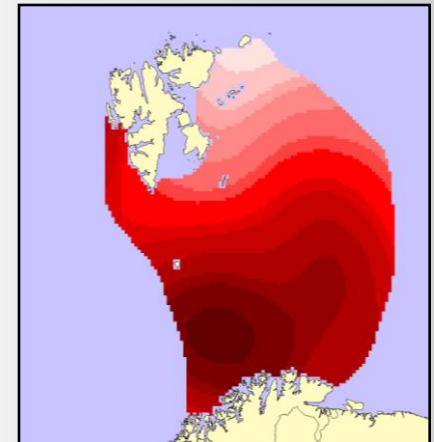
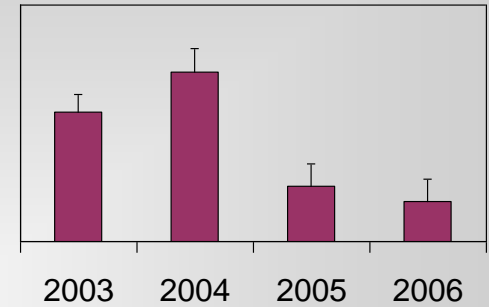
**+ te(X,Y)**

**+ error**

abundance

distribution

residuals





# Pelagic key species

Autumn distribution from GAM models  
- acoustic data from autumn cruises 2003-2006

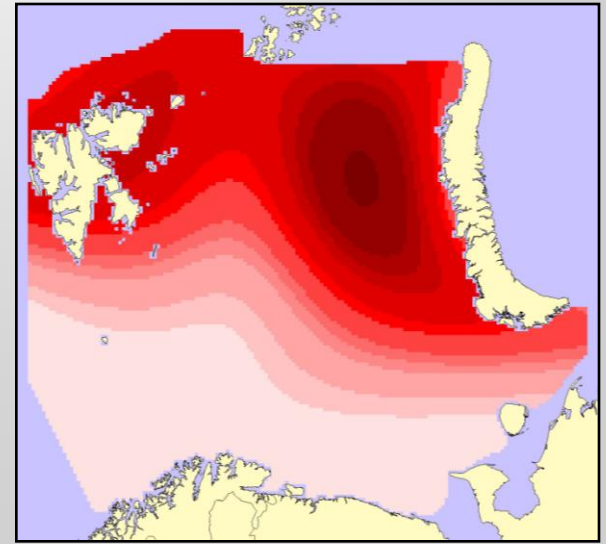
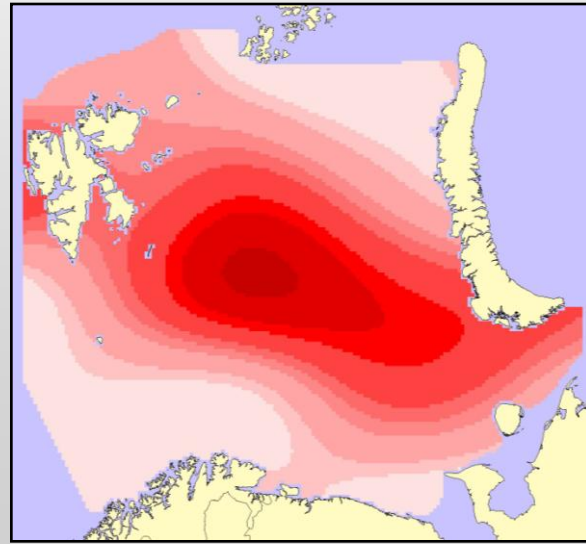
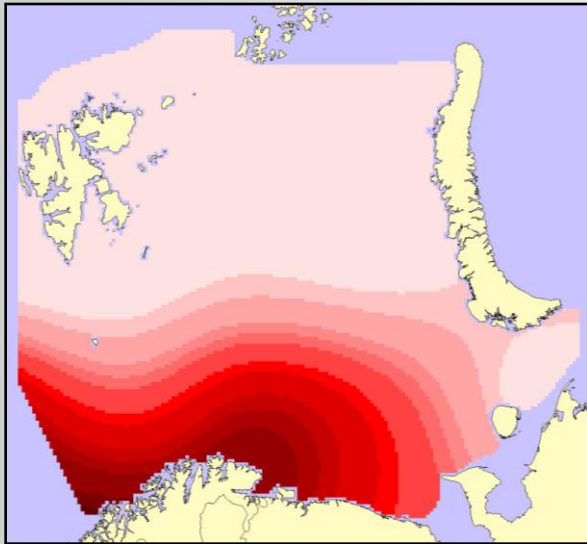
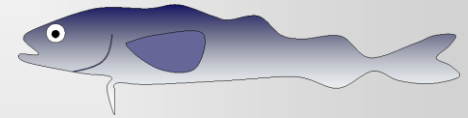
**Herring**



**Capelin**



**Polar cod**





# Seabird communities

## Northern, capelin & polar cod associated communities

Autumn distribution from GAM models 2003-2006

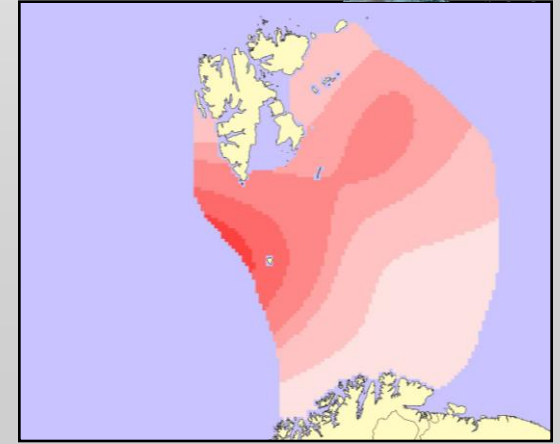
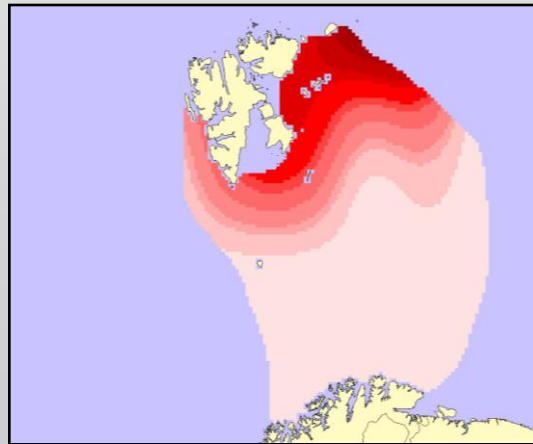
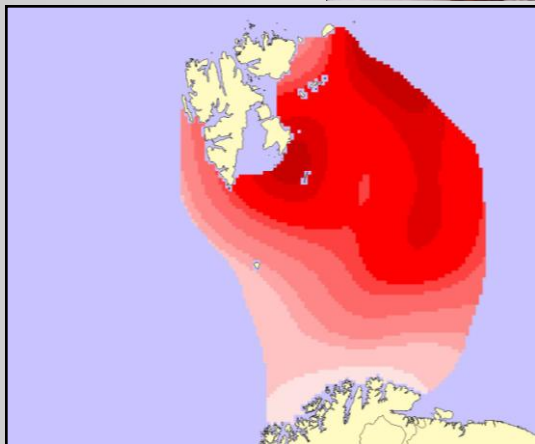
Brünnich's  
guillemot  
*Uria lomvia*



Little auk *Alle alle*



Glaucous  
gull  
*Larus  
hyperboreus*

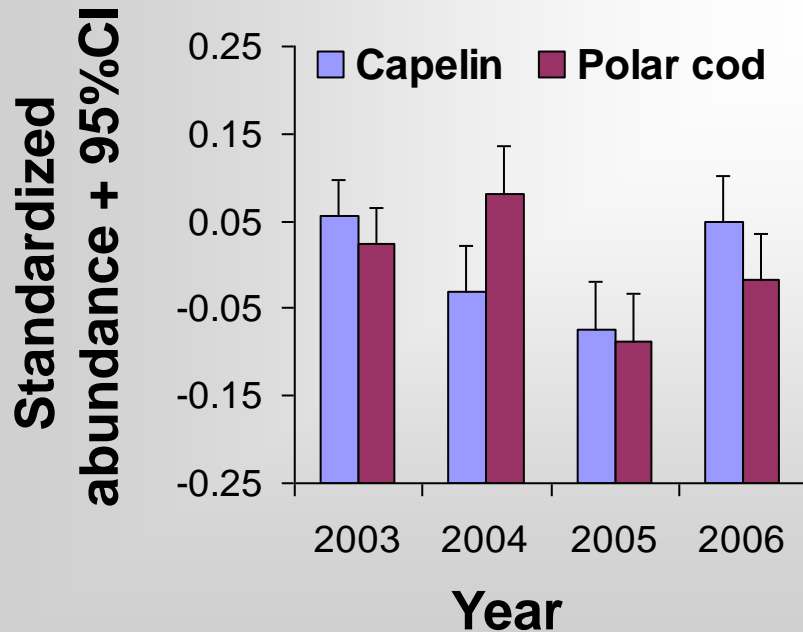


# Seabird communities

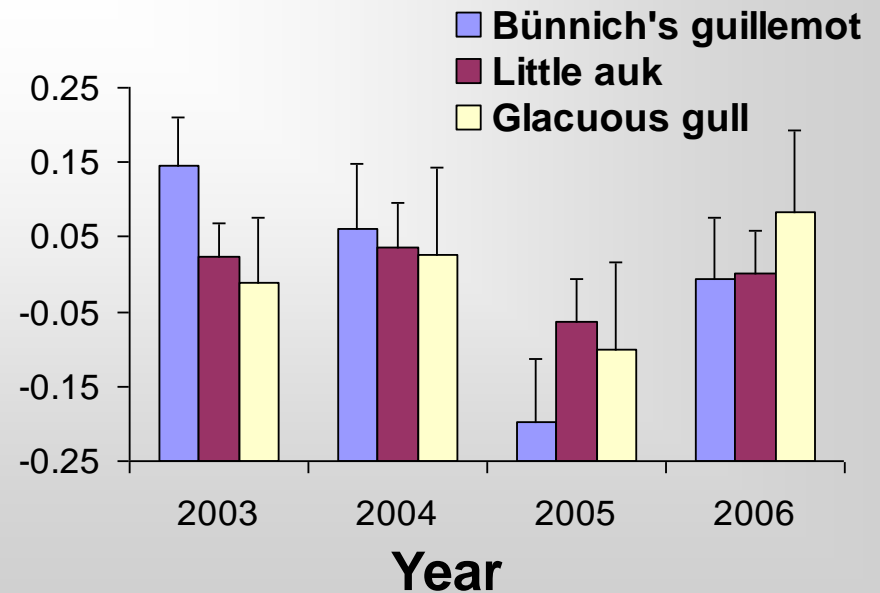
## Northern, capelin & polar cod associated communities

Abundance estimates from GAM models 2003-2006

### Abundance of pelagic fish



### Abundance of seabirds

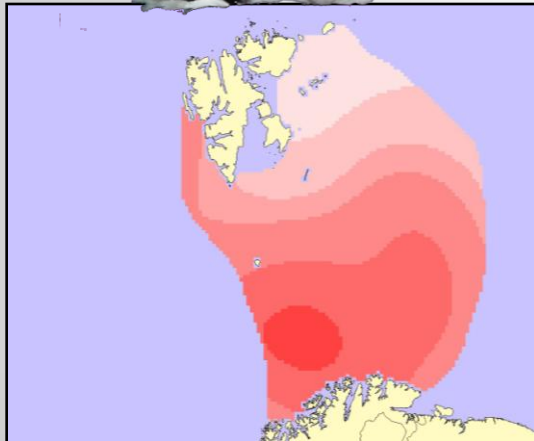


# Seabird communities

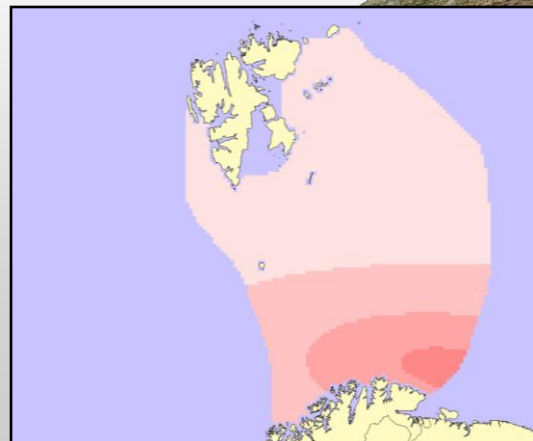
## Southern, herring associated communities

Autumn distribution from GAM models 2003-2006

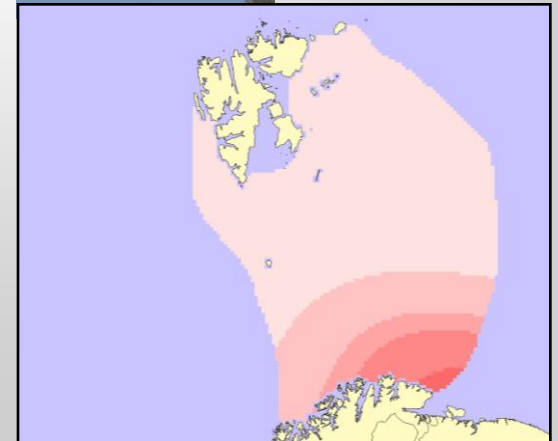
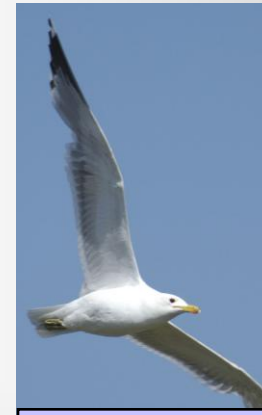
Atlantic puffin  
*Fratercula arctica*



Common guillemot  
*Uria aalge*



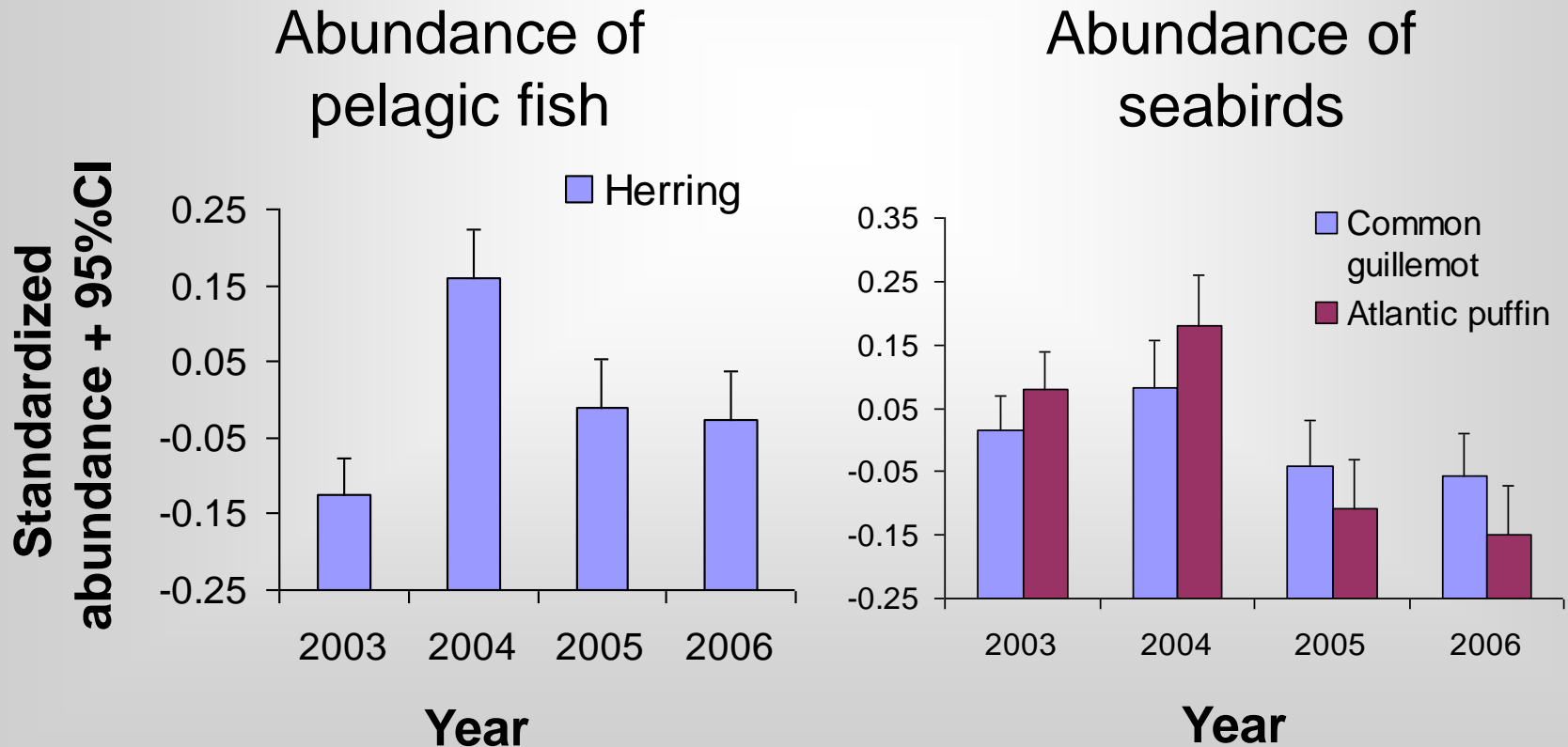
Herring gull  
*Larus argentatus*



# Seabird communities

## Southern, herring associated communities

Abundance estimates from GAM models 2003-2006



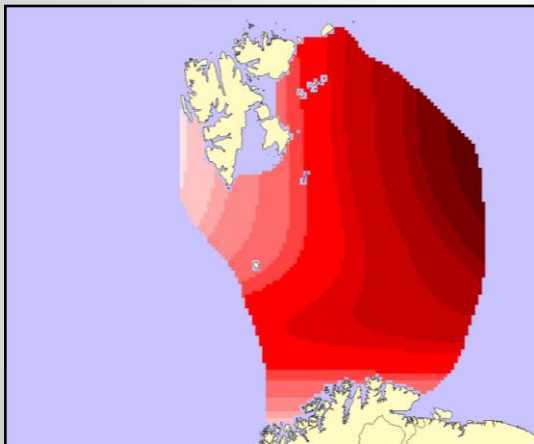


# Seabird communities

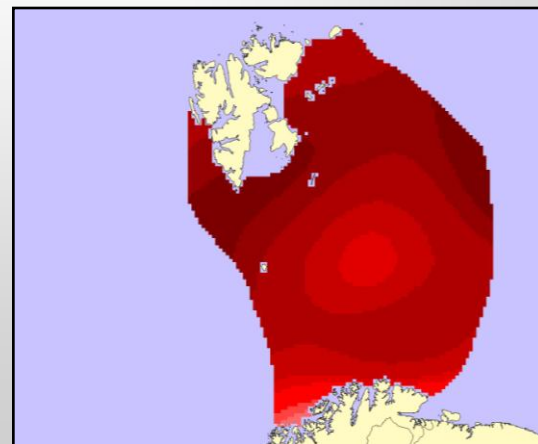
## Pelagic communities

Autumn distribution from GAM models 2003-2006

**Kittiwake** *Rissa*  
*tridactyla*



**Northern fulmar**  
*Fulmarus glacialis*

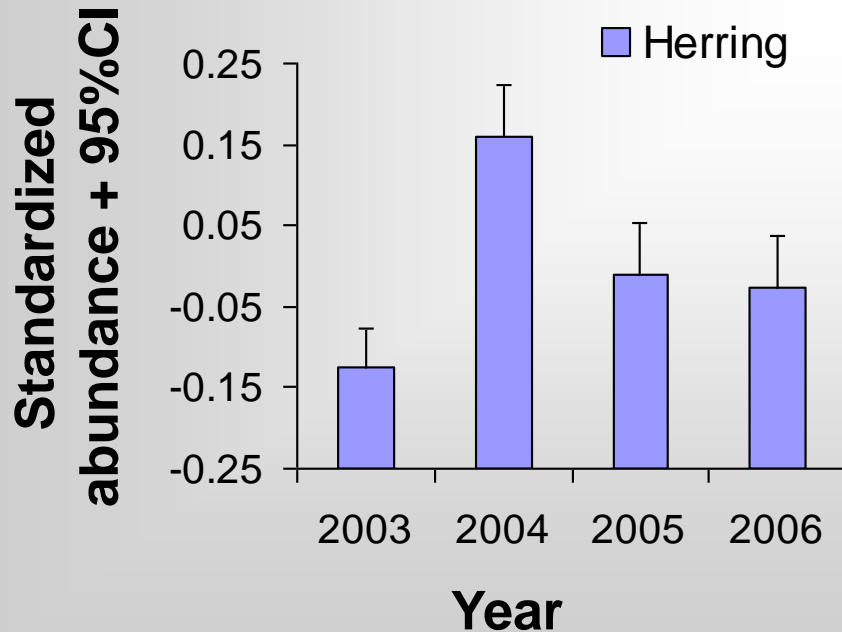


# Seabird communities

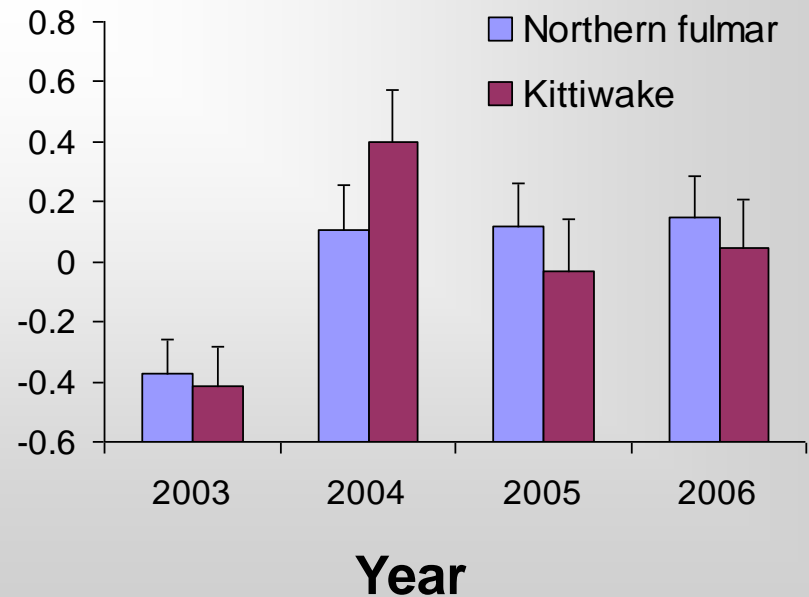
## Pelagic communities

Abundance estimates from GAM models 2003-2006

Abundance of  
pelagic fish



Abundance of  
seabirds



# Conclusion

- Three distinct seabird communities
  1. Northern communities associated with capelin & polar cod
  2. Southern communities associated with herring
  3. Pelagic communities
- Within communities: large synchronous changes in abundance
  - Possibly associated with changes in main prey
  - What happens when capelin is back?
  - What are the relationships between sea and colonies?
- Weak residual spatial correlations
  - Weak small-scale correlations



