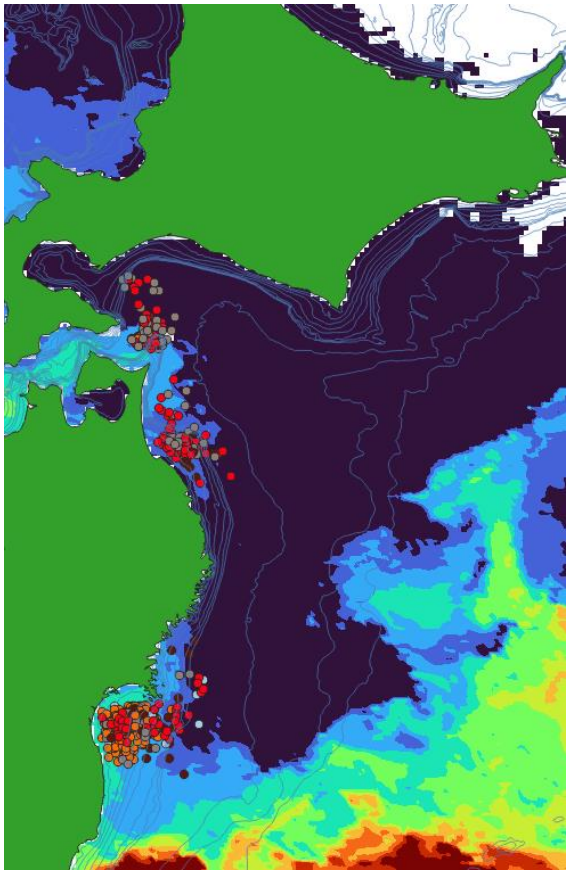
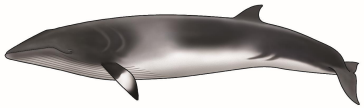
S-7 : Temporal changes in distribution and prey species of common minke whales in Sendai Bay off the Pacific coast of Japan



Tsutomu Tamura[1], Kenji Konishi[1], Tatsuya Isoda[1], Hidehiro Kato[1,2], Mitsuhiro Saeki[3] and Kazushi Miyashita[4]

E-mail: tamura@cetacean.jp



[1] **Institute of Cetacean Research, Tokyo, Japan.**
[2] Tokyo University of Marine Science and Technology, Tokyo, Japan
[3] Miyagi Prefecture Fisheries Technology Institute, Miyagi, Japan
[4] Hokkaido University, Hakodate, Japan

Background

This session deal “Social, economic and ecological implications of recoveries, range expansions and shifting distributions of marine birds, mammals and fish”.

My presentation is the case of decadal changes in the distributions of marine mammals and fish—and their implications and underlying causes.

And then, introduce direct and indirect effects that the changes in prey species distributions are having on marine mammal in this presentation.

Background

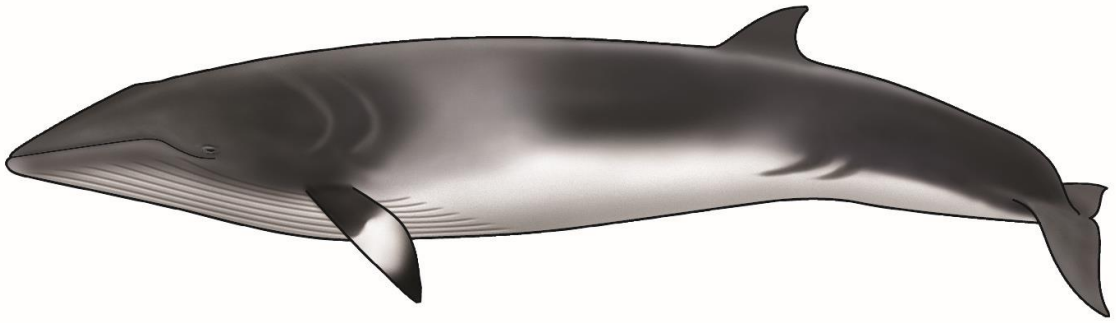
Sendai Bay has been historically an important feeding grounds for common minke whales and has been used as a commercial whaling ground in spring.

Recently, fewer common minke whales have been sighted in Sendai Bay.

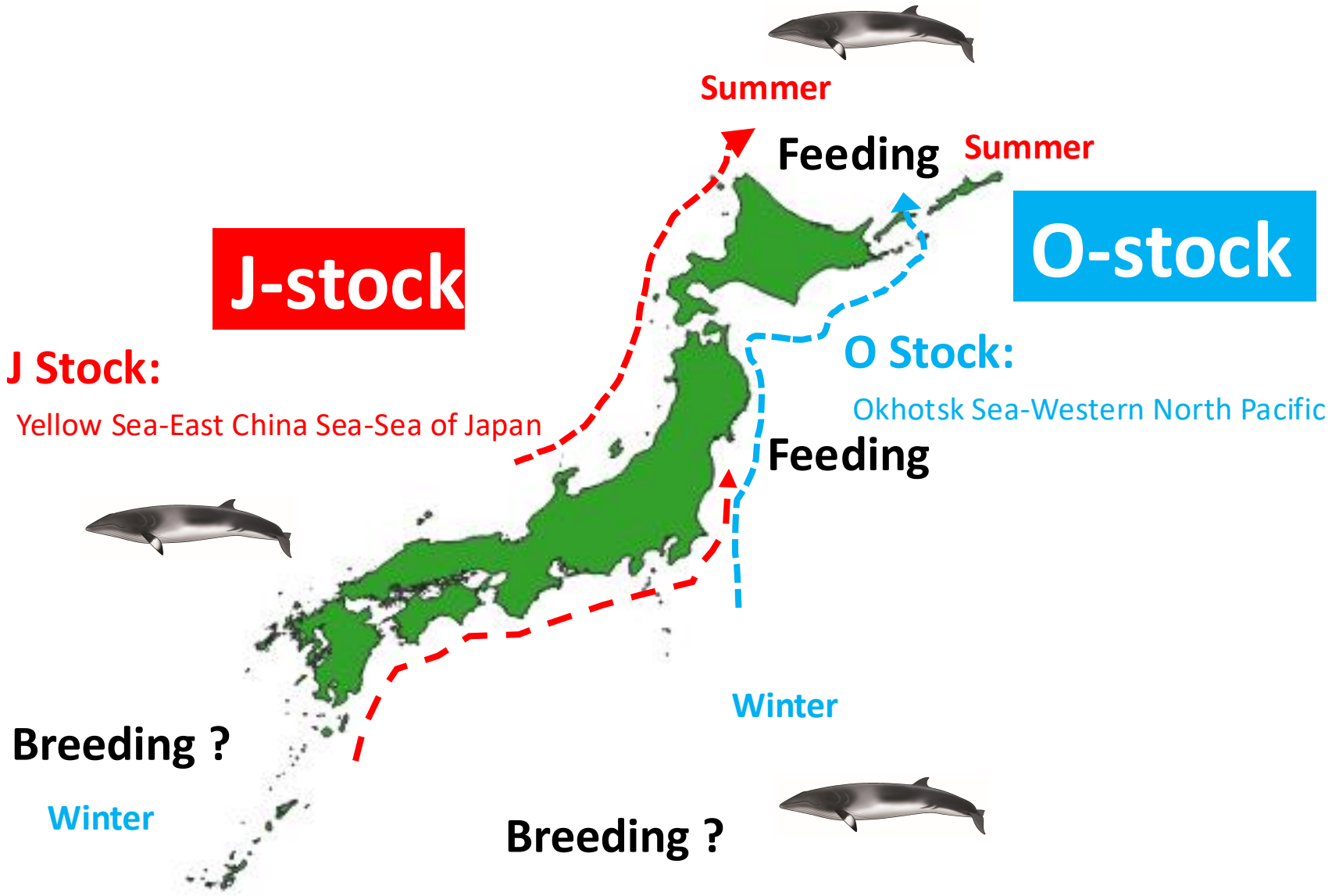
The purpose of this study was to investigate spatial and temporal changes in distribution of common minke whales in the Sendai Bay in relation to prey availability and oceanographic conditions.

Common minke whale

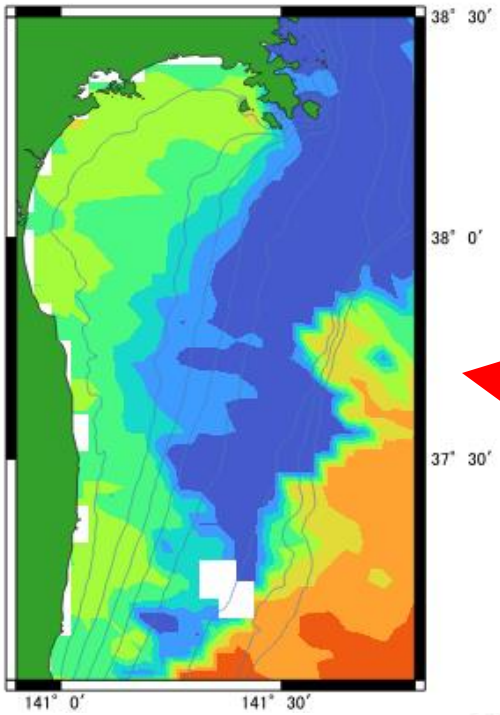
Balaenoptera acutorostrata
Body length: 6～7 m (Max: 8 m)
Black or dark grey upper side, and white or pale grey underside
Small, slender, pectoral fin with white band
Diet: krill, small pelagic fishes, walleye pollock and common squid
Abundance (20,961 cv=0.434)

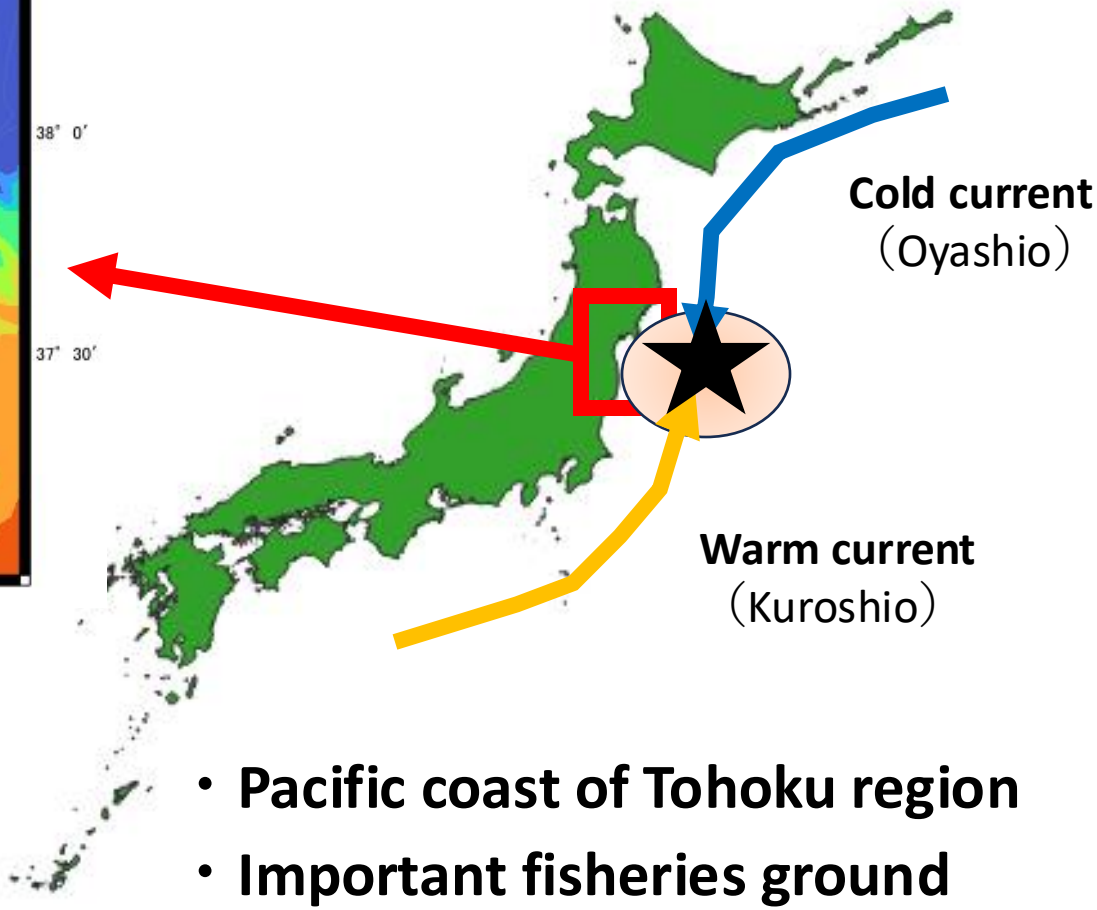


Common minke whale (western North Pacific)



Sendai Bay

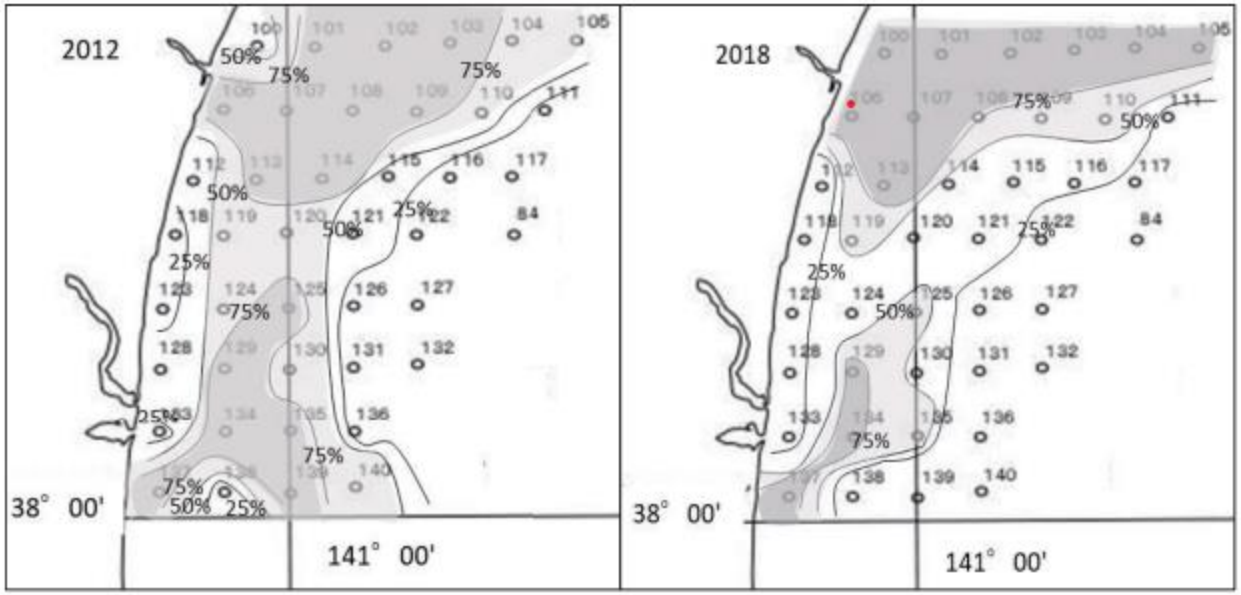




- Pacific coast of Tohoku region
- Important fisheries ground
- The 2011 Great East Japan Earthquake

After 2011 Great East Japan Earthquake

Changes in bottom sediments (Tanabe *et al*, 2022)

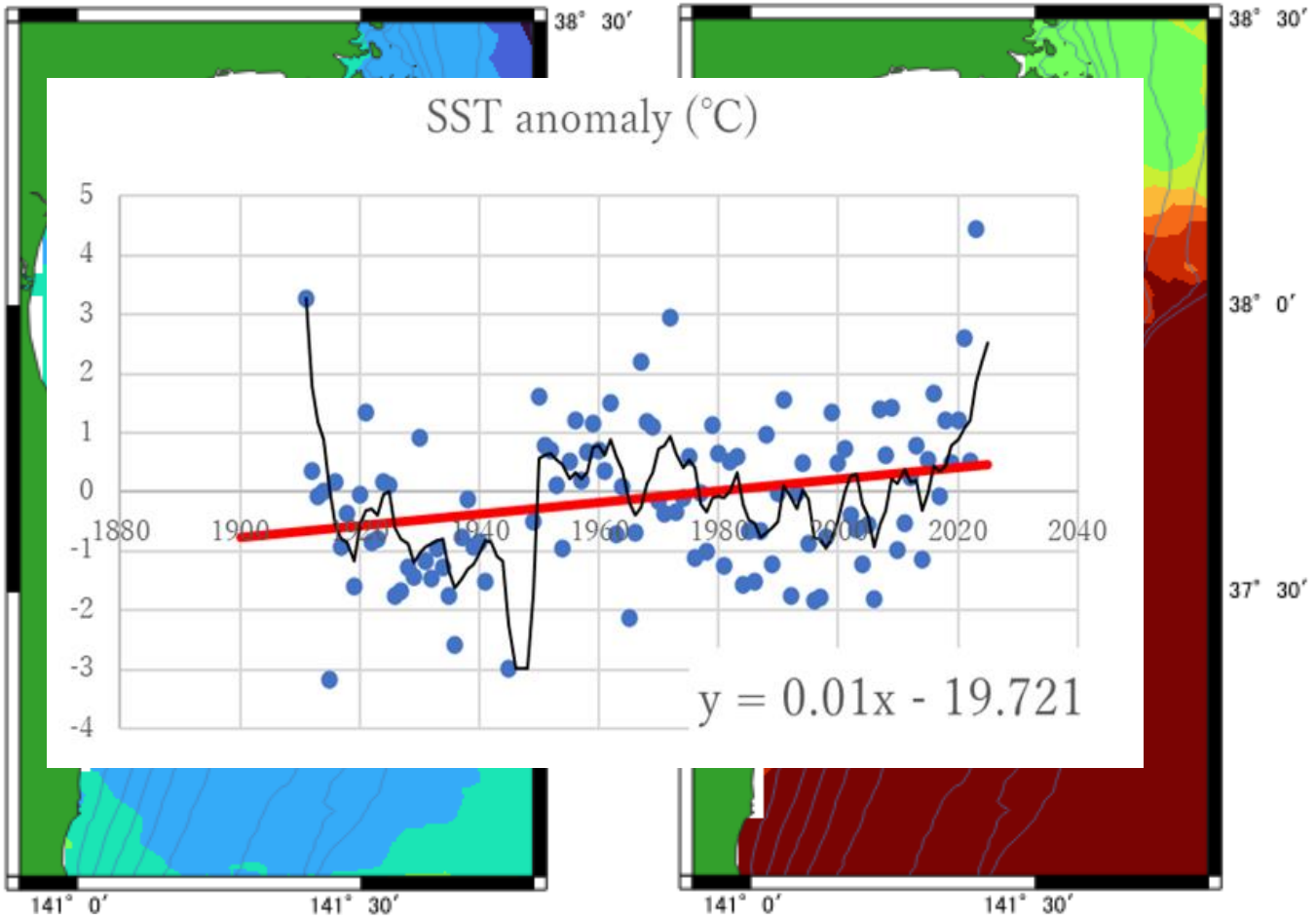


Sand lance fish stocks, a prey species of common minke whale, were affected by sediment changes in the bay, which limited the area of spawning grounds of the fish

Regional warming

April **2003**

April **2023**



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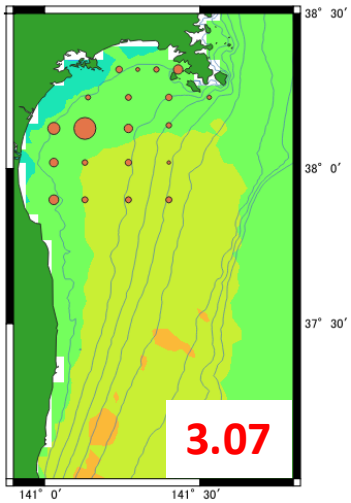
7-9 ℃

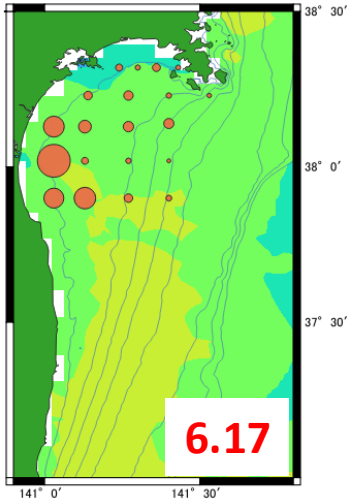
11-14 ℃

Trend of sand lance's distribution and density

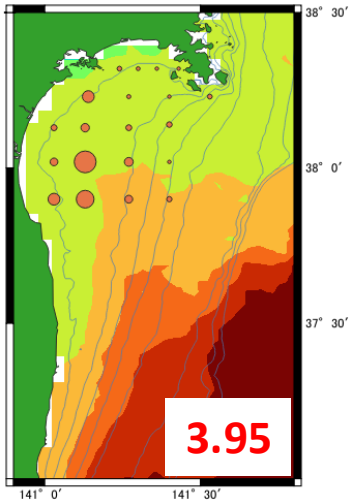
2003-Jan.



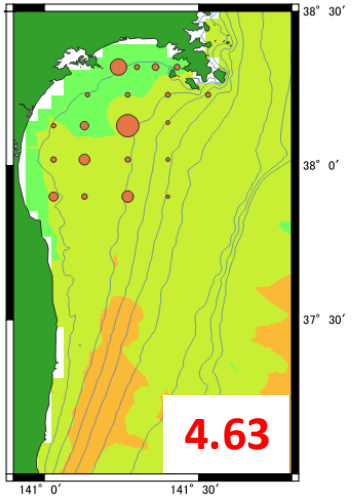
2005-Jan.



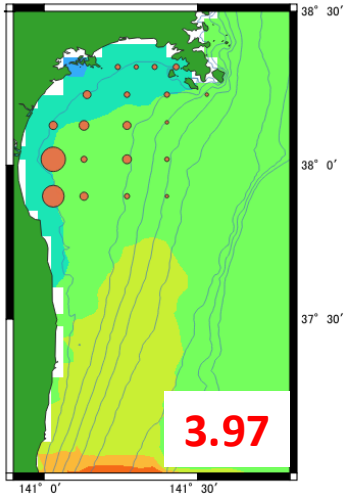
2007-Jan.



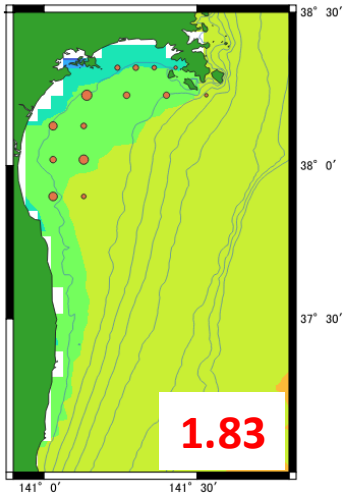
2009-Jan.



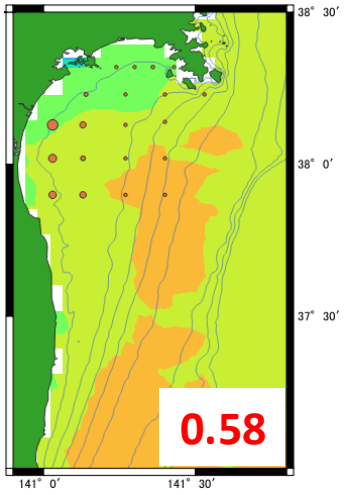
2012-Jan.



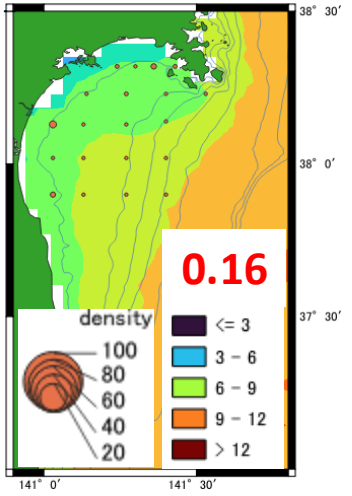
2014-Jan.



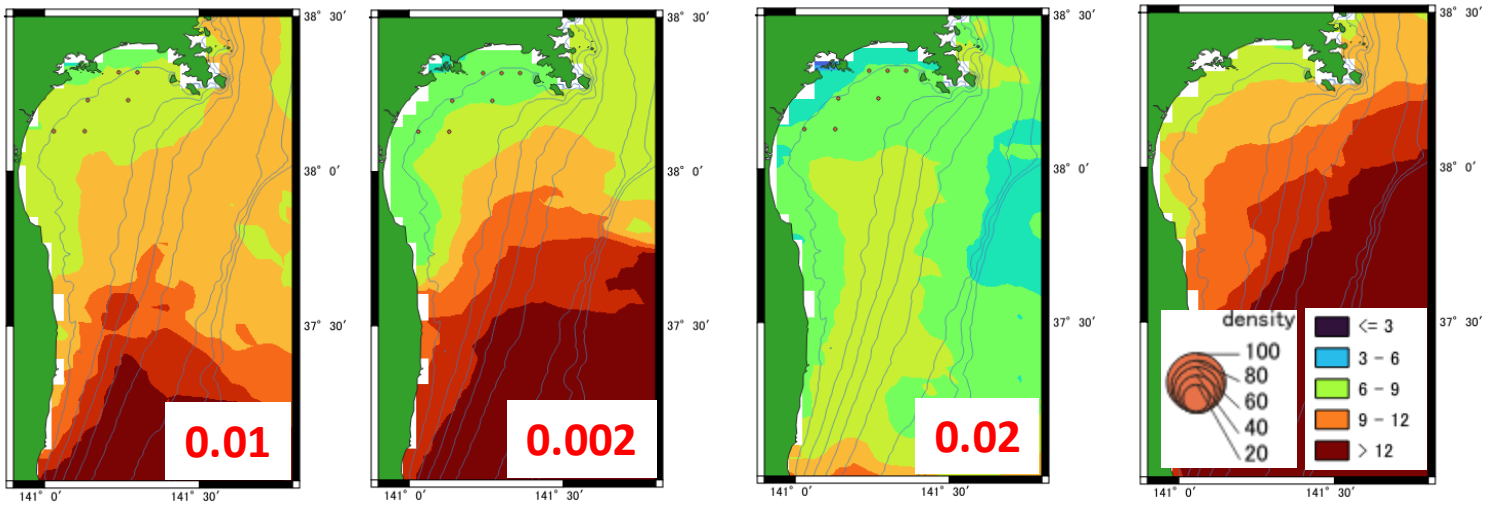
2016-Jan.



2018-Jan.



2020-Jan. **2021-Jan.** **2022-Jan.** **2023-Jan.**



Mann-Kendall-Test

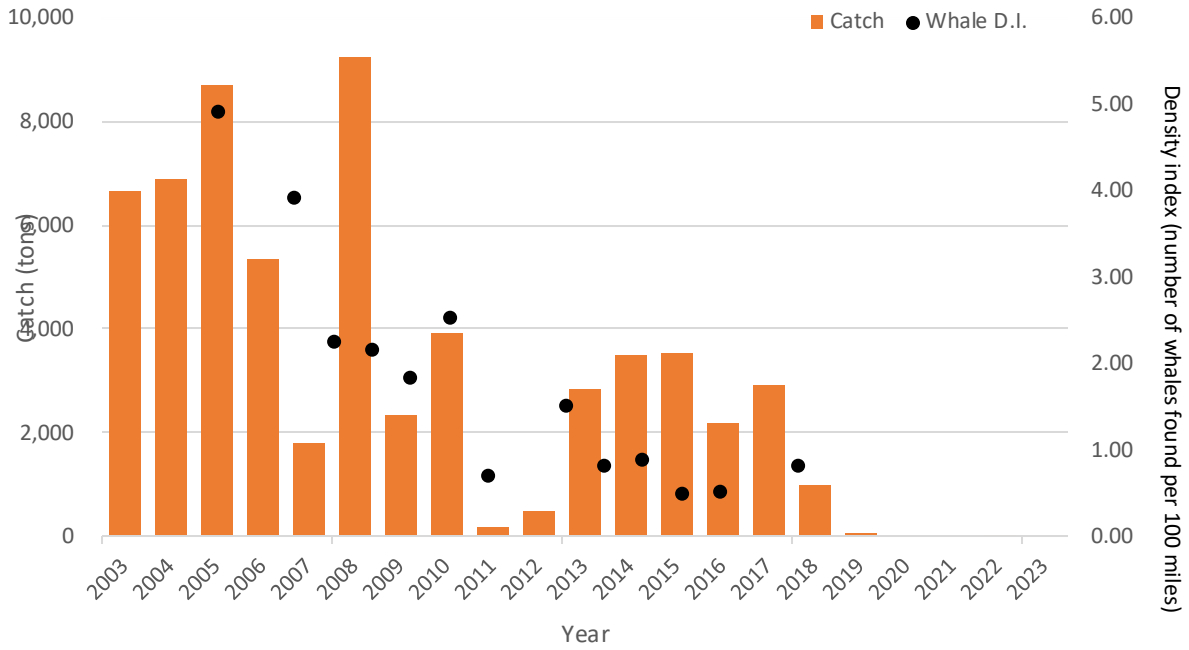
P-value: 0.0008

Significant decreasing trend

SST

<= 6
6 – 7
7 – 8
8 – 9
9 – 10
10 – 11
11 – 12
12 – 13
13 – 14
> 14

Fisheries catch of sand lance and density of common minke whales



Density index: Number of whales found *per* 100 miles of sighting (**2003: 4.80 → 2018: 0.80**)

Mann-Kendall-Test P-value: 0.0008 → **Significant decreasing trend**

The commercial fisheries catch of sand lance has decreased from **10,000 tons** in the 2000's to almost **zero** in recent years.

The decline in catches coincided with a decline in common minke whale densities.

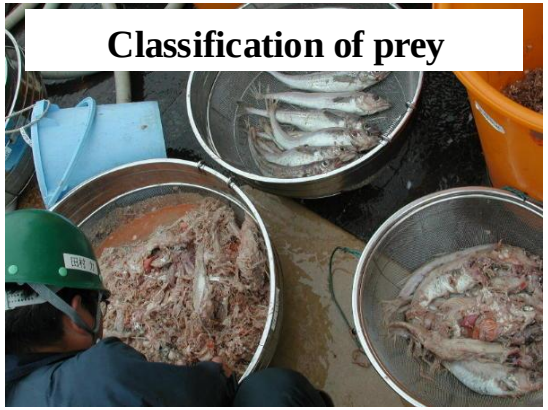
The relative prey composition (%) in weight

$$RW = (Wi / Wall) \times 100$$

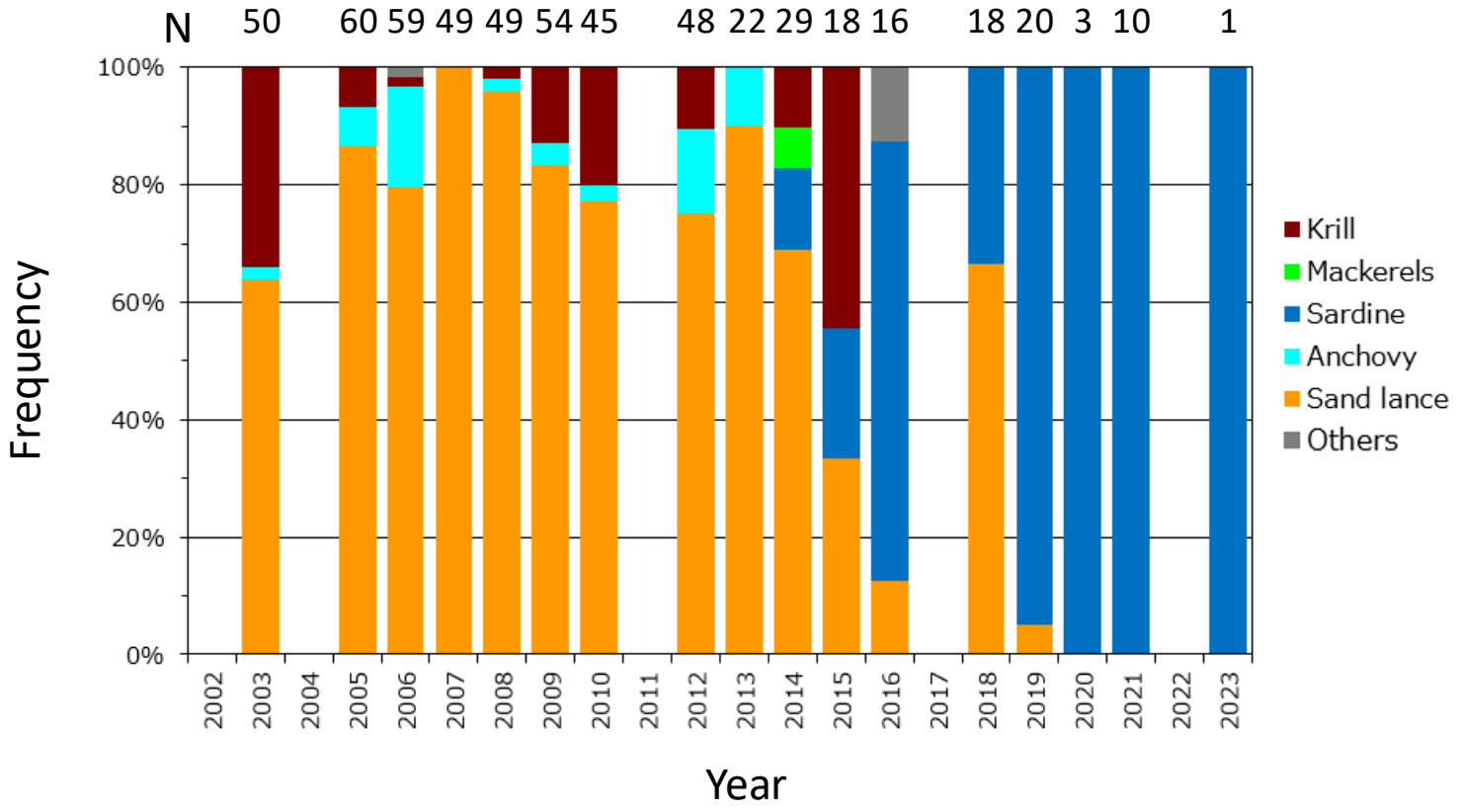
Wi = the weight of contents containing prey group i
$Wall$ = the total weight of contents analyzed

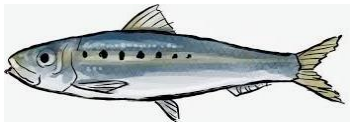
The weight of prey *I*

=(Undigested prey *i* number +digested prey *i* number +
Otoliths number of prey *i* (fish) / 2) × average weight of
undigested prey *i*



Common minke whale – Prey species –

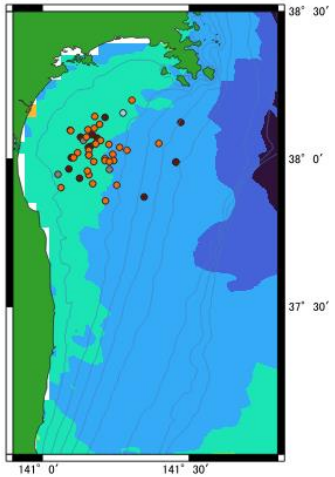




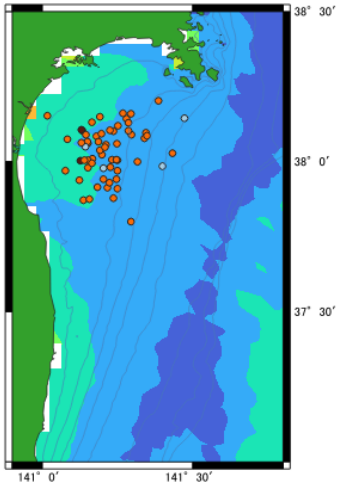
Sand lance → J. sardine

Common minke whale – Distribution –

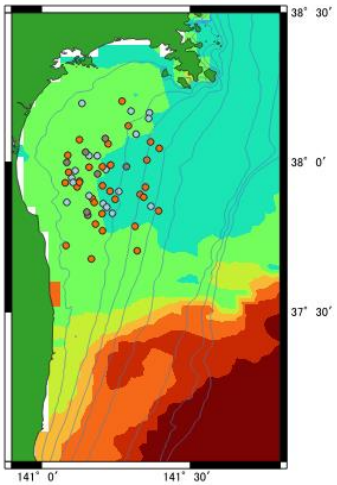
2003-Spring



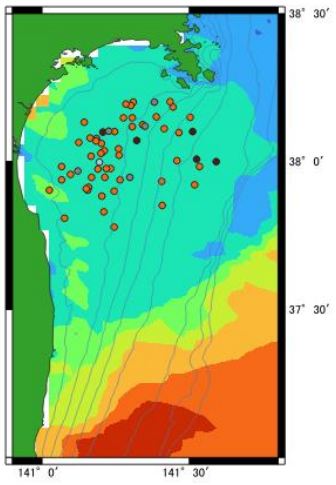
2005-Spring



2007-Spring

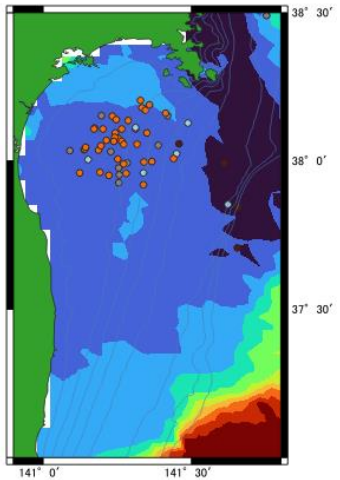


2009-Spring

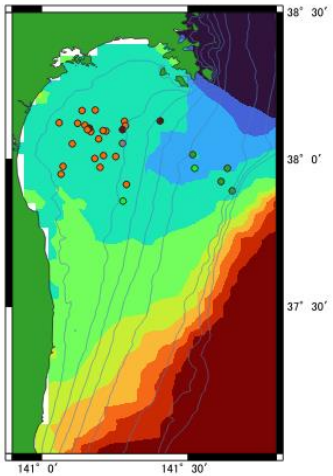


- Krill
- Iwashi
- Sardine
- Anchovy
- Mackerels
- Sand lance
- Walleye pollock
- Other

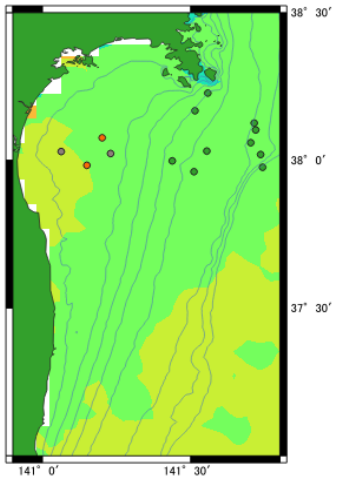
2012-Spring



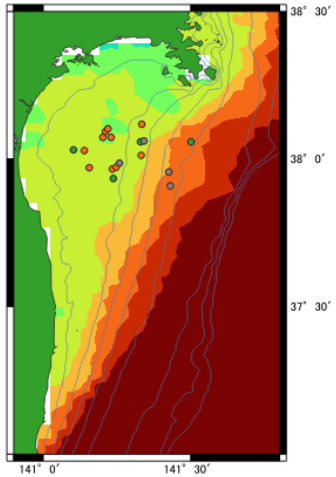
2014-Spring



2016-Spring



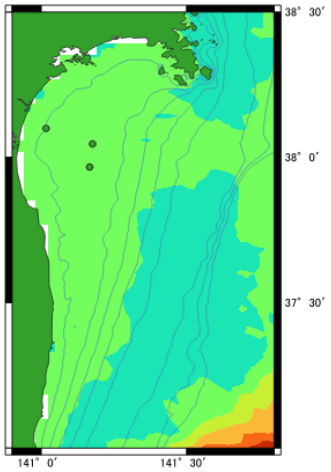
2018-Spring



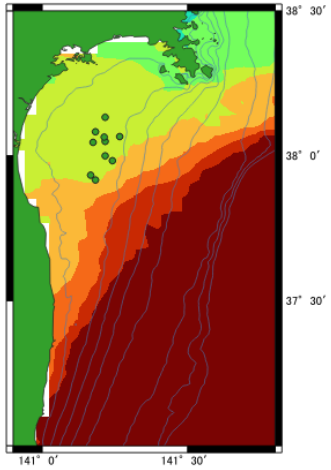
SST

- <= 6
- 6 – 7
- 7 – 8
- 8 – 9
- 9 – 10
- 10 – 11
- 11 – 12
- 12 – 13
- 13 – 14
- > 14

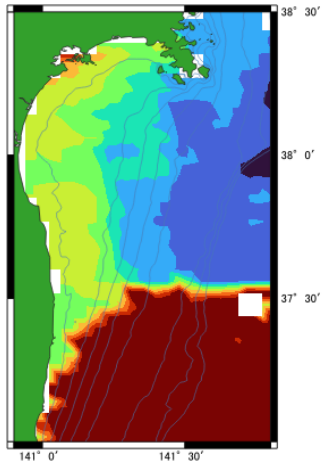
2020-Spring



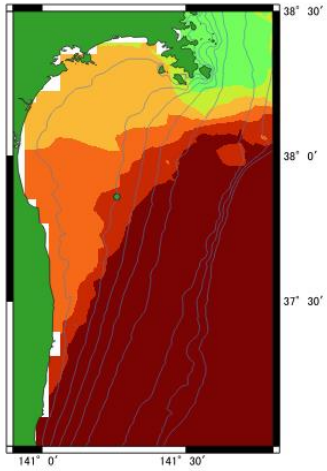
2021-Spring



2022-Spring



2023-Spring



- Krill
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- Anchovy
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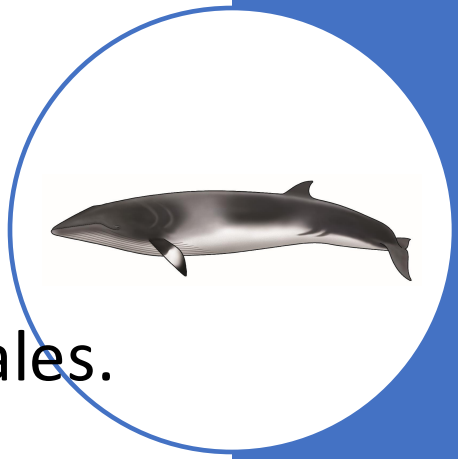
- Sand lance
- Walleye pollock
- Other

SST

- <= 6
- 6 – 7
- 7 – 8
- 8 – 9
- 9 – 10
- 10 – 11
- 11 – 12
- 12 – 13
- 13 – 14
- > 14

Summary

Regional warming of sea temperatures and sediment changes in Sendai bay have caused the collapse of sand lance resources.



Sand lances are no longer available as prey species for common minke whales.

Recent prey environment conditions in Sendai Bay are not the optimal for common minke whales.

Thank you

A case for predator and prey response to climate-induced change.