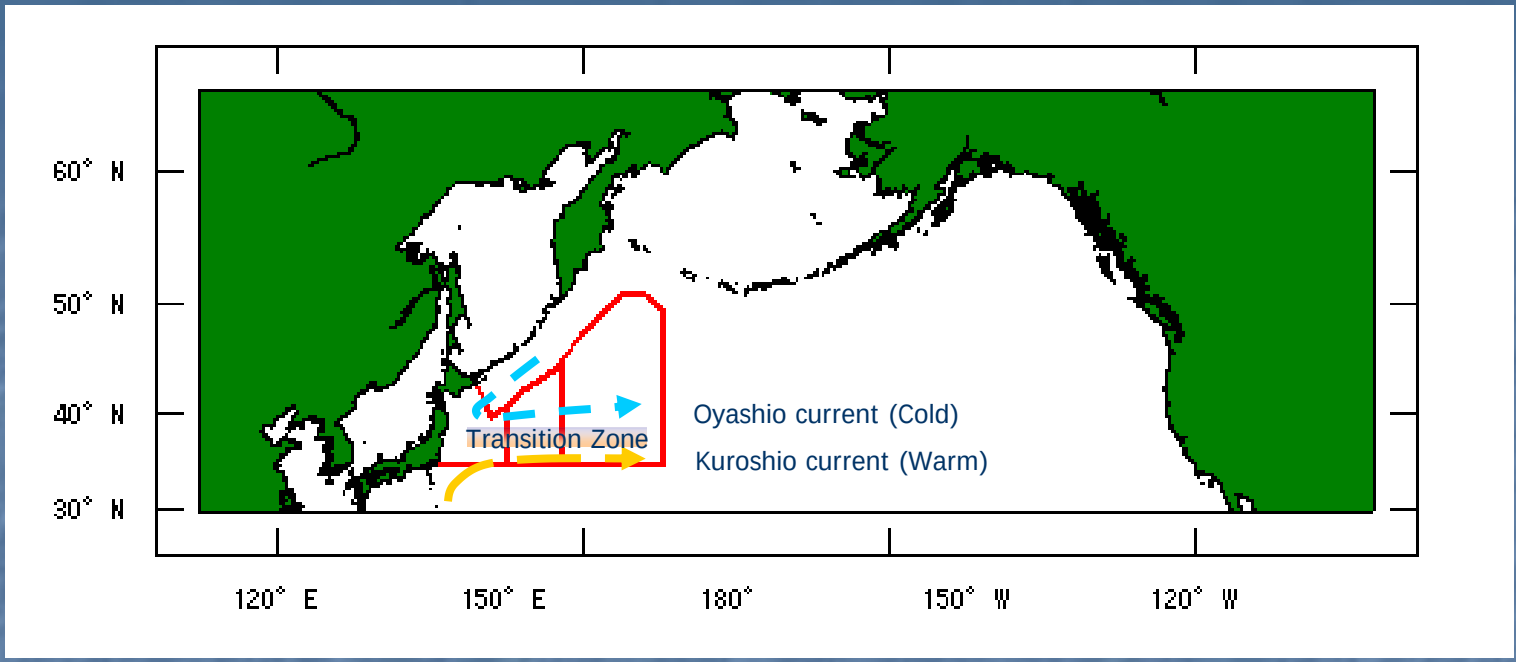
Geographical and temporal distribution of common minke, sei and Bryde's whales in the western North Pacific in relation to prey availability

(PICES / W3)

Tsutomu TAMURA ,Kenji KONISHI, Koji Matsuoka and Takashi Hakamada

The Institute of Cetacean Research



Japanese anchovy

Pacific saury

Mackerels

Back ground

Abundance of baleen whales in research area

English name	Japanese name	Year	Abundance	Area	Resource
Humpback whale	ザトウクジラ	2007	10,000	North Pacific	IWC-web site
Gray whale	コククジラ	2007	121	western North Pacific	IWC-web site
Right whale	セミクジラ	1989–92	920	Okhotsk sea	Miyashita and Kato (1998)
Sei whale	イワシクジラ	2002–03	68,000	North Pacific	Hakamada *et al.* (2004)
Common minke whale	ミンククジラ	1989–1990	25,000	North Pacific-Okhotsk Sea	IWC-web site
Bryde's whale	ニタリクジラ	1998–2002	20,501	western North Pacific	IWC-web site
Sperm whale	マッコウクジラ	1982–1986	102,112	western North Pacific	Kato and Miyashita (1998)
Dall's purpose (Truei type)	イシイルカ	2003–05	174,000	Sea of Japan-Okhotsk Sea	宮下ほか (2007a)
Dall's purpose (Dalli type)		2003–05	178,000	North Pacific-Okhotsk Sea	宮下ほか (2007a)
Striped dolphin	スジイルカ	1983–91	517,000	western North Pacific	Miyashita (1993a)
		1998–2001	504,000	western North Pacific*	南川ほか（2007）
Pantropical spotted dolphin	マダライルカ	1983–1991	438,000	western North Pacific	Miyashita (1993a)
		1998–2001	400,000	western North Pacific	南川ほか（2007）
Bottlenose dolphin	ハンドウイルカ	1983–1991	169,000	western North Pacific	Miyashita (1993a)
		1998–2001	39,000	western North Pacific	南川ほか（2007）
Short-finned pilot whale	コビレゴンドウ	1983–1991	54,000	western North Pacific	Miyashita (1993a)
Southern-form	（マゴンドウ）	1998–2001	15,000	western North Pacific	南川ほか（2007）
False killer whale	オキゴンドウ	1983–1991	17,000	western North Pacific	Miyashita (1993a)
		1998–2001	40,000	western North Pacific	南川ほか（2007）
Risso's dolphin	ハナゴンドウ	1983–1991	76,000	western North Pacific	Miyashita (1993a)
		1998–2001	33,000	western North Pacific*	南川ほか（2007）
Pacific white-sided dolphin	カマイルカ	1992–96	57,000	Coastal area around Japan	宮下ほか (2007b)
		1987–90	988,000	North Pacific	Miyashita (1993b)
Killer whale	シャチ	1992–96	8,300	North Pacific-Okhotsk Sea	宮下 (2008)
	スナメリ	2002–04	11,000	Around Japan	Yoshida (2005)
Northern right whale dolphin	セミイルカ	1987–90	308,000	North Pacific	Miyashita (1993b)

*: Northern part of 30 N degree.

Objectives

- To investigate the seasonal and yearly change in distribution of these whale species in relation to prey availability

Common minke whale

Body length 7 m
Body weight 5 t

Sei whale

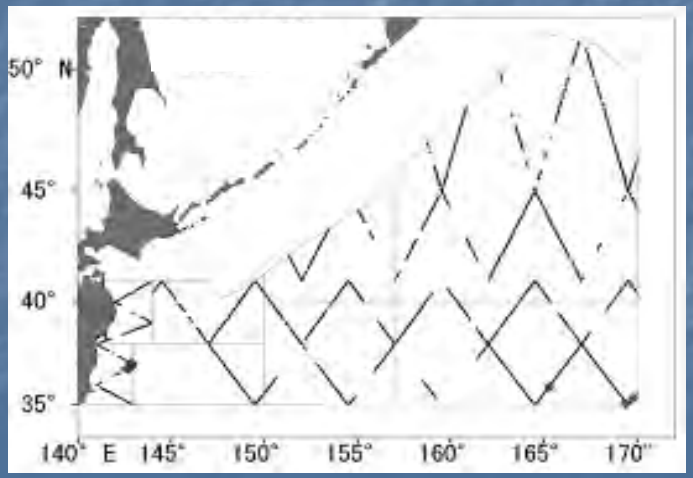
Body length 14 m
Body weight 22 t

Bryde's whale

Body length 13 m
Body weight 16 t

Materials and Methods -1-

- **JARPN II** from May to September in 2000-2012
- Sighting data from survey vessels
- Common minke 979, Sei 984 samples, Bryde's 627 individuals
- Stomach contents analyses
- Environmental data from survey vessels and satellite data.



Track lines in the sighting survey

Materials and Methods -2-

Measurement of body weight

Identification of stomach contents

Sampling of stomach contents

Measurement of stomach contents

The relative prey composition (%) by weight of each prey species

$$(RW)\ RW = (W_i / W_{all}) \times 100$$

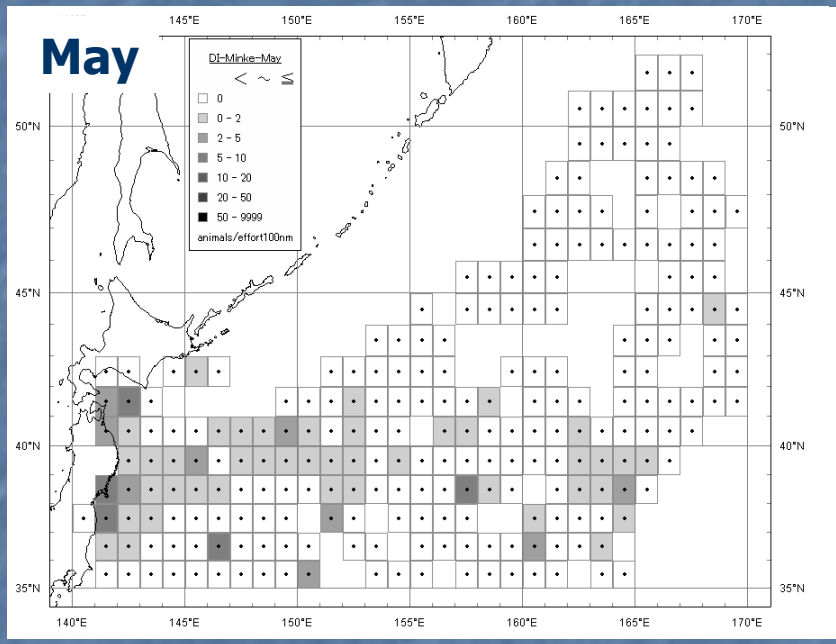
W_i = the weight of contents containing prey group *i*

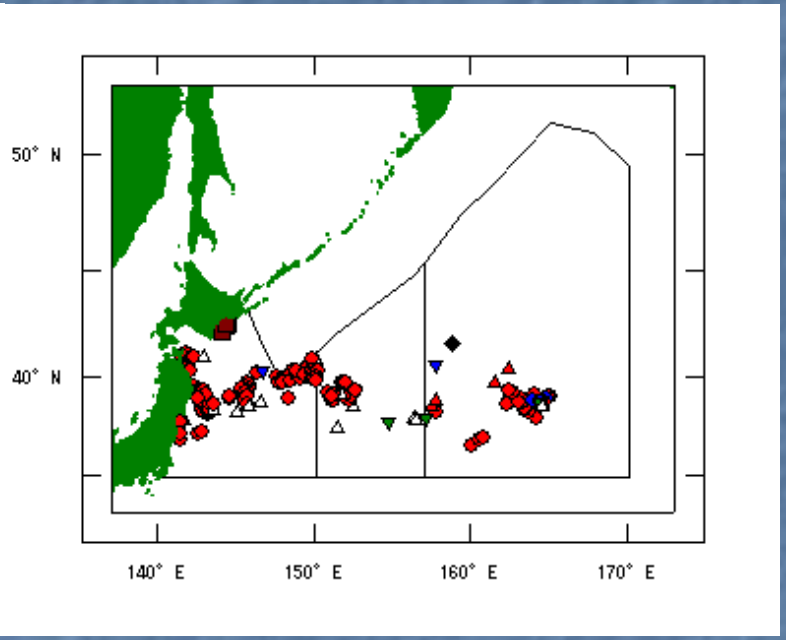
W_{all} = the total weight of contents analyzed.

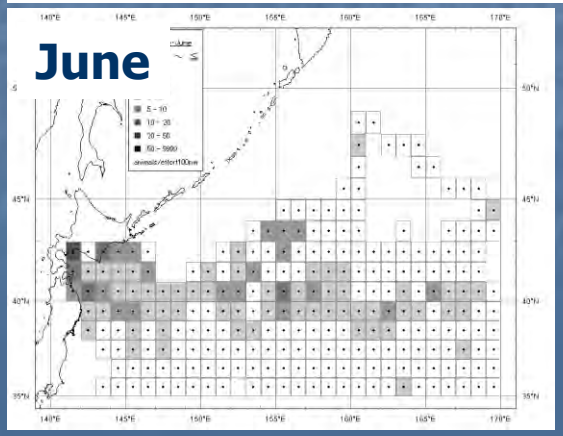
Common minke whale (*Balaenoptera acutorostrata*)

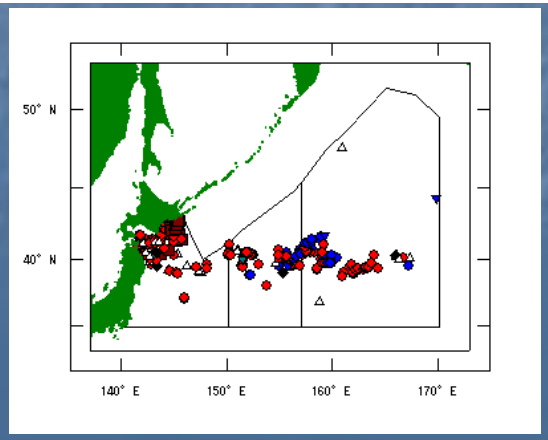
Density Index (whales/100n.mile)

Main prey (stomach contents)









Main prey species

Japanese anchovy (●)

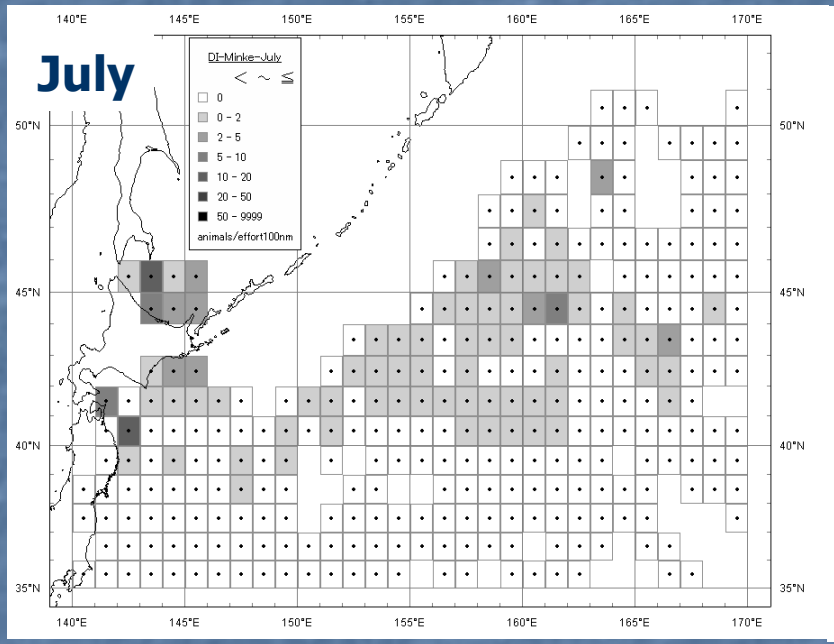
Main distribution

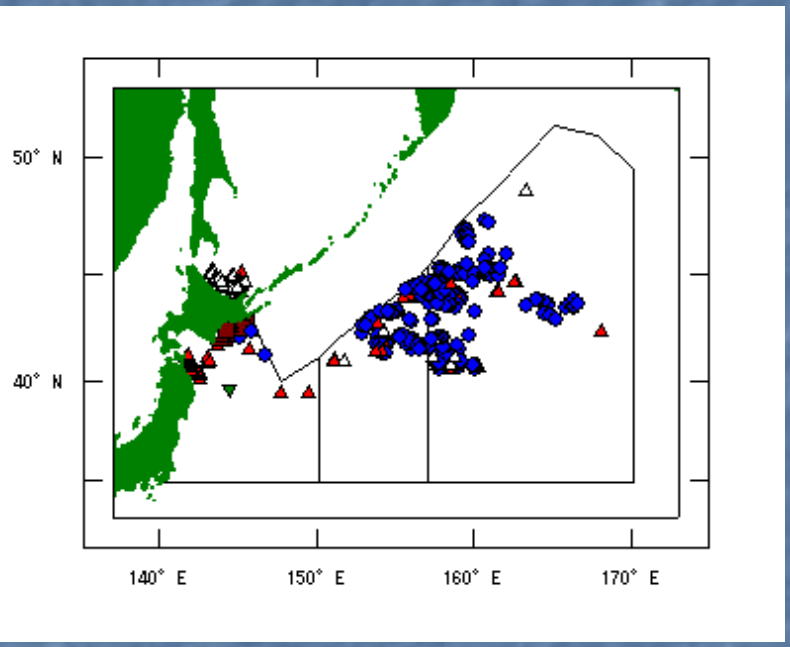
South of 41 N

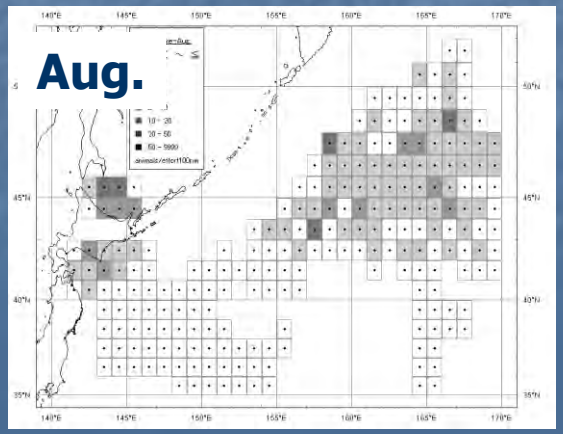
Common minke whale (*Balaenoptera acutorostrata*)

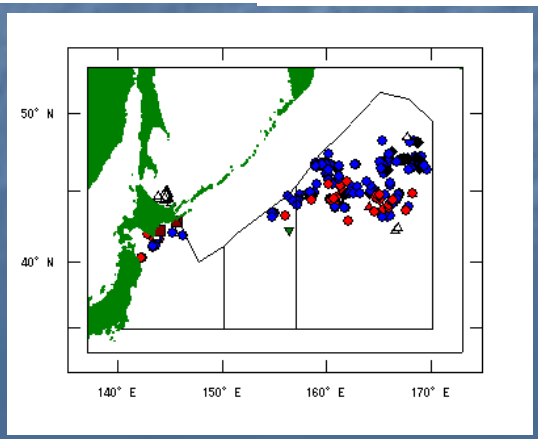
Density Index (whales/100n.mile)

Main prey (stomach contents)









Main prey species

Pacific saury (●)

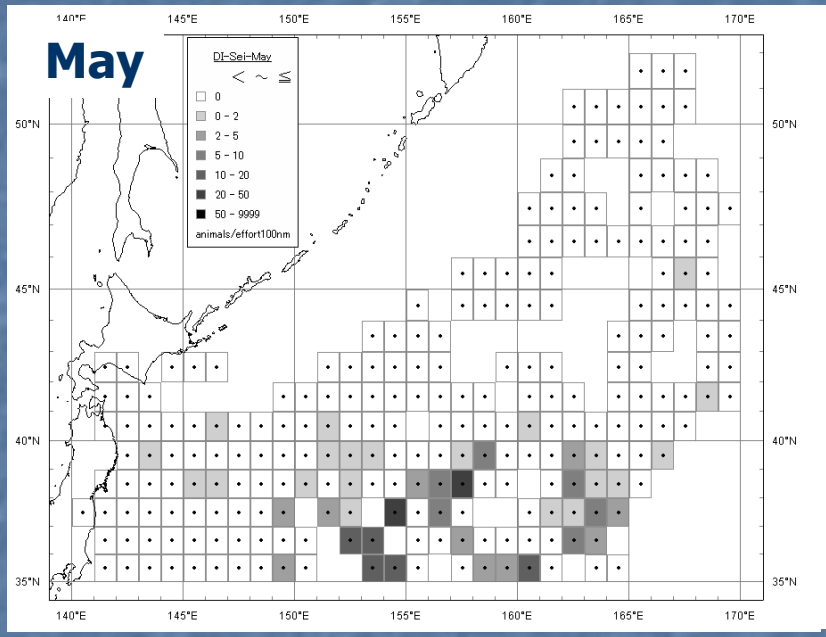
Main distribution

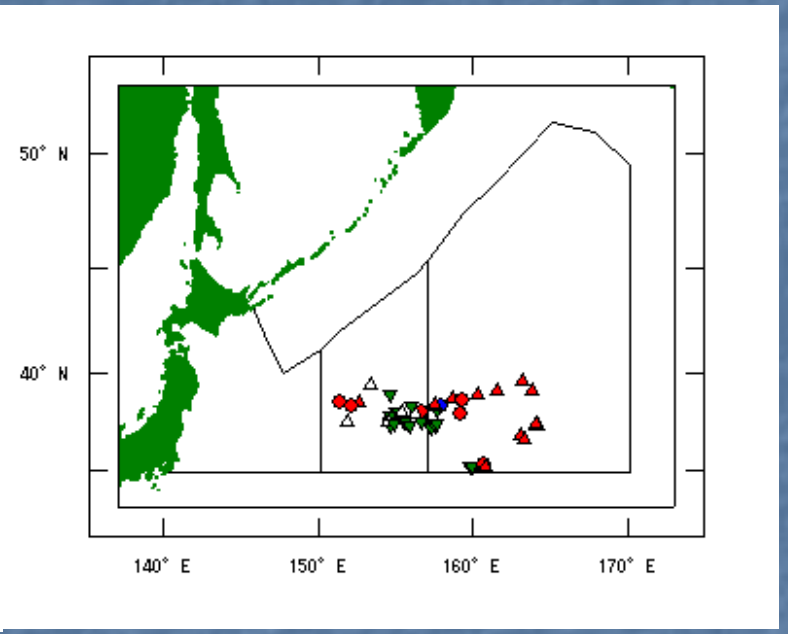
North of 41 N

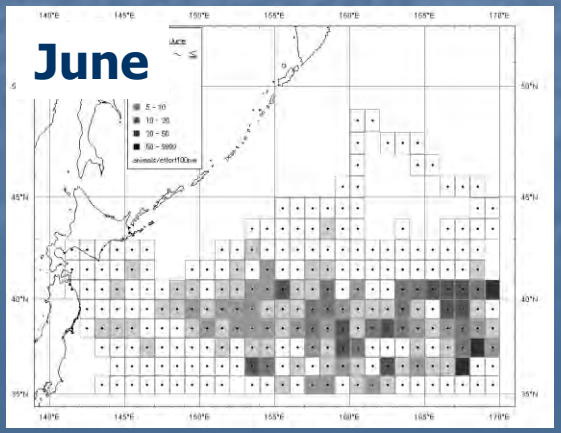
Sei whale (*Balaenoptera borealis*)

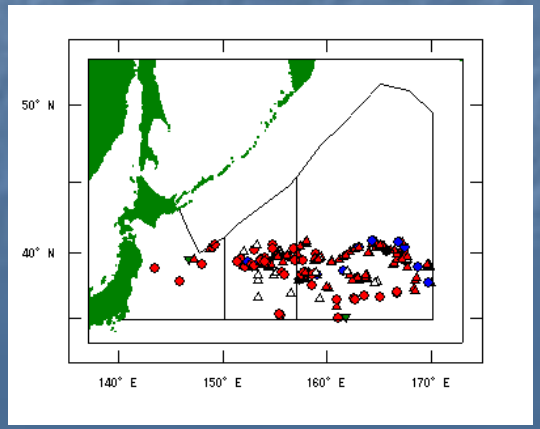
Density Index (whales/100n.mile)

Main prey (stomach contents)









Main prey species

Japanese anchovy (●)

Copepods (▲)

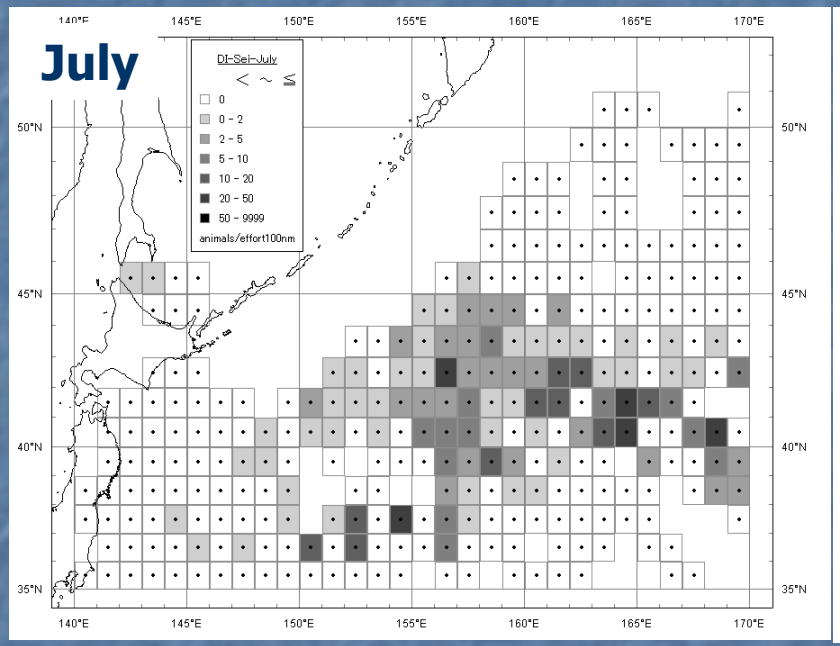
Main distribution

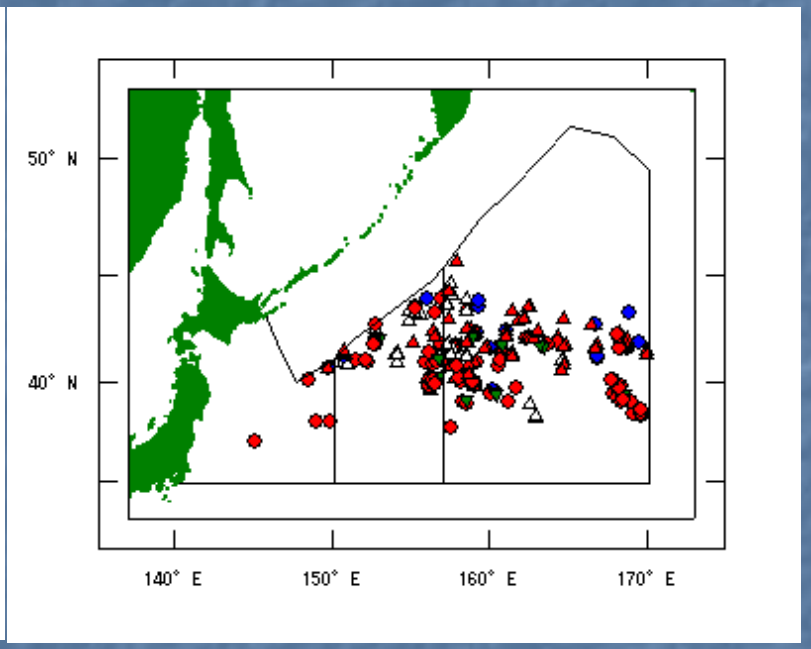
South of 41 N

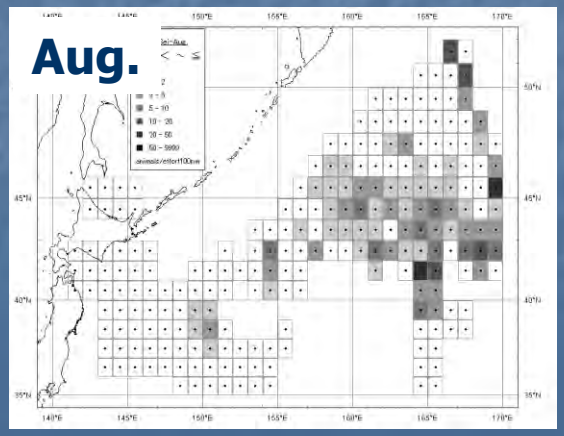
Sei whale (*Balaenoptera borealis*)

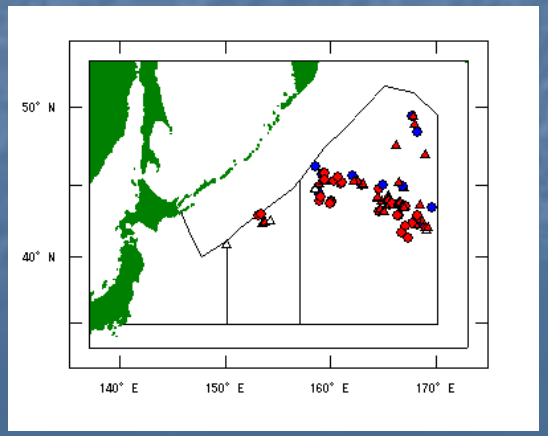
Density Index (whales/100n.mile)

Main prey (stomach contents)









Main prey species

Japanese anchovy (●)

Copepods (▲)

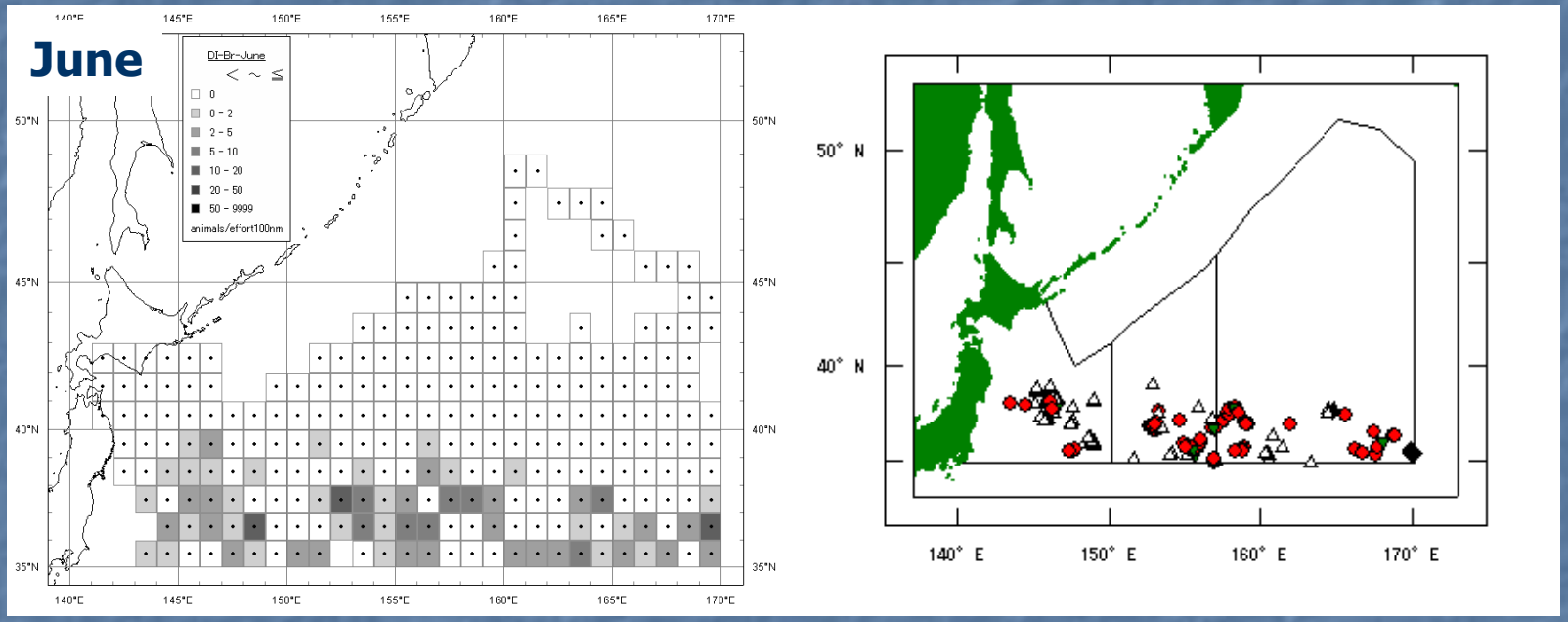
Main distribution

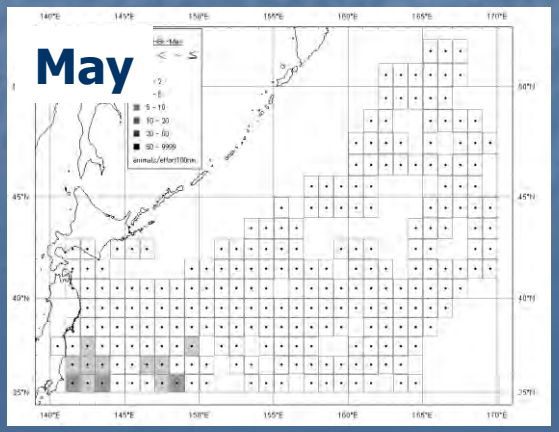
South of 41 N

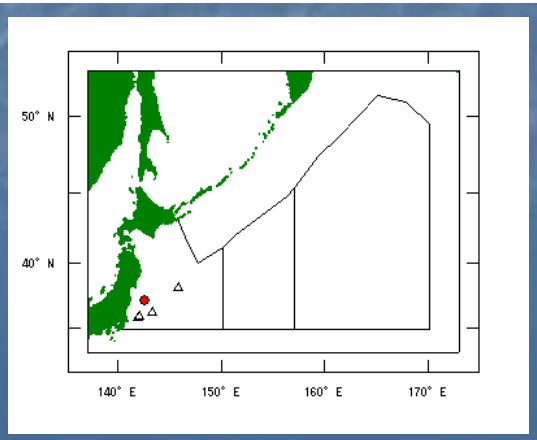
Bryde's whale (*Balaenoptera edeni*)

Density Index (whales/100n.mile)

Main prey (stomach contents)







Main prey species

Krill (▲)

Japanese anchovy (●)

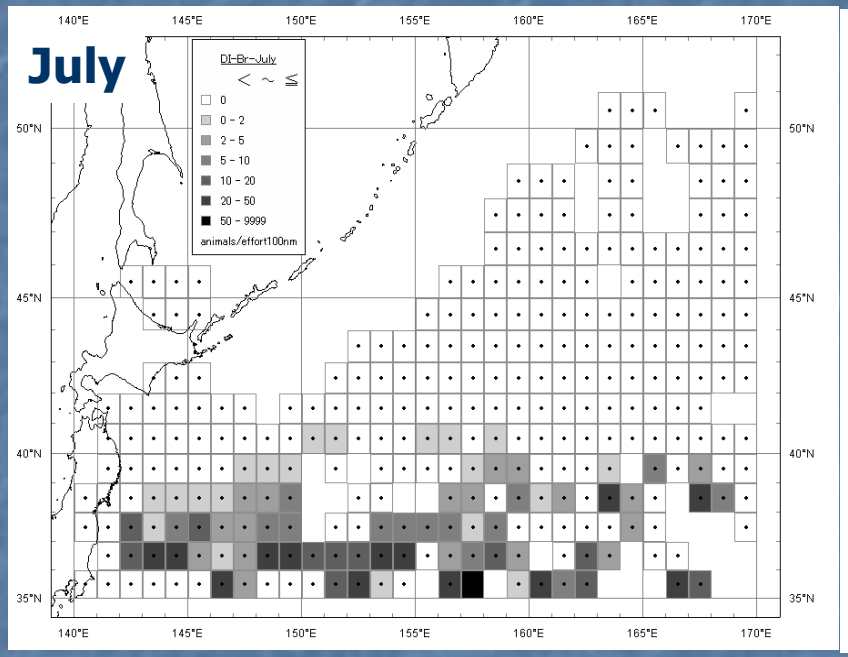
Main distribution

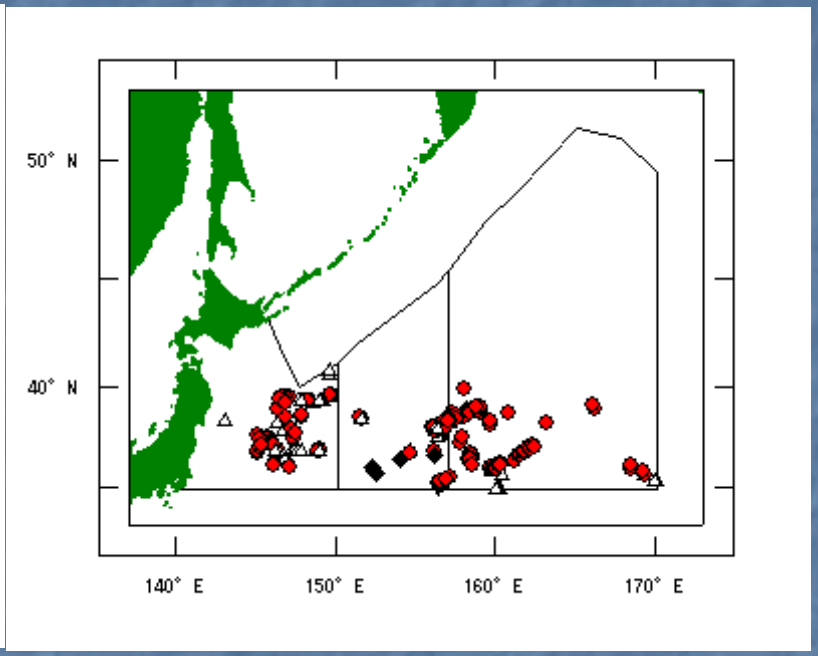
South of 40 N

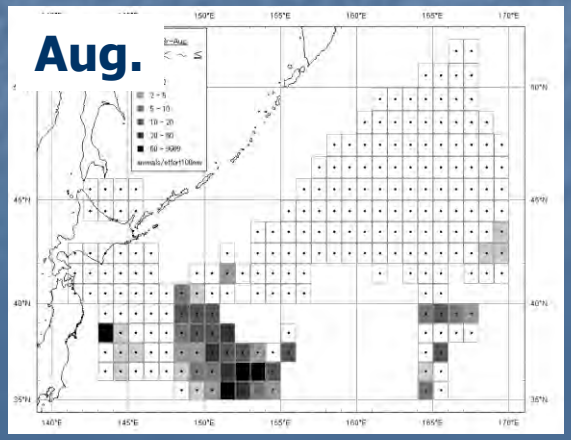
Bryde's whale (*Balaenoptera edeni*)

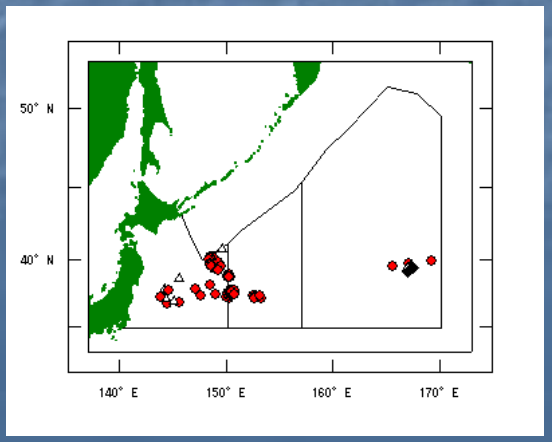
Density Index (whales/100n.mile)

Main prey (stomach contents)









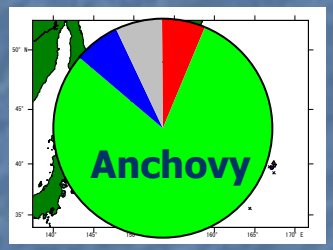
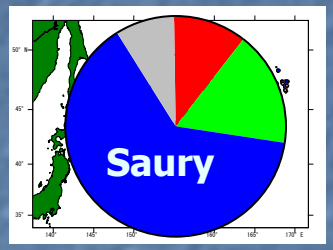
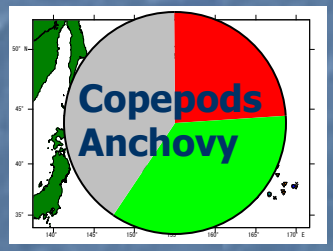
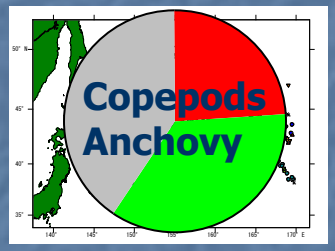
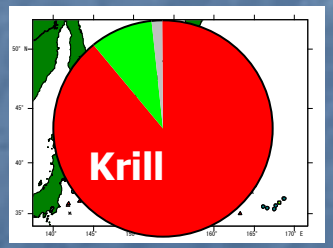
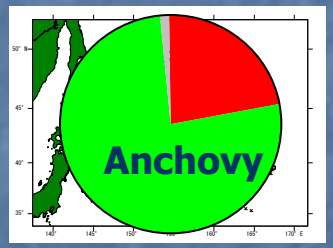
Main prey species

Japanese anchovy (●)

Main distribution

South of 40 N

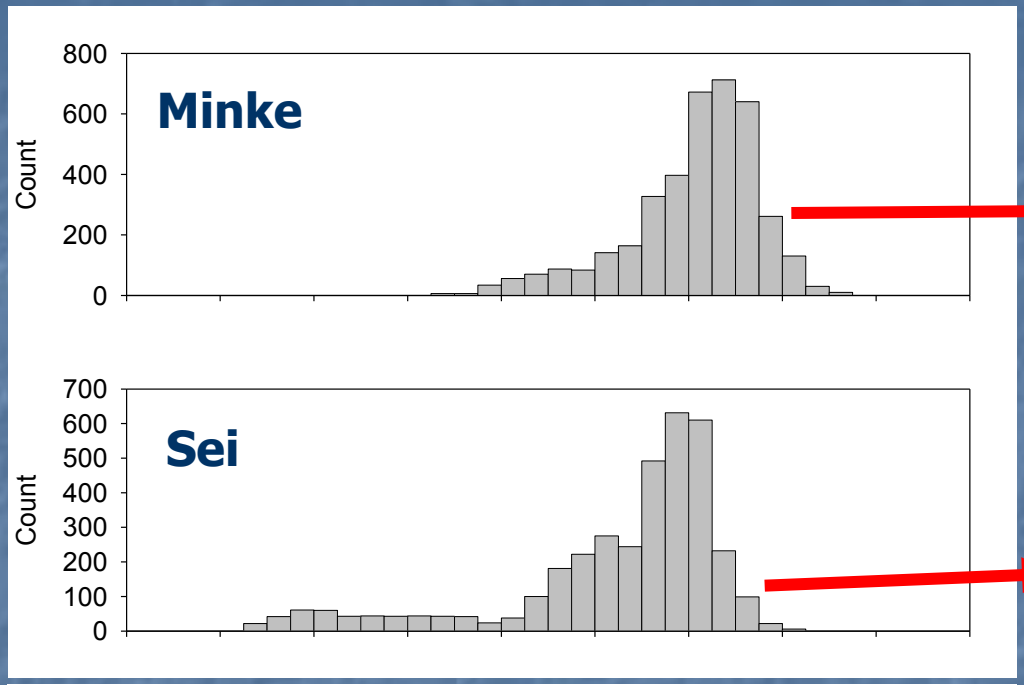
Seasonal and geographical change of prey species

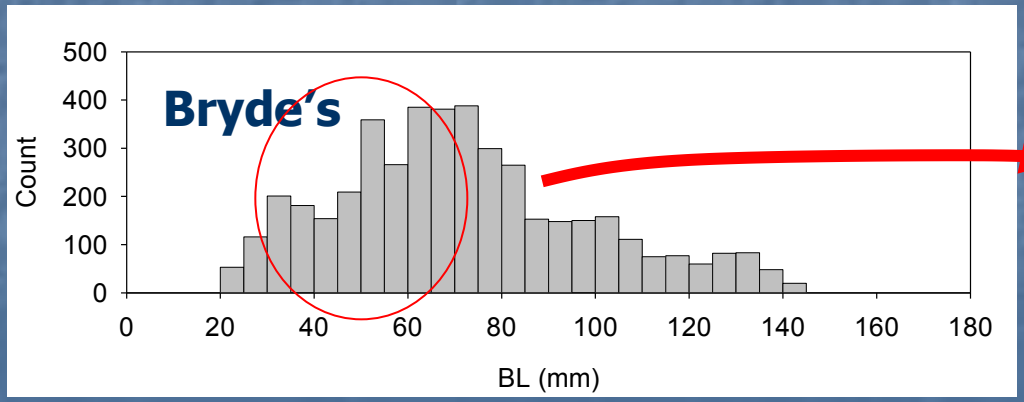
	Early (May-June)	Late (July-Sept.)	Early (May-June)	Late (July-Sept.)
Minke whale			Anchovy →	Saury
Sei whale			Copepods Anchovy →	Copepods Anchovy
Bryde's whale			Krill →	Anchovy

*Coastal area (East off Hokkaido): Walleye pollock and Common squid

Japanese anchovy is most important prey species (2000-2012)

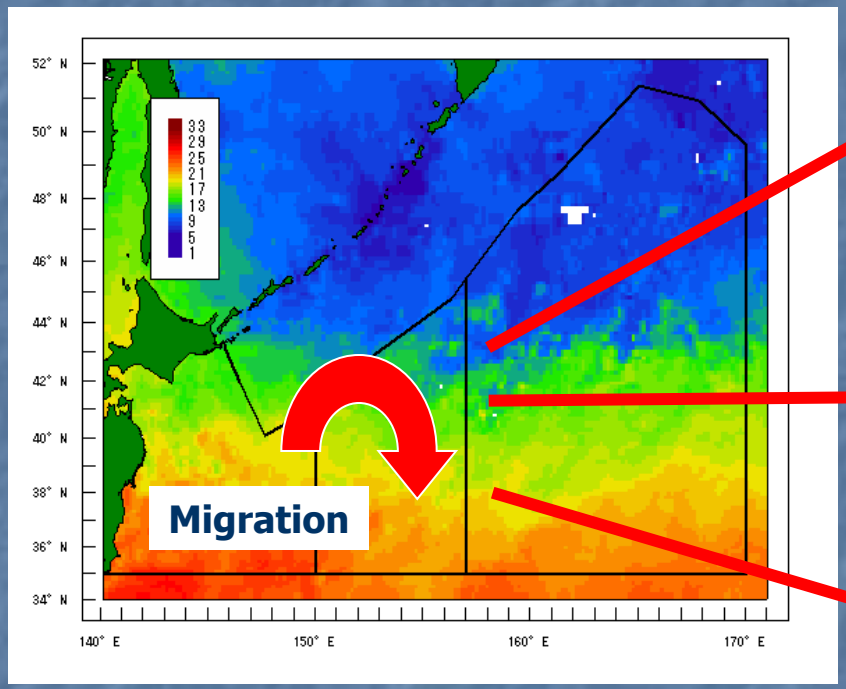
Distribution of anchovy size in the stomach of whales





Different of feeding strategy

Relationship between anchovy distribution and SST

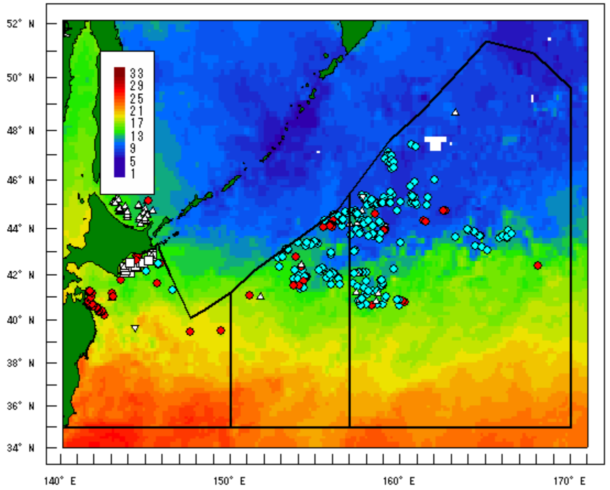


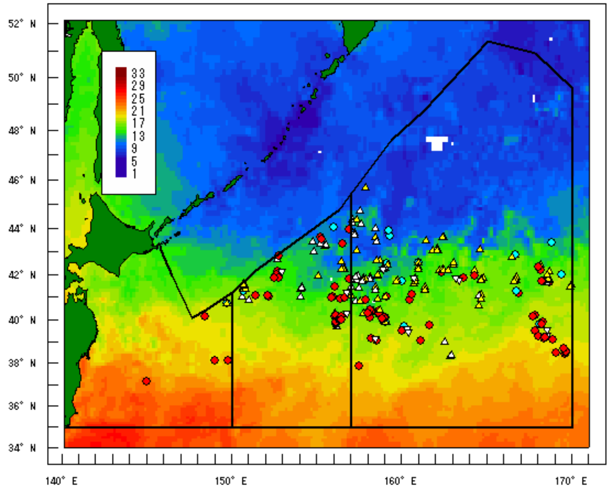
Adult stage

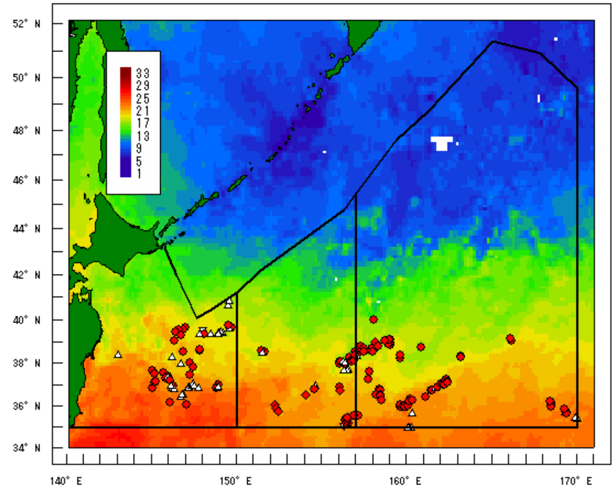
Juvenile stage

Relationship between whales distribution and SST

Late season (July 2000-2012)





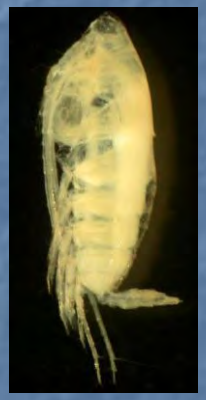


Common minke whale **Sei whale** **Bryde's whale**

Prey species: ▲ : Copepods ● : Anchovy ● : Saury

Feeding habits of baleen whale species

Copepods (*Neocalanus spp.*)



Krill (*Euphausia pacifica*)

Japanese anchovy (*Engraulis japonicus*)

Chub mackerel (*Scomber japonicus*)

Pacific saury (*Colorabis saira*)

Japanese flying squid (*Tadarodes pacificus*)

Minke whale

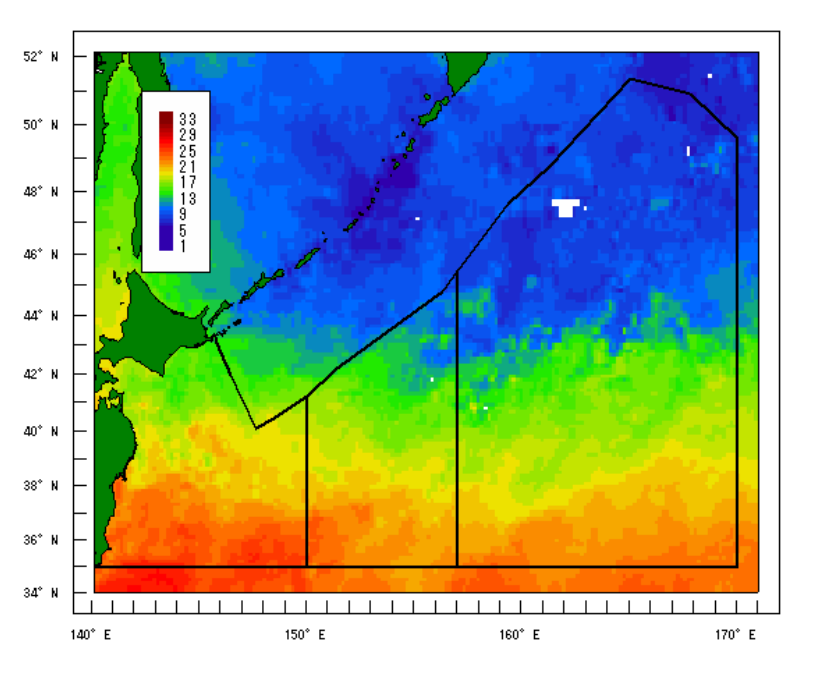
Sei whale

Bryde's whale

 # Differences in feeding habits among three baleen whale species

→ Minke whale Higher trophic level prey (Flying squid)
Sei whale Lower trophic level prey (Copepods, Krill)
Bryde's whale Lower trophic level prey (Krill, Japanese anchovy)

Relationship among three baleen whale species distribution and SST



Euryphagous

Cold water

Stenophagous

Warm water

Summary of results

~ Distribution baleen whales and their prey species ~

- **There is seasonal, geographical change of prey species of three baleen whale species**
- **Japanese anchovy is most important prey during 2000 to 2012**
- **Differences in the prey of three baleen whales probably reflect the abundance of available prey species in the research area**
- **There are differences in feeding habits among three baleen whale species, its depend on their feeding strategy and their distribution**

→ Feeding strategy

Thank you for your attention!