

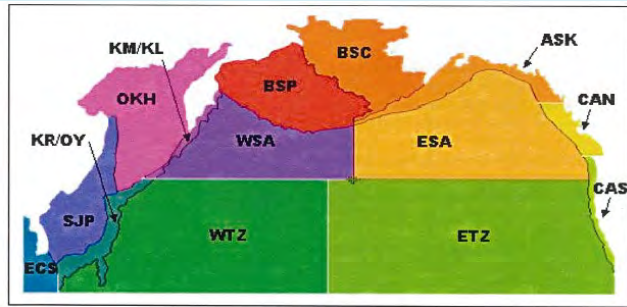
Estimation of prey consumption by marine mammals in the PICES regions -Update to Hunt *et al.* (2000)-

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Takashi Hakamada¹, and Andrew W. Trites²

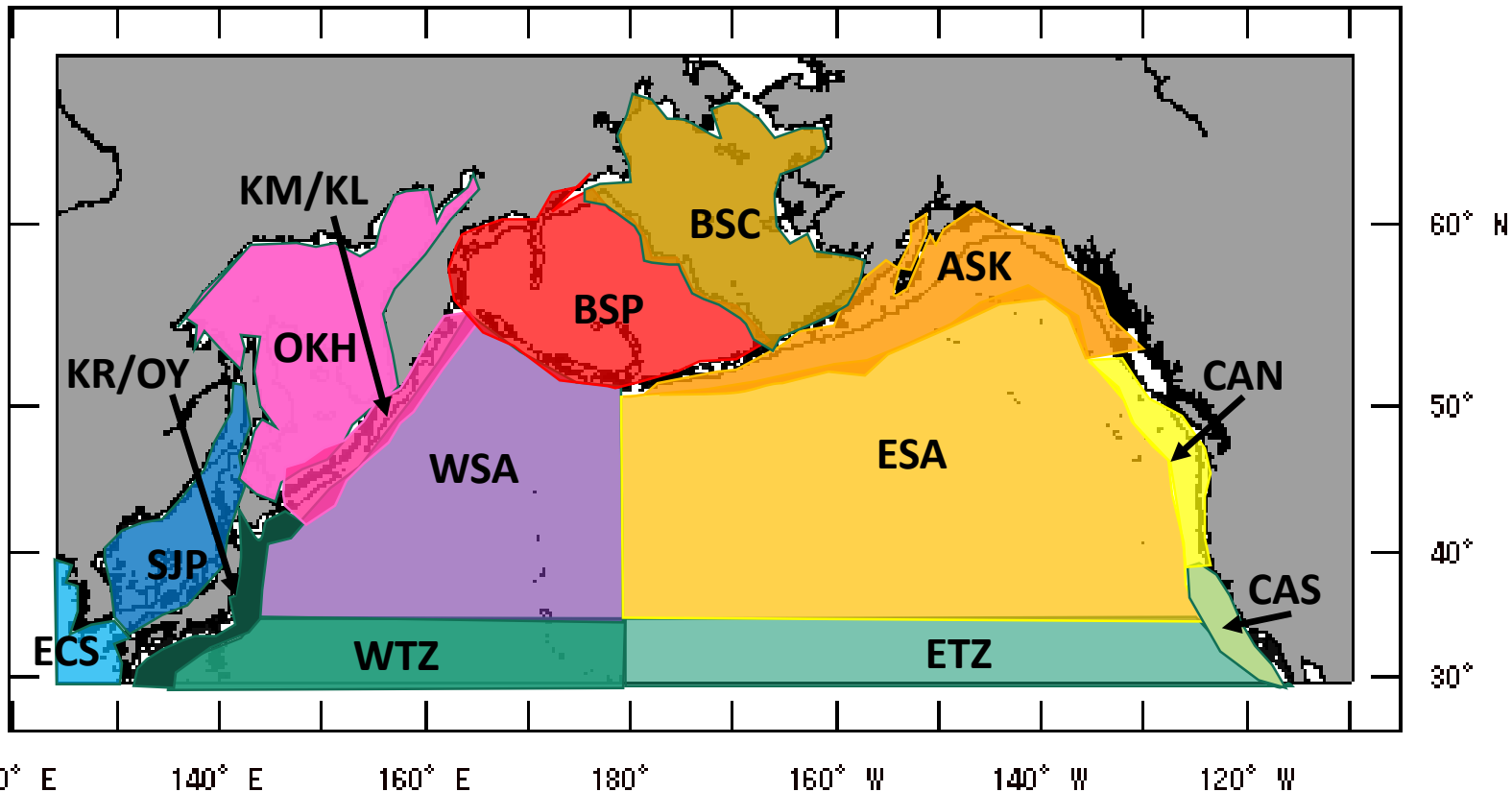
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Previous study – Hunt *et al.* 2000 -



**135 species of sea birds,
47 species of marine mammals**



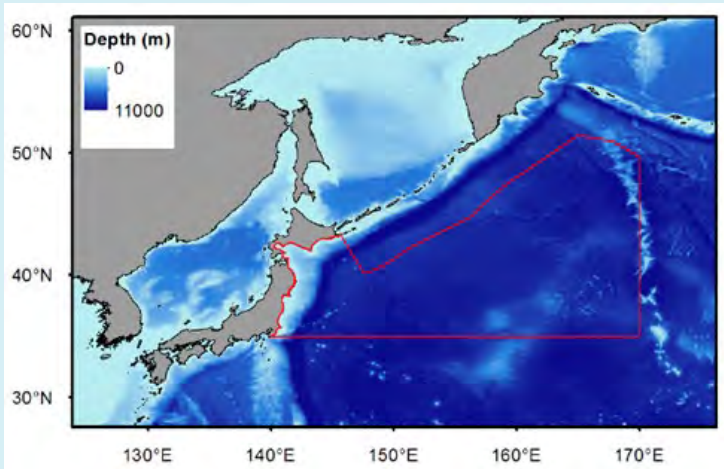
Update issue-

- Up-dating PICES Scientific Report 14 on prey consumption by marine mammals in the western North Pacific.
- 1) Abundance
 - JARPNII (Japan), IWC-POWER, Domestic sighting (Japan) and references
- 2) Prey consumption
 - New equations by Trites
- 3) Days of occupancy
 - 122 days (June – September)

Abundance -Cetaceans-

JARPNII

2000-2016 WSA+KR/OY



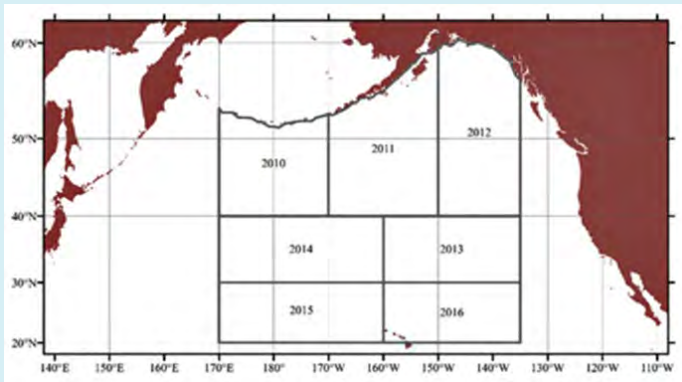
Hakamada and Matsuoka 2016

Species name	Abundance	Coefficient of Variation
Common mnke whale	3,080	0.68
Sei whale	5,086	0.38
Bryde's whale	13,306	0.25
Blue whale	958	0.46
Fin whale	3,958	0.43
Humpback whale	392	0.88
Northern right whale	416	0.65
Sperm whale	10,843	0.36

Abundance -Cetaceans-

IWC/POWER

2010-2016 ASK+ESA+ETZ

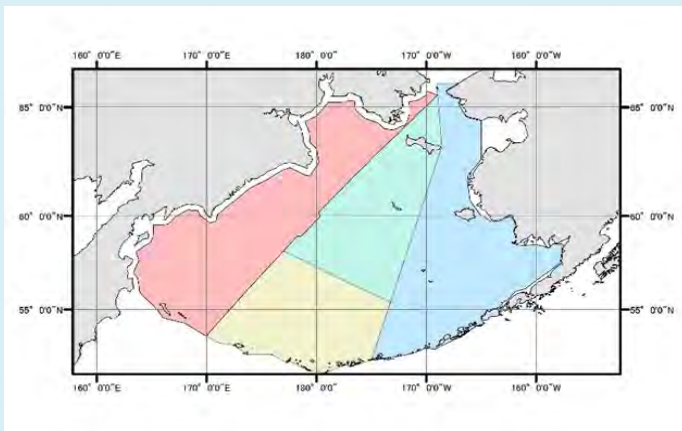


Species name	Abundance	Coefficient of Variation
Sei whale	29,632	0.20
Bryde's whale	11,935	0.25
Humpback whale	14,407	0.56

Hakamada *et al.* 2017a, 2017b

Inai *et al.* 2018

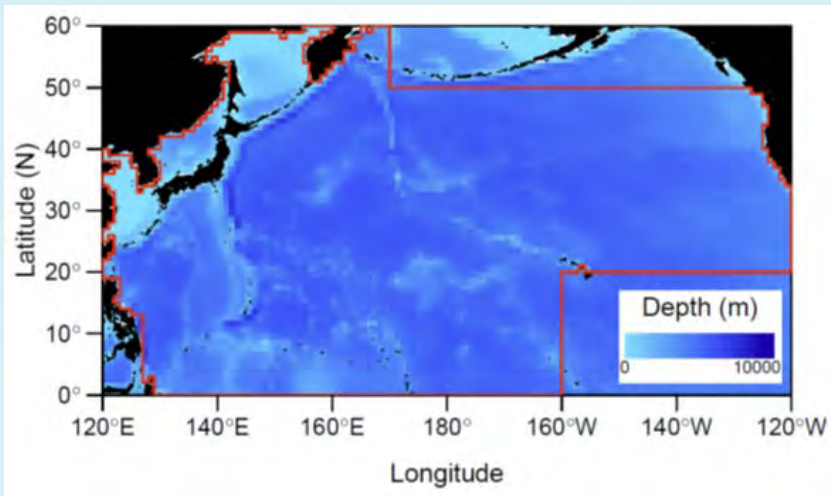
2017-2019 BSP+BSC



Abundance -Cetaceans-

NRIFSF (JAPAN) sighting surveys 1983–2006

ECS+SJP+KR/OY+ OKH+KM/KL+
WSA+ESA+WTZ+ETZ



Kanaji *et al.* 2017

Species name	Abundance	Coefficient of Variation
Spinner dolphin	904,473	0.20
Melon-headed whale	147,597	0.34
Rough-toothed dolphin	102,893	0.24
False killer whale	74,101	0.31
Pantropical spotted dolphin	1,886,022	0.20
Short-finned pilot whale	154,595	0.20
Common bottlenose dolphin	93,170	0.55
Risso's dolphin	349,309	0.24
Striped dolphin	1,766,025	0.15
Short-beaked common dolphin	1,428,857	0.42
Pacific white-sided dolphin	418,090	0.45
Northern right whale dolphin	56,899	0.52
Dall's porpoise	1,022,987	0.04

Abundance -Pinniped-

Steller sea lion



<https://4travel.jp/travelogue/11128257>

Sub regionsCAN	Abundance	References
KM/KL	9,201	Burkanov <i>et al.</i> 2008
KR/OY	553	Burkanov <i>et al.</i> 2008
OKH	8,582	Burkanov <i>et al.</i> 2015
SJP	+	
ASK	94,941	
CAN	++	

Northern fur seal



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Sub regions	Abundance	References
KM/KL	112,601	Burkanov <i>et al.</i> 2007
KR/OY	+	
OKH	188,832	Kuzin 2010
WSA	+	
SJP	+	
CAN	14,050	
ESA	637,561	

Estimation of daily prey consumption

Trites *et al.* (in prep)

LOW cost of living

$$R = 0.797811M^{0.6325}$$

R = daily ration (kg/day), M = mass (kg)

- Right whale
- Sperm whale
- Cuvier's beaked whale
- Bottlenose dolphin
- Pacific walrus
- Northern elephant seal
- Australian sea lion
- Sea Otter

Estimation of daily prey consumption

Trites *et al.* (in prep)

MEDIUM cost of living

$$R = 0.101555M^{0.8387}$$

R = daily ration (kg/day), M = mass (kg)

- Fin whale
- Beluga (white) whale
- Long-finned pilot whale
- Stripped dolphin
- Spinner dolphin
- Rough-toothed dolphin
- Risso's dolphin
- South American sea lion
- South African fur seal
- Ringed seal
- Grey seal
- Harp seal
- Harbour seal

Estimation of daily prey consumption

Trites *et al.* (in prep)

HIGH cost of living

$$R = 0.37222M^{0.7144}$$

R = daily ration (kg/day), M = mass (kg)

- Humpback whale
- Minke whale
- Killer whale
- Pacific white-sided dolphin
- Dusky dolphin
- Common dolphin
- Commerson's dolphin
- Harbour porpoise
- Steller sea lion
- California sea lion
- New Zealand sea lion
- Northern fur seal
- Antarctic fur seal

Common minke whale (June to September)



Sub region	Abundance	Prey consumption (ton)
ECS	+	+
SJP	1,900+	89,749+
KR/OY	+	+
OKH	17,350	819,546
KM/KL	5,841	275,906
WTZ	+	+
WSA	3,080	145,487
BSP	+	+
BSC	+	+
ASK	+	+
ESA	+	+
ETZ	+	+
CAN	636	30,042

Sei whale (June to September)



Sub region+	Abundance	Prey consumption (ton)
KR/OY	+	+
WSA	5,086	537,738
BSP	+	+
BSC	+	+
ASK	+	+
ESA	29,632	3,132,961

Bryde's whale (June to September)



Sub region	Abundance	Prey consumption (ton)
KR/OY	58+	4,726
WTZ	15,422	1,256,501
ETZ	+	+

Blue whale (June to September)



Sub region	Abundance	Prey consumption (ton)
WSA	958	369,652
ESA	1,647	635,508

Fin whale (June to September)



Sub region	Abundance	Prey consumption (ton)
SJP	+	+
OKH	5,000	1,152,642
KM/KL	+	+
WSA	3,958	912,431
ESA	9,029	2,081,441

Humpback whale (June to September)



Sub region	Abundance	Prey consumption (ton)
KR/OY	+	+
OKH	+	+
KM/KL	+	+
WTZ	+	+
WSA	1,107	156,311
BSP	+	+
BSC	4,539	640,916
ASK		
ESA	10,103	1,426,563
CAN		

Northern right whale (June to September)



Sub region	Abundance	Prey consumption (ton)
KR/OY	+	+
OKH	922	103,347
WTZ	+	+
WSA	416	46,629
BSP	+	+
BSC	+	+
ESA	31	3,475
ASK	+	+

Bowhead whale (June to September)

Sub region	Abundance	Prey consumption (ton)
OKH	218	28,972
BSP	17,000	2,259,317
BSC		

Gray whale (June to September)



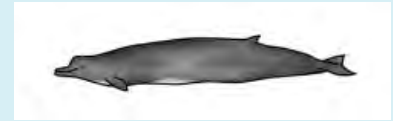
Sub region	Abundance	Prey consumption (ton)
SJP	282	27,758
OKH		
BSP	+	+
BSC	20,990	2,066,136
ASK		
CAN		
CAS		

Sperm whale (June to September)



Sub region	Abundance	Prey consumption (ton)
KR/OY	1,137+	70,184+
KM/KL	+	+
WTZ	2,323+	143,392+
WSA	17,128	1,057,262
ESA	+	+
ETZ	+	+
ASK	1,997	123,269
CAN		
CAS		

Baird's beaked whale (June to September)



Sub region	Abundance	Prey consumption (ton)
SJP	1,500	25,393
OKH	660	11,173
KR/OY	+	+
KM/KL	+	+
WSA	+	+
BSP	+	+
BSC	+	+
ESA	+	+
ASK	+	+
CAN	+	+

Small cetaceans (including dolphin)



Species name	Sub regions	Abundance	Consumption (ton)
Spinner dolphin	ECS, SJP, KR/OY, OKH, KM/KL, WSA, ESA, WTZ, ETZ	904,473	347,370
Melon-headed whale		147,597	90,638
Rough-toothed dolphin		102,893	56,556
False killer whale		74,101	458,552
Pantropical spotted dolphin		1,886,022	1,111,752
Short-finned pilot whale		154,595	434,013
Common bottlenose dolphin		93,170	248,852
Risso's dolphin		349,309	404,971
Striped dolphin		1,766,025	1,179,014
Short-beaked common dolphin		1,428,857	1,615,322
Pacific white-sided dolphin		418,090	430,620
Northern right whale dolphin		56,899	27,816
Dall's porpoise		1,022,987	886,164

Steller sea lion (June to September)



Sub region	Abundance	Prey consumption (ton)
KM/KL	9,201	17,870
KR/OY	553	1,074
OKH	8,582	16,668
WSA	+	+
SJP	+	+
BSP	+	+
BSC	+	+
ASK	94,941	189,876
CAN	++	++
ESA	+	+

Northern fur seal (June to September)



Sub region	Abundance	Prey consumption (ton)
KM/KL	112,601	54,148
KR/OY	+	+
OKH	140,000	67,324
WSA	+	+
SJP	+	+
BSP	+	+
BSC	+	+
ASK	+	+
CAN	14,050	6,897
ESA	637,561	312,990

Prey consumption by marine mammals in each sub regions of PICES

Sub region of PICES	Prey consumption (t)
SJP (Sea of Japan)	115,142
KR/OY (Kuroshio/Oyaho Region)	75,984
OKH (Sea of Okhotsk)	2,227,430
KM/KL (Kurile Islands Region)	347,924
WTZ (Western tropical zone)	1,399,893
WSA (Western subarctic)	2,856,228
BSC (Bering Sea continental shelf)	4,966,369
ASK (Gulf of Alaska continental shelf)	189,876
ESA (Eastern Subarctic)	7,592,938
CAN (California current North)	160,208
Total	19,931,992

Summary

- The estimation of prey consumption by marine mammals could be updated using new proposal equations in PICES region.
- Total prey consumption by marine mammals during feeding season is estimated to 19.9 million tons in PICES region.
- More information is needed on the **abundance** and **prey energy** of marine mammals to make a more realistic table of prey consumption till next year.

Thank you for your
attention!

Acknowledgement

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