



Population biology of killer whales and their marine mammal prey in the North Pacific

Paul Wade

*National Marine Mammal Laboratory, Alaska Fisheries Science Center,
NOAA Fisheries, Seattle, WA*

Conclusions

- Eastern Aleutian transients do not have a spring/summer diet that is composed exclusively of Steller sea lions, because stable isotope ratios show that their diet must include lower trophic level species to offset the high trophic level of the sea lions.

Killer whale marine mammal prey observations

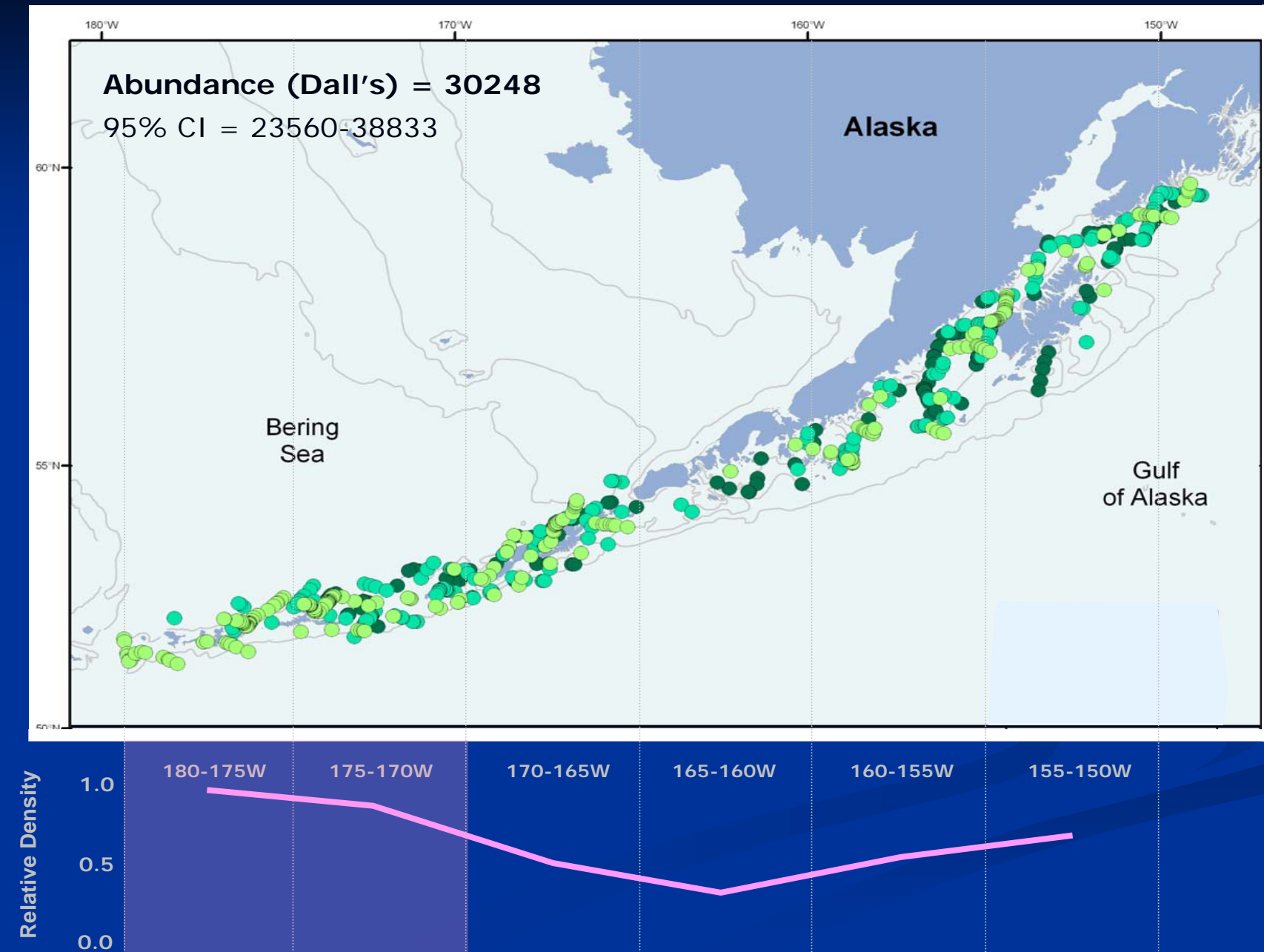
Species	WCNA	GOA	BSAI
Sea otter	1	2	1
Walrus	0	0	2
Harbor seal	112	25	2
N elephant seal	20	0	0
California sea lion	48	0	0
Steller sea lion	26	16	1
unid.sea lion	5	1	0
Northern fur seal	0	0	2
Harbor porpoise	40	4	0
Dall's porpoise	33	16	0
L-b common dolphin	3	0	0
P white-sided dolphin	7	0	0
Beluga	0	3	4
Minke whale	6	6	2
Gray whale	40	0	3
Fin whale	0	1	0
Sperm whale	1	0	0
Total	342	74	17

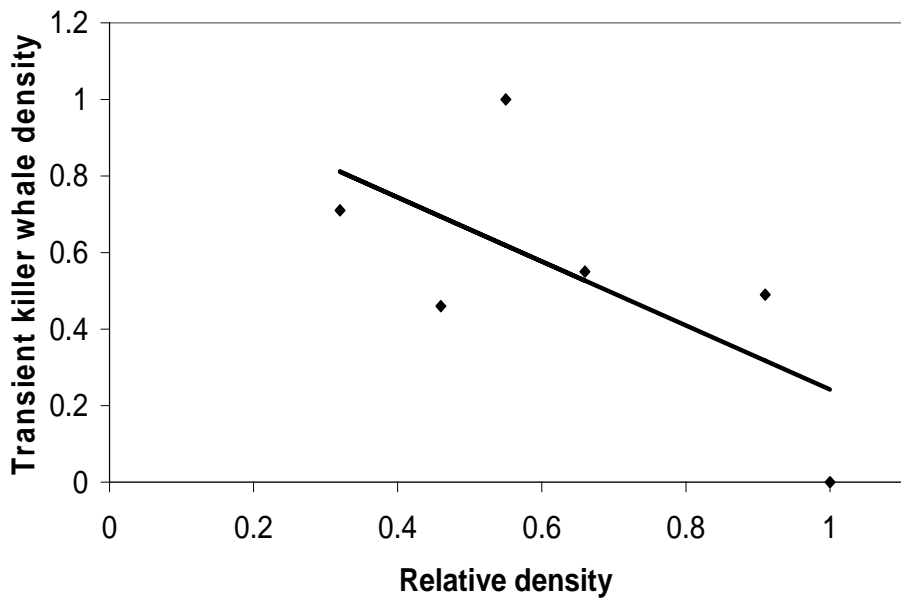
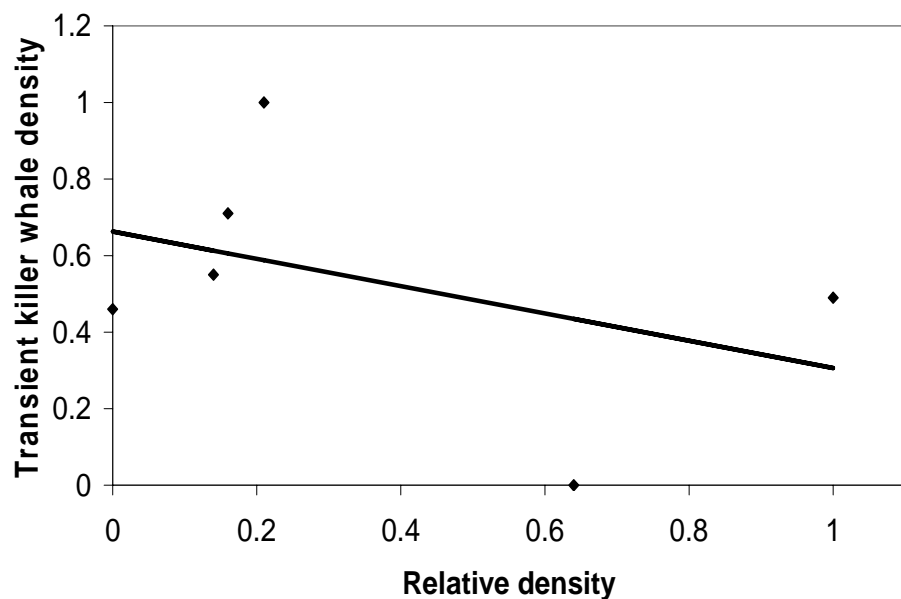
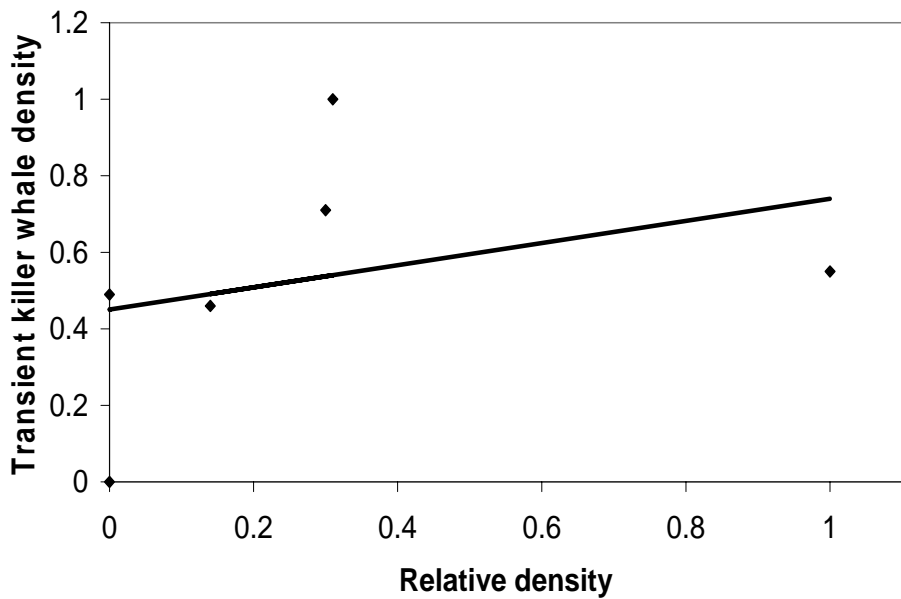
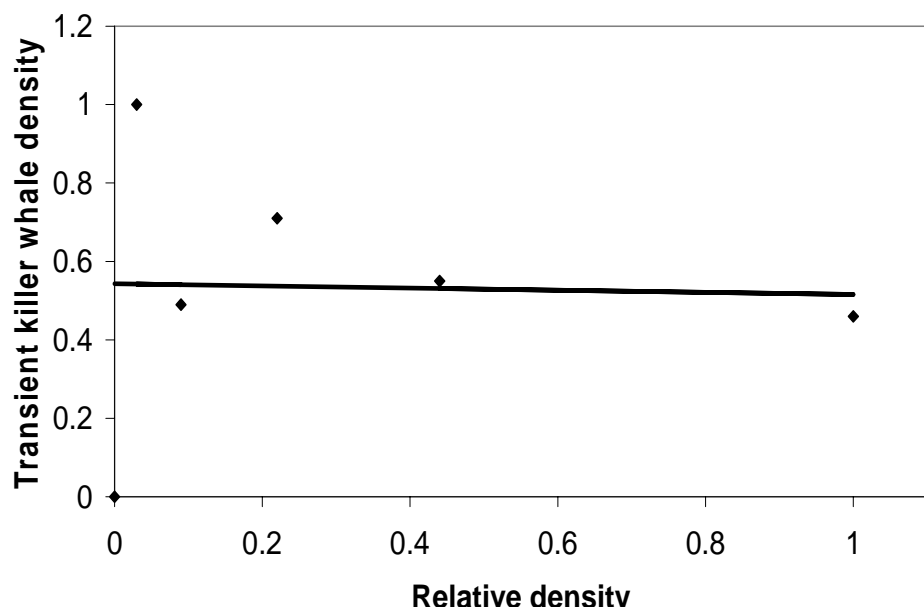
The ecology of killer whales in relation to their
marine mammal prey in the Aleutian Islands,
Bering Sea, and Gulf of Alaska

Wade, Zerbini, and London. In prep.

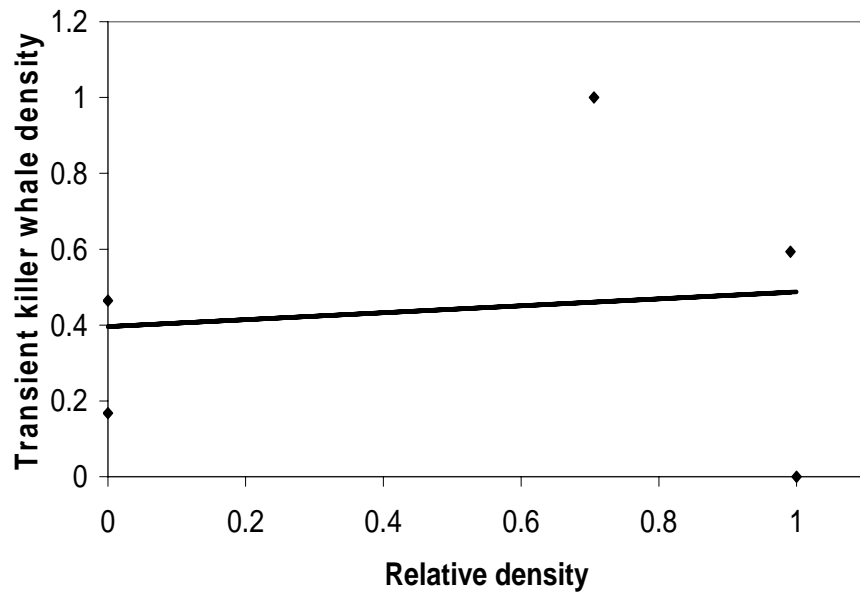


Dall's porpoise density and abundance

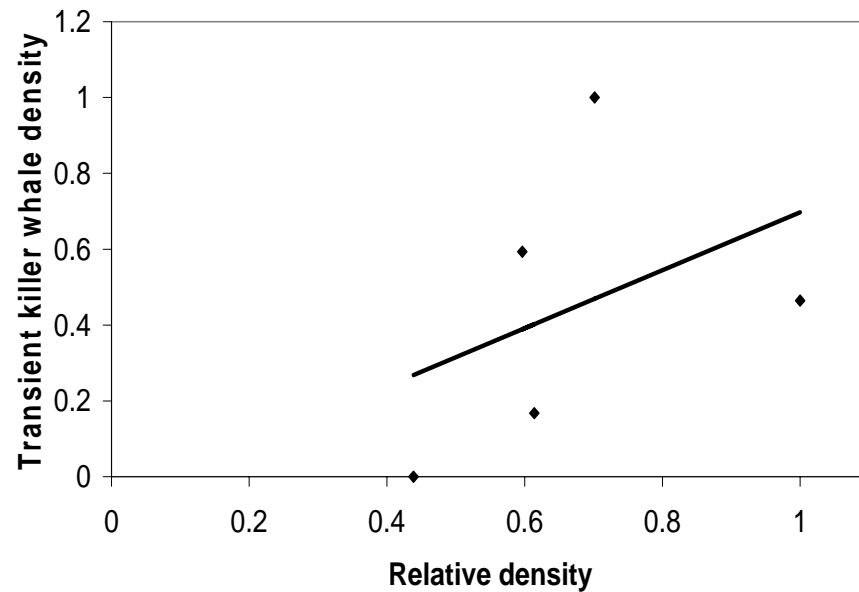


Dall's**Minke****Humpback****Fin**

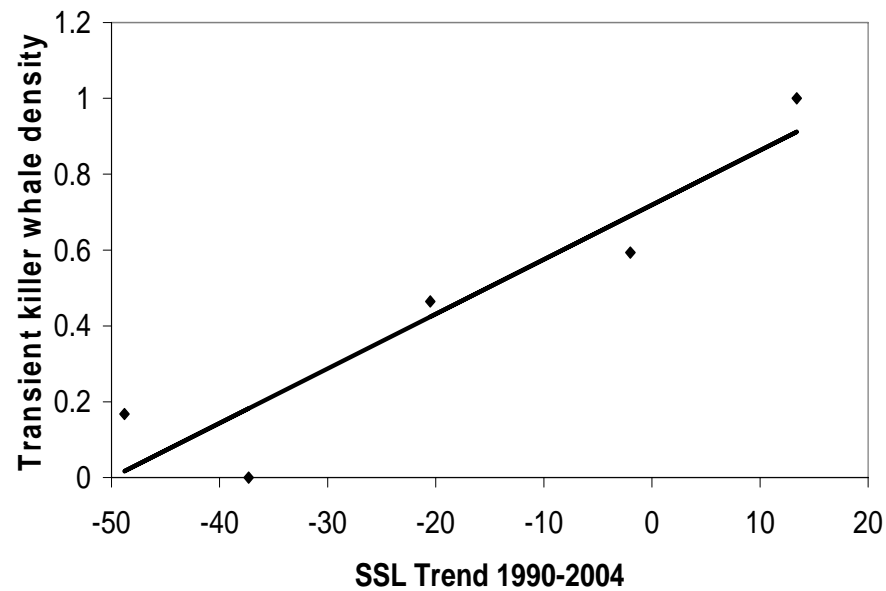
Fur seal



Steller sea lion



Steller sea lion



Transient movements and feeding ecology

- False Pass in the eastern Aleutians has a very high density of transients in May/June, feeding on (apparently) gray whale calves on their northbound migration. (Matkin and Barrett-Lennard)
- Some (25%) of these whales are also seen in summer in the eastern Aleutians, and are therefore eating something else (NMML and Matkin/LBL). Both groups have observed predation on fur seals (particularly Unimak Pass), SSL, and minke whales. Observations of predation have also been seen on Dall's porpoise (SWFSC).
- However, a larger than expected fraction of these whales have never been seen in the summer in the eastern Aleutians, suggesting they may come from a wider area to aggregate in False Pass in May (NMML). Hypotheses include that whales may move from the Bering Sea to False Pass, or come from the Pacific well south of the Aleutian Islands.

Transient movements and feeding ecology

- (1) Same group seen in right whale box, in Bering, 50 miles south of Unimak Island (SWFSC), and near False Pass in June (NMML).
- (2) Bull seen in June 2005 near False Pass in group of 35 (gray whale kill?), was also seen July 2004 in Pribiloffs eating fur seal.
- (3) 3 whales seen in south of Unalaska (Matkin) and by NMML at Barren Islands at entrance Cook Inlet – only movement between regions.
- (4) Umnak to Shumagins we see movements throughout area in summer months (NMML).

Transient movements and feeding ecology

- (5) Bogoslov whales killing fur seals include 3 seen by (NMML) and others by Matkin group, including a group seen previously only at Bogoslof in 1993 (NMML).
- (6) 16 transients seen around Pribis in July 2005 by NMML were all new whales, one kill of fur seal seen (9/16 biopsied, did have cookie cutter shark scars).
- (7) no movements between central and eastern goes with genetics,
- (8) sea otter killers (5 whales) from Adak, pictures from 1999 and 2000 from Tim Tinker and Estes group, we saw same group of 5 in Delaroffs (40m west of Adak) in 2005.

Fur seal specialists?

- There are transients foraging on fur seals around the Pribilofs in summer and reportedly in the fall, as well, with a hypothesis that they might focus on pups newly entering the water at that time. None of these have matched to elsewhere. Pribis might have trophic level appropriate for fur seals.
- Transients are also known to forage on fur seals as well around Bogoslof, appear to be specialists.

Fall and winter?

- Transients in the eastern Aleutians and pribs have high proportion cookie cutter shark bite marks (healed not acquired in summer, fresher marks on False pass whales) on them (Durban and Pitman) (residents have very low proportion). Though the distribution of cookie cutter sharks is not perfectly known, this suggests that these whales make excursions to more southerly latitudes (pelagic warm waters) at some point in their lives. They hypothesize that these whales may make annual excursions in fall and winter to the transition zone in the pelagic Pacific, say ~ 35-45 degrees south, where telemetry has shown that fur seals and elephant seals use as habitat during that time of the year, along with substantial populations of Dall's porpoise and species of small delphinids such as Pacific white-sided dolphins.

Kodiak-Kenai predation

- The Kodiak-Kenai area seems to have a higher incidence of SSL predation than other areas. One thing to note is that there is relatively less alternative pinniped and small cetacean prey available there, with the exception perhaps of Dalls porpoise. Few fur seals, not so many harbor seals, low density of minke whales. 5 times as many harbor seals in SE AK and BC as there are in GOA. 40 times more fur seal, harbor seal, spotted seals in BSAI than harbor seals in GOA.

Steller sea lions as percent prey (percent # of individuals observed killed)

Wade et al. MMS	BSAI	6%
Wade et al. MMS	GOA	22%
Matkin et al. in press	BSAI spring/summer	4%
NMML/NOAA	BSAI summer	11%
NMML	BSAI+GOA summer	8%

Steller sea lion

- BSAI
 - 226 transients, 4% SSL predation
 - 4 months : 242 SSL per year killed (1.2% of pop.)
- BSAI
 - 226 transients, 11% SSL predation
 - 4 months: 511 SSL per year killed (2.6% of pop.)
- GOA
 - 27 transients, 22% SSL predation
 - 4 months: 86 SSL per year killed (0.5% of pop.)

Hypothetical prey allocation

Month	Gray whale	Minke whale	Beluga whale	Dall's porpoise	Harbor porpoise	Pacific walrus	Steller sea lions	Northern fur seals	Harbor seals	Spotted seal	Sea otter
March		15	1	3	2	6	9	50	8	3	3
April		15	1	3	2	6	9	50	8	3	3
May	80							20			
June	80							20			
July		15	1	3	2	6	9	50	8	3	3
August		15	1	3	2	6	9	50	8	3	3
September		15	1	3	2	6	9	50	8	3	3
October	80							20			
Fraction	0.200	0.063	0.004	0.013	0.008	0.025	0.038	0.258	0.033	0.013	0.013

Using 170,000-200,000 kcal/whale

Species	Abundance	# killed	Fraction population
Gray whale	22,052	458	0.021
Minke whale	3,327	186	0.056
Beluga whale	2,274	82	0.036
Harbor porpoise	77,862	2128	0.027
Dall's porpoise	53,505	1659	0.031
Pacific walrus	10,000	261	0.026
Steller sea lion	37,191	1201	0.032
Northern fur seal	888,120	60062	0.068
Harbor seal	43,488	3175	0.073
Spotted seal	59,214	1724	0.029
Sea otter	58,026	5787	0.100