

Supplemental Table 5. Sensing range for toothed whales

Species	Length (m)*	Target size (m)*	Maximum detection range (m)**	Noise	Study type	Reference
<i>Phoena phocoena</i>	1.293	0.076	26	low	S.E.	Kastelein <i>et al.</i> 1999
<i>Phocoena phocoena</i>	1.333	0.051	15.9	low	S.E.	Kastelein <i>et al.</i> 1999
<i>Tursiops truncatus</i>	2.600	0.025	74	Very high	S.E.	Murchison 1980
<i>Tursiops truncatus</i>	2.600	0.076	79	Very high	S.E.	Murchison 1980
<i>Tursiops truncatus</i>	2.600	0.076	113	high	S.E.	Au & Snyder 1980
<i>Pseudorca crassidens</i>	3.250	0.076	119	high	S.E.	Thomas & Turl 1990
<i>Tursiops truncatus</i>	2.600	0.076	178	low	S.E.	Au <i>et al.</i> 2002
<i>Delphinapterus leucas</i>	3.030	0.076	162	low	S.E.	Au <i>et al.</i> 1985
<i>Phocoena phocoena</i>	1.330	0.051	14	low	S.E.	Teilmann <i>et al.</i> 2002
<i>Phocoena phocoena</i>	2.750	0.300	27	low	model	Au <i>et al.</i> 2007
<i>Tursiops truncatus</i>	2.750	0.300	93	high	model	Au <i>et al.</i> 2007
<i>Tursiops truncatus</i>	2.750	0.300	173	low	model	Au <i>et al.</i> 2007
<i>Tursiops truncatus</i>	2.750		140		wild	Akamatsu <i>et al.</i> 1998
<i>Orcinus orca</i>	5.800	fish	480		wild	Barrett-Lennard <i>et al.</i> 1996
<i>Orcinus orca</i>	5.800	Porpoise	800		wild	Barrett-Lennard <i>et al.</i> 1996
<i>Orcinus orca</i>	5.800	0.780	100	high	wild	Au <i>et al.</i> 2004
<i>Pseudorca crassidens</i>	4.900	1.000	210		wild	Madsen <i>et al.</i> 2002
<i>Pseudorca crassidens</i>	4.900	0.200	80		wild	Madsen <i>et al.</i> 2002
<i>Pseudorca crassidens</i>	4.900	tursiops	310		wild	Madsen <i>et al.</i> 2002
<i>Grampus griseus</i>	3.000	0.200	85		wild	Madsen <i>et al.</i> 2002
<i>Grampus griseus</i>	3.000	0.800	130		wild	Madsen <i>et al.</i> 2002

\* when target size was not given, fishbase was used

\*\* maximum distance with 50% correct detection

Study type:

S.E. (semi enclosed) Individuals have been living in captivity for many year and were trained to perform experiments. They are adapted to their small environment and thus shown different foraging patterns (e.g. Wahlberg *et al.* 2011) which are also apparent in their echolocation patterns (e.g. Madsen *et al.* 2002). Experiments where conducted using a 5.0 or 7.62-cm diameter water-filled stainless-steel sphere as a target.

model study Study tested the reflectivity of artificial signals (mimicking toothwhale ecolocation) on real fish. From this the max. sensing distance was estimated.

wild Clicks recorded (hydrophone) in vivo, target detection range calculated from clicks.

## References

- Akamatsu, T., D. Wang, K. Nakamura, K. Wang (1998) Echolocation range of captive and free-ranging baiji (*Lipotes vexillifer*), finless porpoise (*Neophocaena phocaenoides*), and bottlenose dolphin (*Tursiops truncatus*). *J. Acoust. Soc. Am.* 104 (4), 2511-2516.
- Au, W. W. L., and Snyder, K. J. (1980). Long-range target detection in open waters by an echolocating Atlantic bottlenose dolphin. *J. Acoust. Soc. Am.* 56, 1280-1290.
- Au, W. W. L., Carder, D. A., Penner, R. H. and Scronce, B. L. (1985). Demonstration of adaptation in beluga whale echolocation signals. *J. Acoust. Soc. Am.* 77, 726-730.
- Au, W. W. L., Lemonds, D. W., Vlachos, S., Nachtigall, P. E., and Roitblat, H. L. (2002). Atlantic bottlenose dolphin hearing threshold for brief broadband signals. *J. Comp. Psychol.* 116, 151-157.

- Au, W.W.L., J.K.B. Ford, J.K. Horne, K.A. Newman Allman (2004). Echolocation signals of free-ranging killer whales (*Orcinus orca*) and modeling of foraging for chinook salmon (*Oncorhynchus tshawytscha*). *J. Acoust. Soc. Am.* 115 (2), 901-909.
- Au, W.W.L., K. J. Benoit-Bird, R. A. Kastelein (2007) Modeling the detection range of fish by echolocating bottlenose dolphins and harbor porpoises. *J. Acoust. Soc. Am.* 121 (6), 3954-3962.
- Barret-Lennard, L. G., Ford, J. K. B. and Heise, K. A. (1996). The mixed blessing of echolocation: Differences in sonar use by fish-eating and mammal-eating killer whales. *Anim. Behav.* 51, 553-665.
- Kastelein, R. A., Au, W. W. L., Rippe, T., Schooneman, N. M. (1999). Target detection by an echolocating harbor porpoise *Phocoena phocoena*. *J. Acoust. Soc. Am.* 105, 2493-2498.
- Madsen, P. T., Kerr, I., and Payne, R. (2004). Echolocation clicks of two free-ranging delphinids with different food preferences: False killer whales (*Pseudorca crassidens*) and Risso's dolphin (*Grampus griseus*). *J. Exper. Biol.* 207, 1811-1823.
- Murchison, A. E. (1980). Detection Range and Range Resolution in Echolocating Bottlenose Porpoise (*Tursiops truncatus*). in *Animal Sonar Systems*, edited by R. G. Bushel and J. F. Fish (Plenum, New York)
- Teilmann, J., L.A. Miller, T. Kirketerp, R.A. Kastelein, P.T. Madsen, B.K. Nielsen and W.W. L. Au (2002) Characteristics of echolocation signals used by a harbour porpoise (*Phocoena phocoena*) in a target detection experiment. *Aquatic Mammals* 28.3, 275-284.
- Thomas, J. A., and Turl, C. W. (1990). Echolocation characteristics and range detection threshold of a false killer whale (*Pseudorca crassidens*). in *Sensory Abilities of Cetaceans: Laboratory and Field Evidence*, edited by J. A. Thomas and R. A. Kastelein, Plenum, New York, 321-334.