Revised 03/15/2022

MINKE WHALE (*Balaenoptera acutorostrata scammoni*): California/Oregon/Washington Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The International Whaling Commission (IWC) recognizes 3 stocks of minke whales in the North Pacific: one in the Sea of Japan/East China Sea, one in the rest of the western Pacific west of 180W, and one in the "remainder" of the Pacific (Donovan 1991). The "remainder" stock only reflects the lack of exploitation in the eastern Pacific and does not imply that only one population exists in that area (Donovan 1991). In the "remainder" area, minke whales are relatively common in the Bering and Chukchi seas and in the Gulf of Alaska, but are not considered abundant in any other part of the eastern Pacific (Leatherwood *et al*. 1982; Brueggeman *et al*. 1990). In the Pacific, minke whales are usually seen over continental shelves (Brueggeman *et al*. 1990). In the extreme north, minke whales are believed to be migratory, but in inland waters of Washington and in central California they appear to establish home ranges (Dorsey *et al*. 1990). Minke whales occur year-round in California (Dohl *et al*. 1983; Forney *et al*. 1995; Barlow 1997) and in the Gulf of California (Tershy *et al*. 1990). Minke whales are present at least in summer/fall along the Baja California peninsula (Wade and Gerrodette 1993). Because the "resident" minke whales from California to Washington appear behaviorally distinct from migratory whales further north, minke whales in coastal waters of California, Oregon, and Washington (including Puget Sound) are considered as a separate stock. Minke whales in Alaskan waters are addressed in a separate stock assessment report.

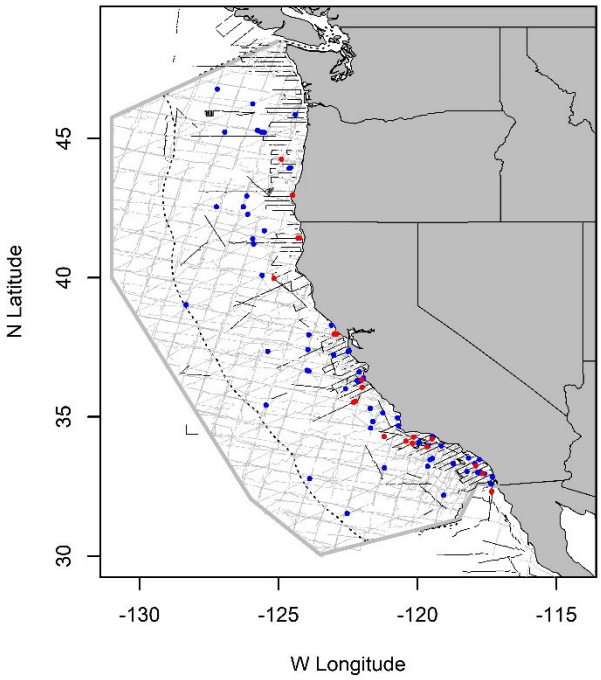

Figure 1. Minke whale sightings based on shipboard surveys off California, Oregon, and Washington, 1991-2018. Dashed line represents U.S. EEZ, thin lines indicate completed transect effort (gray = 1991-2014, black = 2018). Sightings from the 2018 survey are shown in red.

POPULATION SIZE

Becker *et al*. (2020) generated species distribution models (SDMs) from fixed and dynamic ocean variables, using 1991-2018 line-transect survey data to estimate density and abundance of cetaceans in the California Current Ecosystem (CCE). The use of SDMs for density estimation is well-established for this region and models incorporate changes in species abundance and habitat shifts over time (Becker *et al*. 2016, 2017, 2020, Redfern *et al*. 2017). Additionally, use of SDMs facilitates abundance estimation when survey coverage is limited, as was the case in 2018 when line-transect effort was largely limited to continental shelf waters (Henry *et al*. 2020). The best-estimate of abundance is taken as the estimate from 2018, or 915 (CV=0.792) animals (Becker *et al.* 2020).

Minimum Population Estimate

The minimum population estimate for minke whales is taken as the lower 20th percentile of the log-normal distribution of the 2018 abundance estimate (Becker *et al*. 2020), or 509 whales.

Current Population Trend

No apparent trends in population size are evident from a series of abundance estimates generated from 1991-2018 vessel-based line-transect surveys and habitat-based species distribution models applied to these survey data (Barlow 2016, Becker *et al.* 2016, Figure 2).

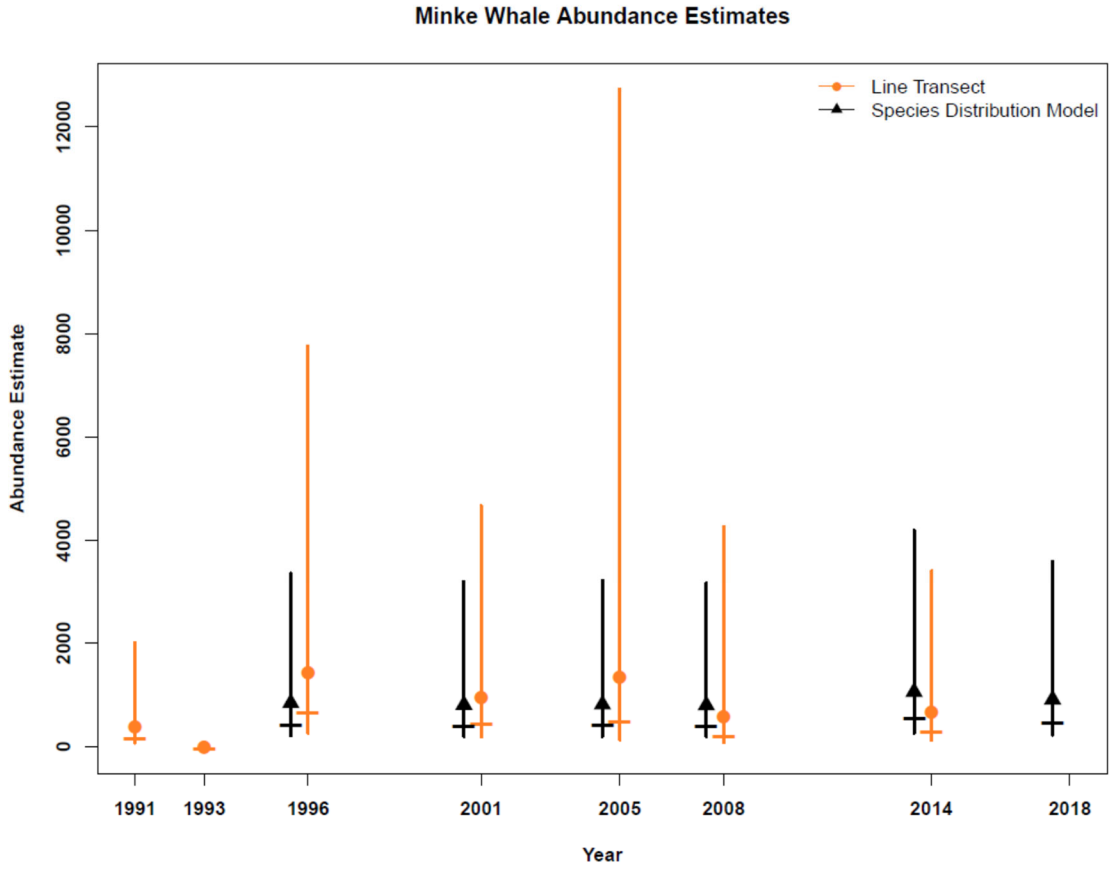

Figure 2. Minke whale abundance estimated from vessel-based line transect surveys (Barlow 2016) and habitat-based species distribution models based on 1991-2018 line-transect surveys (Becker *et al*. 2020). Vertical bars indicate approximate 95% log-normal confidence limits for line-transect estimates and 95% confidence limits reported from species distribution model estimates. Line-transect surveys in 1991 and 1993 exclude Oregon and Washington waters. Vertical bars indicate approximate 95% log-normal confidence limits for line-transect and species distribution model estimates. Horizontal hatch marks represent minimum population size estimates based on 20th percentiles of mean estimates.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of the growth rate of minke whale populations in the North Pacific (Best 1993).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (509) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.40 (for a stock of unknown status with a mortality estimate CV > 0.80), resulting in a PBR of 4.1 whales.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Table 1. Summary of available information on the incidental mortality and injury of minke whales (CA/OR/WA stock) for commercial fisheries that might take this species (Carretta 2020, Carretta *et al.* 2021). Mean annual takes are based on 2015-2019 data.

Fishery Name	Years	Data Type	Percent Observer Coverage	Observed mortality (and serious injury)	Estimated Mortality (CV)	Mean Annual Takes (CV)
CA/OR thresher shark/swordfish gillnet fishery	2015-2019	Observer	21%	0	1.2 (0.99)	0.24 (0.99)
CA halibut and other species large mesh (>3.5") set gillnet fishery	2017	Observer	~10%	0	0	0 (n/a)
Unidentified fisheries	2015-2019	Sightings and strandings	n/a	1 (0.75)	1.75 (n/a)	≥ 0.35 (n/a)
Total annual takes						≥ 0.59 (0.99)

Fishery Information

Minke whales may occasionally be caught in coastal set gillnets off California, in salmon drift gillnet in Puget Sound, Washington, and in offshore drift gillnets off California. The most-recent estimate of bycatch in the California swordfish drift gillnet fishery is 1.2 (CV=0.99) whales for the 5-year period 2015-2019, or 0.24 whales annually (Carretta 2021, Table 1). This is a model-based estimate based on a total of four minke whales observed entangled (2 dead, 2 released alive) between 1990-2019 from 9,158 observed fishing sets (Carretta 2021). Two additional unidentified fishery interactions with minke whales were recorded during 2015-2019, totaling 1.75 serious injuries/deaths (Carretta *et al*. 2021). The mean annual mortality and serious injury of minke whales from this stock during 2015-2019 is 0.59 animals (Table 1).

Vessel Strikes

No vessel strikes of minke whales were reported during the most recent 5-years, 2015 to 2019, but most strikes are likely to go undetected compared to larger baleen whales where estimates of vessel strike detection are generally <10% (see blue and fin whale stock assessments).

STATUS OF STOCK

Minke whales are not listed as "endangered" under the Endangered Species Act and are not considered "depleted" under the MMPA. The annual mortality and serious injury due to fisheries (0.59/yr) and vessel strikes (0.0/yr) is less than the calculated PBR for this stock (4.1), so they are not considered a "strategic" stock under the MMPA. Estimated fishery mortality is not less than 10% of the PBR; therefore, total fishery mortality is not approaching zero mortality and serious injury rate. Trends in the abundance of this stock are unknown. Harmful algal blooms are a habitat concern for minke whales and at least one death along the U.S. west coast has been attributed to domoic acid toxicity resulting from the consumption of northern anchovy prey (Fire *et al.* 2010). Increasing levels of anthropogenic sound in the world's oceans has been suggested to be a habitat concern for whales, particularly for baleen whales that may communicate using low-frequency sound (Croll *et al*. 2002). Behavioral changes associated with exposure to simulated mid-frequency sonar, including no change in behavior, cessation of feeding, increased swimming speeds, and movement away from simulated sound sources has been documented in tagged blue whales (Goldbogen *et al*. 2013), but it is unknown if minke whales respond in the same manner to such sounds.

REFERENCES

Barlow, J. 1997. Preliminary estimates of cetacean abundance off California, Oregon, and Washington based on a 1996 ship survey and comparisons of passing and closing modes. Admin. Rep. LJ-97-11. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA 92038. 25 pp.

Barlow, J. 2016. Cetacean abundance in the California current estimated from ship-based line-transect surveys in 1991-2014. Southwest Fisheries Science Center, Administrative Report, LJ-2016-01. 63 p.

Becker E.A., Forney K.A., Thayre B.J., Debich A.J., Campbell G.S., Whitaker K., Douglas A.B., Gilles A, Hoopes R., Hildebrand J.A. 2017. Habitat-based density models for three cetacean species off

southern California illustrate pronounced seasonal differences. Frontiers in Marine Science. 4(121):1–14.

Becker, E.A., Karin A. Forney, David L. Miller, Paul C. Fiedler, Jay Barlow, and Jeff E. Moore. 2020. Habitat-based density estimates for cetaceans in the California Current Ecosystem based on 1991-2018 survey data, U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-638.Best, P. B. 1993. Increase rates in severely depleted stocks of baleen whales. ICES J. Mar. Sci. 50:169-186.

Brueggeman, J.J., G.A. Green, K.C. Balcomb, C.E. Bowlby, R.A. Grotefendt, K.T. Briggs, M.L. Bonnell, R.G. Ford, D.H. Varoujean, D. Heinemann, and D.G. Chapman. 1990. Oregon-Washington Marine Mammal and Seabird Survey: Information synthesis and hypothesis formulation. U.S. Department of the Interior, OCS Study MMS 89-0030.

Carretta, J.V. 2021. Estimates of marine mammal, sea turtle, and seabird bycatch in the California large-mesh drift gillnet fishery: 1990-2019. NOAA Technical Memorandum NMFS-SWFSC-654.

Carretta, J.V., J. Greenman, K. Wilkinson, J. Freed, L. Saez, D. Lawson, J. Viezbicke, and J. Jannot. 2021. Sources of human-related injury and mortality for U.S. Pacific West Coast Marine Mammal Stock Assessments, 2015-2019. NOAA Technical Memorandum NMFS-SWFSC-643. 157 pp.

Croll, D.A., C.W. Clark, A. Acevedo, B. Tershy, S. Flores, J. Gedamke, and J. Urban. 2002. Only male fin whales sing loud songs. Nature 417:809

Donovan, G. P. 1991. A review of IWC stock boundaries. Rept. Int. Whal. Commn., Special Issue 13:39-68.

Dorsey, E. M., S. J. Stern, A. R. Hoelzel, and J. Jacobsen. 1990. Minke whale (Balaenoptera acutorostrata) from the west coast of North America: individual recognition and small-scale site fidelity. Rept. Int. Whal. Commn., Special Issue 12:357-368.

Fire, S.E., Wang, Z., Berman, M., Langlois, G.W., Morton, S.L., Sekula-Wood, E. and Benitez-Nelson, C.R., 2010. Trophic transfer of the harmful algal toxin domoic acid as a cause of death in a minke whale (*Balaenoptera acutorostrata*) stranding in southern California. Aquatic Mammals, 36(4), pp.342-350.

Forney, K. A., J. Barlow, and J. V. Carretta. 1995. The abundance of cetaceans in California waters. Part II: Aerial surveys in winter and spring of 1991 and 1992. Fish. Bull. 93:15-26.

Goldbogen, J.A., Southall B.L.,DeRuiter S.L., Calambokidis J., Friedlaender A.S.,Hazen E.L., Falcone E.A., Schorr G.S., Douglas A., Moretti D.J., Kyburg C., McKenna M.F., Tyack P.L. 2013. Blue whales respond to simulated mid-frequency military sonar. Proc. R. Soc. B 280:20130657. http://dx.doi.org/10.1098/rspb.2013.0657

Leatherwood, S., R. R. Reeves, W. F. Perrin, and W. E. Evans. 1982. Whales, dolphins, and porpoises of the eastern North Pacific and adjacent Arctic waters: A guide to their identification. NOAA Technical Rept. NMFS Circular 444. 245pp.

Tershy, B. R., D. Breese, and C. S. Strong. 1990. Abundance, seasonal distribution and population composition of balaenopterid whales in the Canal de Ballenas, Gulf of California, Mexico. Rept. Int. Whal. Commn., Special Issue 12:369-375.

Wade, P. R. and T. Gerrodette. 1993. Estimates of cetacean abundance and distribution in the eastern tropical Pacific. Rept. Int. Whal. Commn. 43:477-493.