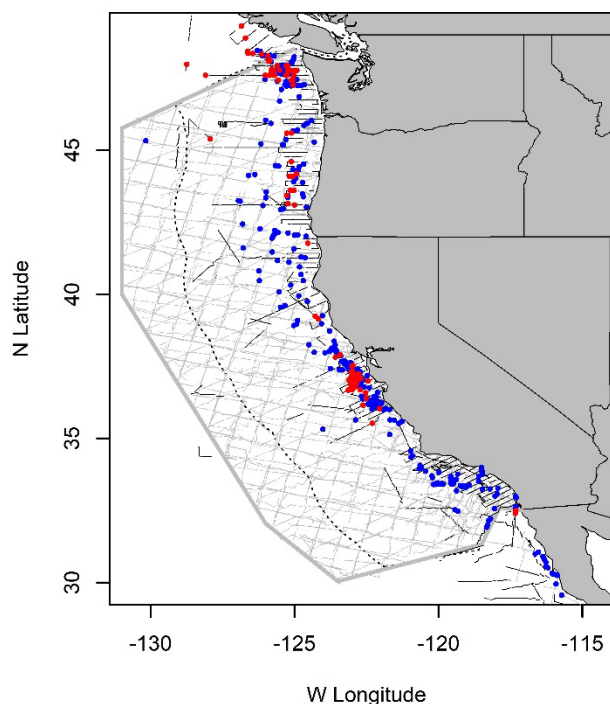


## PACIFIC WHITE-SIDED DOLPHIN (*Lagenorhynchus obliquidens*): California/Oregon/Washington, Northern and Southern Stocks

### STOCK DEFINITION AND GEOGRAPHIC RANGE

Pacific white-sided dolphins are endemic to temperate waters of the North Pacific Ocean, and common both on the high seas and along the continental margins (Brownell et al. 1999). Off the U.S. west coast, Pacific white-sided dolphins occur primarily in shelf and slope waters (Figure 1). Sighting patterns from aerial and shipboard surveys conducted in California, Oregon and Washington (Green et al. 1992; 1993; Forney and Barlow 1998; Barlow 2016) suggest seasonal north-south movements, with animals found primarily off California during the colder water months and shifting northward into Oregon and Washington as water temperatures increase in late spring and summer. Stock structure throughout the North Pacific is poorly understood, but based on morphological evidence, two forms are known off the California coast (Walker et al. 1986). Specimens belonging to the northern form were collected from north of about 33°N, (Southern California to Alaska), and southern specimens were obtained from about 36°N southward along the coasts of California and Baja California. Samples of both forms have been collected in the Southern California Bight, but it is unclear whether this indicates sympatry in this region or whether they may occur there at different times (seasonally or interannually). Genetic analyses have confirmed the distinctness of animals found off Baja California from animals occurring in U.S. waters north of Point Conception, California and the high seas of the North Pacific (Lux et al. 1997). Based on these genetic data, an area of mixing between the two forms appears to be located off Southern California (Lux et al. 1997). Two types of echolocation have been documented for Pacific white-sided dolphins off Southern California and these have been hypothesized to reflect acoustic differences between the two forms (Soldevilla et al. 2008, 2011; Henderson et al. 2011).

Although there is clear evidence that two forms of Pacific white-sided dolphins occur along the U.S. west coast, there are no known differences in color pattern, and it is not currently possible to distinguish the two stocks reliably during surveys. Geographic stock boundaries appear dynamic and are poorly understood, and therefore cannot be used to differentiate the two forms. Until means of differentiating the two forms for abundance and mortality estimation are developed, these two stocks are managed as a single unit. Pacific white-sided dolphins are not restricted to U.S. territorial waters, but there are no cooperative management agreements with Mexico or Canada for fisheries which may take this species (e.g. gillnet fisheries). For the Marine Mammal Protection Act (MMPA) stock assessment reports, Pacific white-sided dolphins within the

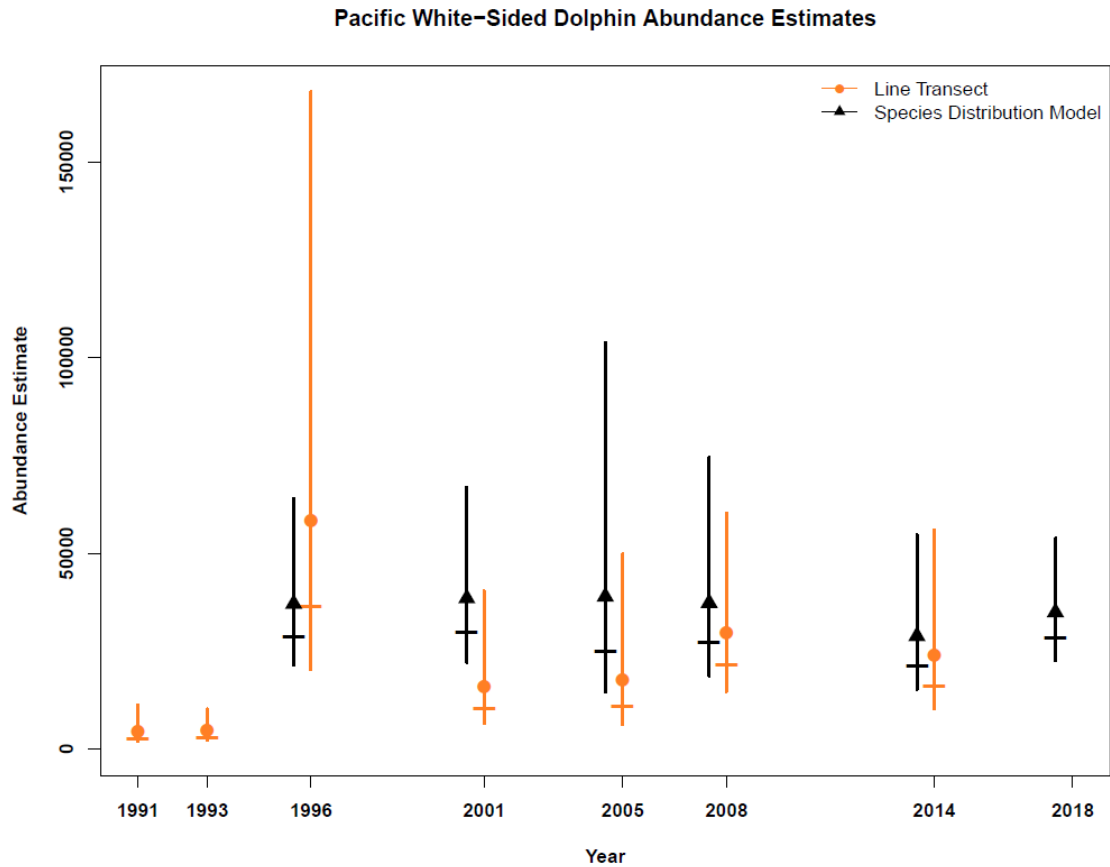


**Figure 1.** Pacific white-sided dolphin sightings based on shipboard surveys off California, Oregon, and Washington, 1991-2018. Dashed line represents U.S. EEZ, thin lines indicate completed transect effort (gray = 1991-2014, black = 2018). Sightings from the 2018 survey are shown in red.

Pacific U.S. Exclusive Economic Zone are divided into two discrete, non-contiguous areas: 1) waters off California, Oregon and Washington (this report), and 2) Alaskan waters.

**POPULATION SIZE**

Becker *et al.* (2020) generated species distribution models (SDMs) from fixed and dynamic ocean variables in a generalized additive model framework 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.* 2012, 2016, 2017, 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 34,999 (CV=0.222) animals (Becker *et al.* 2020).



**Figure 2.** Abundance estimates and 95% confidence intervals from vessel-based line transect surveys (Barlow 2016) and species distribution models (Becker *et al.* 2020) within the California Current. Line-transect surveys in 1991 and 1993 did not include the waters of Oregon and Washington. 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 20<sup>th</sup> percentiles of mean estimates.

**MINIMUM POPULATION ESTIMATE**

The log-normal 20th percentile of the 2018 abundance estimate is 29,090 Pacific white-sided dolphins.

**CURRENT POPULATION TREND** The distribution and abundance of Pacific white-sided dolphins off California, Oregon and Washington varies considerably at both seasonal and interannual time

scales (Forney and Barlow 1998, Becker *et al.* 2012, 2020, Barlow 2016), but no long-term trends have been identified (Figure 2).

**CURRENT AND MAXIMUM NET PRODUCTIVITY RATES**

No information on current or maximum net productivity rates is available for Pacific white-sided dolphins off the U.S. west coast.

**POTENTIAL BIOLOGICAL REMOVAL**

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (29,090) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.48 (for a species of unknown status with a mortality rate CV between 0.3 and 0.6; Wade and Angliss 1997), resulting in a PBR of 279 Pacific white-sided dolphins per year.

**HUMAN-CAUSED MORTALITY AND SERIOUS INJURY**

**Fishery Information**

A summary of recent fishery mortality and injury information for this stock of Pacific white-sided dolphin is shown in Table 1. More detailed information on these fisheries is provided in Appendix 1. The estimate of mortality and serious injury for Pacific white-sided dolphin in the California drift gillnet fishery for the five most recent years of monitoring, 2015-2019 is 4.0 (CV=0.37) per year. Unidentified fishery deaths from strandings are multiplied by a correction factor of 4.0 to account for incomplete detection of carcasses (Carretta *et al.* 2016) (Table 1).

**Table 1.** Summary of available information on the incidental mortality and injury of Pacific white-sided dolphins (California/ Oregon/Washington Stock) in commercial fisheries that might take this species (Carretta 2020; Jannot *et al.* 2018). All observed entanglements of Pacific white-sided dolphins resulted in the death of the animal. Coefficients of variation for mortality estimates are provided in parentheses; n/a = not available.

Fishery Name	Data Type	Year(s)	Percent Observer Coverage	Observed Mortality	Estimated Annual Mortality	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish drift gillnet fishery	observer	2015-2019	21%	0	12.1 (0.76)	2.4 (0.76)
WA, OR, CA domestic groundfish trawl fishery (includes at-sea hake and other limited-entry groundfish sectors)	observer	2012-2016	98% - 100%	4	4 (n/a)	0.8 (n/a)
Unidentified gillnet fishery	stranding	2015-2019	n/a	1	≥ 4 (0.46)	≥ 0.8 (0.46)
<b>Minimum total annual takes</b>						4.0 (0.37)

**Other removals**

Pacific white-sided dolphins have been seriously injured and killed in scientific research trawls for sardines and rockfish. From 2015 - 2019, there were 14 deaths and 1 serious injury of Pacific white-sided dolphins in scientific research trawls, or an average of 3.0 annually (Carretta *et al.* 2021).

**STATUS OF STOCK**

The status of Pacific white-sided dolphins in California, Oregon and Washington relative to OSP is not known, and there is no indication of a trend in abundance for this stock. No habitat issues are known to be of concern for this species. They are not listed as "threatened" or "endangered" under the Endangered Species Act nor as "depleted" under the MMPA. The average annual human-caused mortality and serious injury from fisheries (4.0 animals), plus other anthropogenic sources (3.0) during 2015-2019 (7.0 annually)

is estimated to be less than the PBR (279), and therefore this stock of Pacific white-sided dolphins is not classified as a "strategic" stock under the MMPA. The total commercial fishery mortality and serious injury for this stock (4.0/yr) is less than 10% of the calculated PBR and, therefore, is considered to be insignificant and approaching zero.

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