Gray Whale, Western North Pacific Distinct Population Segment (*Eschrichtius robustus*) 5-Year Review:

Summary and Evaluation

Photo: D. Weller NOAA

National Marine Fisheries Service
Office of Protected Resources
Silver Spring, MD
2023

5-YEAR REVIEW

Gray Whale, Western North Pacific Distinct Population Segment *(Eschrichtius robustus)*

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional or Headquarters Office: T. Conant and A. Lohe: Office of Protected Resources, Silver Spring, MD.
Cooperating Science Center(s): Southwest Fisheries Science Center, D. Weller, and A. Lang; Alaska Fisheries Science Center, N. Young.

1.2 Methodology used to complete review

A 5-year review is a periodic analysis of a species' status conducted to ensure that the listing classification of a species currently listed as threatened or endangered on the List of Endangered and Threatened Wildlife and Plants (List) (50 CFR 17.11 – 17.12) is accurate. The 5-year review is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (ESA) and was prepared pursuant to the joint National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service's 5-year Review Guidance and Template (NMFS and USFWS 2018).

NMFS initiated a 5-year review of the endangered western North Pacific (WNP) gray whale (*Eschrichtius robustus)* and solicited information from the public on January 29, 2018 (83 FR 4032). Five public comment letters, including literature citations were received and incorporated as appropriate in this review. The review was led by the NMFS Office of Protected Resources, in collaboration with the West Coast and Alaska Regional Offices and the Southwest, Southeast, and Alaska Fisheries Science Centers. The review team first gathered information that had become available since the proposed rule to delist the Eastern North Pacific (ENP) gray whale was completed in 1991, including peer-reviewed publications, government and technical reports, conference papers, dissertations and theses. Because the WNP gray whale was listed as a distinct population segment (DPS) under the ESA prior to the 1996 DPS Policy (61 FR 4722; February 7, 1996), and because the new information suggested that the definition of the listed entity might not accurately reflect the current scientific understanding of gray whale population structure, a Status Review Team (SRT) was convened to determine whether the WNP gray whale classification was consistent with the 1996 DPS Policy. The SRT found that three gray whale units met the DPS Policy criteria for discreteness and significance and recommended designation of a single DPS (for more information, please refer to the SRT report, Weller et al. 2023). This recommendation informed the remainder of this 5-year review. Information on gray whale biology and habitat, threats, and conservation efforts was summarized and analyzed in light of the ESA section 4(a)(1) factors (see Section 2.5) to determine whether a reclassification or delisting may be warranted (see Section 3.0).

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review

83 FR 4032, January 29, 2018

1.3.2 Listing History

Original Listing
FR notice: 35 FR 18319
Date listed: December 2, 1970
Entity listed: Gray whale (*Eschrichtius robustus* (*glaucus, gibbosus*))
Classification: Endangered

Revised Listing, if applicable
FR notice: 58 FR 3121
Date listed: January 7, 1993
Entity listed: Gray whale (*Eschrichtius robustus*)
Classification: Designated and delisted the Eastern North Pacific Gray Whale as a distinct population segment and determined gray whales in the Western North Pacific should remain endangered.

FR notice: 59 FR 31094 (amended list)
Date listed: June 16, 1994
Entity listed: 50 CFR 17.11 Gray whale (*Eschrichtius robustus*), range-wide, except eastern North Pacific Ocean: coastal, and Bering, Beaufort and Chukchi Seas; 50 CFR 222. Western North Pacific (Korean) gray whale (*Eschrichtius robustus*)
Classification: Endangered

FR notice: 79 FR 42687 (amended list)
Date listed: July 23, 2014
Entity listed: 50 CFR 17.11 Whale, gray (Western North Pacific DPS) (*Eschrichtius robustus*); 50 CFR 224.101. Whale, gray (Western North Pacific DPS) (*Eschrichtius robustus*)
Classification: Endangered

1.3.3 Associated rulemakings

N/A

1.3.4 Review History

Breiwick, J.M. and H.W. Braham. 1984. The status of endangered whales. Marine Fisheries Review 46(4):1-64.

Conclusion: No change in endangered classification

NMFS Proposed Rule to Delist the Eastern North Pacific Gray Whale (November 22, 1991; 56 FR 5886); Notice of availability of Status Reviews (June 27, 1991; 56 FR29471)

Conclusion: No change in endangered classification

1.3.5 Species' Recovery Priority Number at start of 5-year review

No recovery priority number has been issued for the western North Pacific gray whale.

1.3.6 Recovery Plan or Outline

No recovery plan has been completed for the western North Pacific gray whale. Section 4(f) of the ESA requires NOAA Fisheries to develop and implement recovery plans for conservation and survival of all endangered or threatened species, unless such a plan will not promote the conservation of the species. In general, listed species which occur entirely outside U.S. jurisdiction – such as the western North Pacific DPS of gray whale – are not likely to benefit from recovery plans (55 FR 24296; June 15, 1990).

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy[1]

2.1.1 Is the species under review a vertebrate?

__X_**Yes**, *go to section 2.1.2*

____**No**, *go to section 2.2*

[1] To be considered for listing under the ESA, a group of organisms must constitute a "species," which is defined in section 3 of the ESA to include "any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature". NMFS and USFWS jointly published a policy regarding the recognition of DPSs of vertebrate species under the Endangered Species Act (61 FR 4722, February 7, 1996). "DPS" is not a scientifically defined term; it is a term used in the context of ESA law and policy. Furthermore, when passing the provisions of the ESA that give us authority to list DPSs, Congress indicated that this provision should be used sparingly. We have discretion with regard to listing DPSs and, in order to be consistent with the directive of the Congressional report that followed the introduction of the DPS language in the ESA to identify DPSs sparingly. We will generally not, on our own accord, evaluate listings below the taxonomic species

2.1.2 Is the species under review listed as a DPS?

_X_**Yes**, *go to section 2.1.3.1*
___**No**, *go to section 2.1.4*

2.1.3 Was the DPS listed prior to 1996?

__X_**Yes**, the DPS was listed on January 7, 1993, *go to section 2.1.2*
____**No**, *go to section 2.2*

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

_____**Yes**, *provide citation and go to section 2.1.4*
__X__**No**, *go to section 2.1.3.2*

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

___X__**Yes**, please refer to Weller et al. 2023 for more information.
_____**No**, *discuss how it is not consistent with the DPS policy and consider the 5-year review completed. Go to section 2.4., Synthesis.*

2.1.4 Is there relevant new information for this species regarding the application of the DPS Policy?

___X_**Yes**,
_____**No**, *go to section 2.2., Recovery Criteria*

The WNP gray whale was listed prior to the joint NMFS-U.S. Fish and Wildlife Service policy on identifying DPSs ("DPS Policy," 61 FR 4722; February 7, 1996). We convened a Status Review Team to examine whether the current listing meets the criteria for a DPS as specified in the DPS Policy (Weller et al. 2023). The SRT findings are summarized in Section 2.3.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan[2] containing objective, measurable criteria?

_____***Yes***, *go to section 2.2.2*
__X__***No***,

2.3 Updated Information, Distinct Population Segment Analysis, and Current Species Status

Significant new information has become available since the last review was completed in 1991. Some of this information suggested that the definition of the WNP gray whale DPS might not accurately reflect the current scientific understanding of gray whale population structure. A Status Review Team (SRT) was convened to sequentially (1) assess if the description of eastern North Pacific (ENP) and WNP gray whales used in the original listing (58 FR 3121; January 7, 1993, and 59 FR 31094; June 16, 1994) remained accurate in light of the best currently available science; and (2) then, if a revised DPS definition was necessary following the outcome of point (1), evaluate whether WNP gray whales meet the DPS Policy criteria (Weller et al. 2023).

The SRT review, DPS analysis, and recommendations are documented in the supporting Status Review report (Weller et al. 2023). The SRT unanimously concluded that the original definition of ENP and WNP gray whale stocks used in the 1993 and 1994 listing revisions were no longer valid based on the best available science. The SRT found that three groups or "units" of gray whales each met the DPS Policy criteria for discreteness and significance: (1) gray whales that spend their entire lives in the WNP (termed the "WNP-only unit"), (2) gray whales that feed in the WNP in the summer and fall and migrate to the ENP (including Mexico) in the winter ("WNP-ENP unit"), and (3) a single unit consisting of both the WNP-only and WNP-ENP units. The SRT recommended the combined option (3) be used to define the WNP gray whale DPS. The SRT did not conclude that the WNP-only unit or WNP-ENP unit are not separate DPSs, but rather they agreed that the most practicable means of obtaining positive management outcomes is to combine the units into a single DPS and provide protections throughout the entire range of that DPS (Weller et al. 2023).

Based on the recommendations of the SRT, for the purposes of this 5-year review "WNP gray whales" or "western gray whales" are considered to be gray whales that spend *all or part* of their lives in the western North Pacific in the waters of Vietnam, China, Japan, Korea (Republic of Korea and/or Democratic People's Republic of Korea), or the Russian Far East, including southern and southeastern Kamchatka but not necessarily areas north of 55°N in eastern Kamchatka. This definition is consistent with that used in the International Union for Conservation of Nature (IUCN)/International Whaling Commission's (IWC) Western Gray Whale Conservation Management Plan as well as with how the western gray whale subpopulation has been evaluated by the IUCN under its Red List of Threatened Species (Cooke et al. 2018).

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[2] Although the guidance generally directs the reviewer to consider criteria from final approved recovery plans, criteria in published draft recovery plans may be considered at the reviewer's discretion.

In addition to the information cited in the Status Review Report (Weller et al. 2023), the following sections provide updated information on abundance, population trends, demographic trends, spatial distribution and habitat characteristics.

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

See Sections 2.3.1.2—2.3.1.6.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Gray whales in the western North Pacific were greatly depleted by commercial whaling off Korea and Japan between the 1890s and 1960s (Kato and Kasuya 2002, Weller et al. 2002). Despite some speculation that the population had been extirpated as early as the 1930s (Mizue 1951, Bowen 1974), catches of gray whales off Korea between 1948 and 1966, along with sporadic sightings of small numbers of whales in the Okhotsk Sea in the 1960s and 1970s, showed that gray whales remained extant in the western North Pacific (Berzin 1990, Brownell and Chun 1977). Long-term photo-identification and genetic studies of gray whales feeding in the nearshore and offshore waters of northeastern Sakhalin Island, Russia, which is located in the Okhotsk Sea, began in 1995 and continue to date (Weller et al. 1999, Burdin et al. 2022, Tyurneva et al. 2010a); data collected as part of these efforts form the basis for much of what is known about western gray whales. In addition, studies of the gray whales that feed off the southern and southeastern coasts of the Kamchatka Peninsula, which began in 2004, provide further evidence of the continued use of that portion of the western North Pacific by gray whales. Many of the whales sighted off Kamchatka are also known to use the Sakhalin feeding area (Tyurneva et al. 2010b, Burdin et al. 2022).

While the pre-exploitation abundance of western gray whales is unknown, some have estimated that the population contained between 1,500 and 10,000 (Yablokov and Bogoslovskaya 1984 cited in NMFS 2018) and up to approximately 25,000 (Cooke 2019) individuals prior to commercial whaling. Mark-recapture analysis of photo-identification data collected on the Sakhalin Island feeding ground provided the first post-exploitation estimates of the abundance of western gray whales and indicated that fewer than 100 whales used the feeding ground between 1997 and 2003 (Bradford et al. 2008). More recently, an assessment using a stage-structured individual-based population model estimated that the number of whales, excluding calves, using the combined Sakhalin-southeastern Kamchatka area in 2016 was 320-410 whales, with the abundance increasing at annual rates of 2-5% during recent years (Cooke 2018). Approximately 130-170 of those whales were estimated to feed predominantly off Sakhalin Island (Cooke et al. 2017).

Recent satellite tagging data and photo-identification matches between Sakhalin, Canada, the United States and Mexico have identified 59 whales known to travel between the eastern and western North Pacific (Weller et al. 2012, Mate et al. 2015, Urbán et al. 2019, Martinez-Aguilar et al. 2022), leaving open the question about the proportion of western gray whales that remain in the western North Pacific year-round. Based on population modeling that incorporated data on known movements of western gray whales into the eastern North Pacific, Cooke (2020) concluded that approximately 48% of Sakhalin whales migrate to the eastern North Pacific in the winter, indicating that about 52% migrate elsewhere, likely to wintering areas off the Asian coast. Thus the number of western gray whales remaining in the western North Pacific year-round is small (fewer than 100 whales; Cooke 2018), making these whales more vulnerable than previously thought (Weller and Brownell 2012).

Based on the positive growth rates and estimates that the number of mature western gray whales had exceeded 50, the IUCN down listed the western gray whale from Critically Endangered to Endangered status in 2018 (Cooke et al. 2018).

Although the longevity of gray whales is unknown, photo-identification data collected off Mexico has identified whales of known minimum ages ranging from 25 to 46 (Martinez et al. 2016). The non-calf survival rate is estimated to be 0.975 (± SE 0.005), while calf (first year post-weaning) survival was estimated to be 0.65 (± SE 0.07) (Cooke et al. 2019). Potential sources of calf mortality include entanglement in fishing gear, ship strikes, inadequate nutritional reserves and killer whale (*Orcinus orca*) predation (Bradford 2003, Bradford et al. 2006, Lowry et al. 2018, Weller et al. 2018, Silber et al. 2021, Burdin et al. 2022).

From 1994-2020, 37 reproductive females with one or more calves were observed on the Sakhalin feeding grounds (Burdin et al. 2021). Apparent age to first reproduction for seven females who were first sighted as calves or yearlings and later observed with a calf ranged from seven to 12 years (Bradford et al. 2010; Burdin et al. 2019, 2021). Based on a stage-structured population model, Cooke et al. (2016) reported mean age at first reproduction for females to be 10.3 years (± 0.6 year). The number of breeding females in 2016 was estimated at 51-72 females using the combined Sakhalin and southeastern Kamchatka areas (Cooke et al. 2018). Between 1995 and 2007, the apparent birth-interval ranged from one to six years, with the majority being two-year intervals (Weller et al. 2009). A male-biased sex ratio was found for whales of known sex (n = 156; 57% male to 43% female, Lang et al. 2021). Calves exhibited a slightly greater male bias (n = 75; 60% male to 40% female), but the bias varied by year. The male-biased sex ratio was not linked to maternal condition and other reproductive characteristics (Bradford et al. 2011). Weller et al. (2009a) reported that Andrews (1914) and Mizue (1951) had recorded a similar male bias for whales killed off the coast of Korea in the early 1900s, so the male bias in the population may be persistent.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Brüniche-Olsen et al. (2018b) used coalescent-based approaches with whole genome sequences generated from two western gray whales and one eastern gray whale to investigate the populations' demographic history, levels of genetic diversity, and potential to adapt to changes in their environment. They found that the eastern and western lineages showed similar demographic trajectories over evolutionary time, with an ancient population decline during previous ice ages and a more recent decline to an effective size (Ne) of ~20,000 individuals after the last glacial maximum (~25,000 years ago). This estimate is lower than but similar to a previous genetic estimate of historic Ne (Ne=34,410, 95% CL: 31,175-38,084), which was based on a more limited marker set (mtDNA cytochrome B and nine nuclear introns) and analysis of eastern gray whale samples (Alter et al. 2007). This previous estimate was used to generate a census abundance estimate of ~96,000 individuals, which was considered to represent the historic population size of gray whales throughout the North Pacific (Alter et al. 2007). These genetic estimates are substantially higher than other estimates of pre-exploitation abundance of eastern and western gray whales. However, genetic approaches are limited in their ability to infer recent historical abundance and instead represent long-term averages over broad temporal and spatial scales (Palsbøll et al. 2013), and thus these genetic estimates are not necessarily representative of whale abundance just prior to commercial exploitation.

In addition, Brüniche-Olsen et al. (2018b) found that genetic diversity (i.e., genome-wide heterozygosity) measured from the eastern gray whale genome was greater than that found in the genomes of the western individuals (by ~1.2-fold). Inbreeding was greater in the two western genomes than in the eastern individual's genome. Measures of genetic distance indicated that the two western gray whales were more related to each other than to the eastern gray whale, although the null hypothesis that all three individuals were part of the same population could not be rejected (Brüniche-Olse et al. 2018b). The reduced diversity and increased inbreeding identified among the western gray whales are likely related to the small size of the western gray whale population, raising concerns about the loss of its adaptive potential (Brüniche-Olsen et al. 2018b).

Studies involving other genetic markers provide additional measures of contemporary genetic diversity. Using 12 microsatellite loci, which are non-coding and biparentally-inherited nuclear markers, Lang et al. (2021) found slightly lower observed heterozygosity in western gray whales (H_O = 0.986) relative to eastern gray whales (H_O = 0.998). Based on the allele frequencies of these 12 microsatellite loci, the contemporary effective size of the western gray whale population was estimated to be 80 individuals (95% jackknife: 61.9-107.7). Assuming that the census size is approximately 2.0-3.5 time larger than the effective size (similar to the ratio used in other populations, e.g., Alter et al. 2007, Roman and Palumbi 2003, Ruegg et al., 2010, 2013), the census estimate would be between 180-280 whales, which is similar to estimates based on demographic modeling (e.g., Cooke 2018).

Using a panel of 84 single nucleotide polymorphism (SNP) loci identified in or near functional genes (DeWoody et al. 2017), Brüniche-Olsen et al. (2018a) found significantly higher observed heterozygosity in the western population (N = 77 samples collected from Sakhalin Island; H_O = 0.32) compared to the eastern population (N = 135 samples, collected near the Mexican winter breeding area; H_O = 0.28). However, for both of the nuclear marker sets, the majority of alleles found among western gray whales were also found among eastern gray whales.

Sequencing of the mtDNA control region, which is maternally inherited, has shown that western gray whales have lower mtDNA diversity than that found among eastern gray whales (h_{WGW}=0.76, h_{EGW}=0.95; LeDuc et al. 2002, Lang et al. 2021). Although the number of mtDNA control region haplotypes identified among western gray whales (n=22 haplotypes in 156 individuals) is lower than that found among eastern gray whales (n=32 haplotypes among 103 individuals), the reduction in haplotype diversity is largely driven by the distribution of mtDNA haplotypes among individuals (LeDuc et al. 2002, Lang et al. 2021). While mtDNA haplotypes are relatively evenly distributed among sampled eastern gray whales, the distribution in western gray whales is highly skewed, with two haplotypes found in very high frequencies, representing 36% and 33% of all animals sampled from that area (Lang et al. 2021). All except for two of the mtDNA control region haplotypes identified among western gray whales have also been found among eastern gray whales (Lang et al. 2021).

Similar patterns were found when the full mitogenomes of 36 gray whales sampled off Sakhalin and 38 gray whales sampled off Mexico were compared (Brüniche-Olsen et al. 2021). Western gray whales had a lower number of haplotypes (n=9) and a lower haplotype diversity (h=0.723) than did the whales sampled off Mexico (n=22, h=0.975). Only three of the mitogenome haplotypes found among western gray whales were also found in the whales sampled off Mexico.

2.3.1.4 Taxonomic classification or changes in nomenclature:

No new information was found regarding the taxonomic classification of the western gray whale (Society for Marine Mammalogy)[3].

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

Dispersal of gray whales between the Pacific and Atlantic has occurred several times over the last 100,000 years as the sea level rose and extent of ice cover diminished, which allowed passage across the Arctic. With changes in climate conditions, we can anticipate further dispersal of gray whales from the Pacific to the Atlantic (Alter et al. 2015). Recently, gray whales have been recorded in the Atlantic Ocean. Recent sightings from the Atlantic include: (1) May 2010 in the Mediterranean Sea (Scheinin et al. 2011, Hoelzel et al. 2021), (2) May 2013 in Walvis Bay, Namibia (Elwen and Gridley 2013) and (3) April 2022 one off the coast of Pozzuoli, Italy.[4] These whales are likely vagrants from the larger eastern North Pacific population.

In the Pacific, the current migratory routes and wintering areas of western gray whales is a complex matter and not fully understood (Weller et al. 2015, 2016). Recent studies support a trans-Pacific migration for some whales during the winter to areas off Canada, the U.S. West Coast, and Mexico. However, other western gray whales stay in the western Pacific and migrate

[3] https://www.marinemammalscience.org/species-information/list-marine-mammal-species-subspecies/

[4] https://www.wantedinrome.com/news/grey-whale-pays-extremely-rare-visit-to-italy.html

south along the Asian coast in the winter (Omura 1988; Brownell et al. 2007; Weller and Brownell 2012; Weller et al. 2015, 2016). Migration routes in the WNP may include the coastal waters of eastern Russia, North Korea, South Korea, Vietnam, and Japan. The South China Sea also may serve as a wintering ground (Weller et al. 2002).

In Korean waters, the last verified sighting of a gray whale was 1977 (Park 1995). From 2006 to 2011, systematic shore-based and five vessel-based sighting surveys were conducted during the winter seasons. The surveys consisted of 226 hours of observation at two shore stations and over 808 nautical miles onboard vessels. No gray whales were observed (Kim et al. 2013). In February 2015, a video was taken of a whale in a port facility near Samcheok-si, Korea. Although not confirmed, it is possible that this whale was a gray whale (Kim and Sohn 2015).

Western gray whales have been found off both coasts of Japan, but sightings are uncommon. From 1955 to July 2020, 37 records of gray whales were reported (Nakamura et al. 2022). Most of the records were from the Pacific coast of Japan, with a few (n=9) reports from the Sea of Japan and one from the Okhotsk Sea. The lack of frequent sightings off Japan may reflect true absence but may also reflect limited search effort (Weller et al. 2016). While still rare, the frequency with which gray whales are reported off Japan has increased in recent years, with 16 records, some of which included the same individual, reported in 2015 or later (Nakamura et al. 2022). A female gray whale that died in a Japanese set net off the Pacific coast of Honshu, Japan, in 2007 was identified as a whale observed off Sakhalin Island (Weller et al. 2008). This photographic match was the first to show that whales on the summer feeding grounds off Sakhalin are found 1,500 km south within a migratory corridor. In addition, Weller et al. (2016) documented the migratory movement of one gray whale that moved back and forth from Sakhalin Island and the Pacific coast of Honshu, Japan, during 2014 to 2016. This individual was first observed as a calf with its mother off Sakhalin Island during the summer of 2014, and then observed off Japan during March through May of 2015, back in Sakhalin during the summer of 2015, and then off Japan in January through February of 2016. The March to May sighting dates overlap with the timing of the eastern gray whale northward migration in the spring from Mexico wintering grounds to Bering Sea feeding grounds, while the January and February sightings correspond with the timing of the eastern gray whale southbound migration in the winter to Mexico. These records support a migratory link between the summer Sakhalin feeding grounds and wintering areas along the coast of Asia (Weller et al. 2016).

Gray whales are rarely recorded in the waters of China. From 1933 to 2002, 24 gray whales were sighted in Chinese waters (Weller et al. 2013, Wang et al. 2015). More recently, a female gray whale was taken in fishing gear in 2011 in the Taiwan Strait off Baiqingxiang, China (Wang et al. 2015, Zhu 2012).

In summary, some western gray whales overwinter off Asia, possibly including the coastal waters of eastern Russia, North Korea, South Korea, Vietnam, Japan, and the South China Sea (Weller et al. 2002.), while others overwinter in the northeastern Pacific (e.g., Mate et al. 2015). During summers, western gray whales feed off Sakhalin Island (Weller et al. 1999, Burdin et al. 2022) and southeastern Kamchatka Peninsula (Tyurneva et al. 2010a, 2010b; Burdin et al. 2022).

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

The Okhotsk Sea off Sakhalin Island, Russia, is a vital summer and fall feeding ground that supports western gray whale population growth. In particular, the nearshore waters (< 20 m depth) off the mouth of Piltun Lagoon and the offshore waters (25-65 m depth) of the northeast coast of Sakhalin Island are important feeding grounds (Meier et al. 2007, Schwarz et al. 2022). Reproductive females show high fidelity to the nearshore feeding area (Burdin et al. 2011, Broker et al. 2020). Importantly, mother-calf pairs and newly independent calves have not been observed in the offshore area, and females known to be pregnant are seen more often in the nearshore area (Sychenko 2011, Schwarz et al. 2022). These sighting patterns highlight the importance of the nearshore area for reproduction and thus for population survival and growth.

Western gray whales also feed off southern and southeastern Kamchatka Peninsula, Russia. Photographic matches of adults and calves have been found between Sakhalin and Kamchatka, with approximately 50% of the whales sighted off Kamchatka also being identified off Sakhalin (Tyurneva et al. 2010a, 2010b). Some whales may forage in the two areas during the same season. For example, during the feeding season of 2007, 13 whales sighted off Kamchatka were seen later in waters off Sakhalin (Tyurneva et al. 2010a, 2010b). The intra and interannual use of the feeding areas may be driven by prey availability (Tyurneva et al. 2010a, 2010b; Burdin and Sychenko 2015). Many of the whales sighted off Sakhalin and on the Kamchatka feeding area are juvenile aged (Burdin et al. 2011, Tyurneva et al. 2010). Mother-calf pairs are also sighted in the feeding area off Kamchatka (Burdin et al. 2019, 2020).

Gray whales feed primarily on isopods and amphipods (e.g. *Pontoporeia affinus, Monoporeia affinis, Ampelisca eschrichti*) that occur at high densities off Sakhalin Island (Fadeev 2011, 2012; Tombach Wright et al. 2013; Demchenko et al. 2016; Kriksunov et al 2016). From 2001 to 2015, benthic sampling during summer/autumn off northeastern Sakhalin Island revealed that benthic biomass was related to water depth and varied across years, in part, due to changes in regional climate conditions across the Sea of Okhotsk and the Pacific Arctic region (Blanchard et al. 2019). Average amphipod biomass was higher within the offshore feeding area (>100g/m2) when compared to the nearshore feeding area (<60 g/m2) (Blanchard et al. 2019), although within the nearshore area it is highest (91 g/m2) in the shallower waters that are preferentially used by mother-calf pairs and juveniles (Fadeev 2002). Benthic sampling conducted between 2001 and 2015 documented a decline in amphipod biomass in both the nearshore and offshore feeding areas over time (Blanchard et al. 2019). Within the nearshore Piltun, Sakhalin Island feeding area amphipod biomass peaked in 2003 before dropping to lower concentrations in 2013-2015 (Blanchard et al. 2019). Within the offshore feeding area, amphipod biomass also declined between 2002 and 2015. The sudden decrease in amphipod biomass in 2013 in the nearshore Piltun area was, at that time, attributed to lower salinity levels from flooding of the Amur River and increased gray whale consumption. However, the decrease appears to persist, and the number of gray whales feeding in the nearshore Piltun area has also declined in recent years (Western Gray Whale Advisory Panel (WGWAP) 2017, Burdin et al. 2022).

In an open statement of concern, the WGWAP (2019) appealed to Sakhalin Energy and Exxon Neftegas to resume their annual benthic research program to understand the changes in biomass density in nearshore and offshore feeding areas[5]. Of particular concern is the decrease in gray whales using the nearshore feeding areas. Calves and yearlings have not been observed in the offshore feeding area. The loss of suitable prey in the nearshore area could have serious implications for western gray whale productivity (WGWAP 2019).

2.4 Distinct Population Segment Analysis:

The DPS Policy identifies two criteria for DPS designations:

(1) The population must be discrete in relation to the remainder of the taxon (species or subspecies) to which it belongs; and

(2) The population must be significant to the species to which it belongs.

In terms of discreteness, a population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

(1) "It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation"; or

(2) "it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the ESA".

If a population segment is considered discrete, we must then determine whether the discrete segment is significant relative to its taxon. Criteria that can be used to determine whether the discrete population segment is significant include, but are not limited to, the following:

- Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon;
- Evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon;
- Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range; or
- Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

Weller et al. 2023 provides an accounting of the work of the aforementioned SRT, convened by NMFS, to determine whether western North Pacific gray whales qualify as a DPS under the joint NMFS-USFWS policy on identifying Distinct Population Segments ("DPS Policy," 61 FR 4722; February 7, 1996). Following the deliberations and an expert elicitation process used by the SRT, it was concluded that three gray whale units meet the DPS Policy criteria for discreteness and significance; these include: (1) WNP-only unit (gray whales that spend their entire life in the WNP), (2) WNP- ENP unit (gray whales that feed in the WNP in the summer and fall and migrate

[5] https://www.iucn.org/news/western-gray-whale-advisory-panel/201907/iucn-scientific-panel-calls-investigation-decline-prey-western-gray-whales

to the ENP [including Mexico] in the winter) and (3) WNP-only + WNP-ENP combined as a single unit. The following sections summarize the report of the SRT (Weller et al. 2023).

2.4.1 DPS Discreteness

In advance of evaluating the discreteness criteria, the SRT reviewed the best available scientific and commercial information and spent considerable time in discussion. Following this effort, they then worked together to draft five questions pertinent to evaluating discreteness. The five questions agreed to by the SRT were:

(1) *Are there gray whales that spend their entire lives in the western North Pacific (WNP)?*

(2) *Assuming there are gray whales that spend their entire lives in the WNP, are they markedly separate from the whales that feed on the Northern Feeding Ground (NFG) and spend their entire lives in the eastern North Pacific (ENP) as a consequence of physical, physiological, ecological, or behavioral factors?*

(3) *Assuming there are gray whales that spend their entire lives in the WNP, are they markedly separate from the whales that feed in the WNP in the summer and fall and migrate to the ENP (including Mexico) in the winter as a consequence of physical, physiological, ecological, or behavioral factors?*

(4) *Are the gray whales that feed in the WNP in the summer and fall and migrate to the ENP (including Mexico) in the winter markedly separate from the whales that feed on the NFG and spend their entire lives in the eastern North Pacific (ENP) as a consequence of physical, physiological, ecological, or behavioral factors?*

(5) *Are whales that spend all or part of their lives in the WNP (the WNP-only whales and the WNP-ENP whales as a combined unit, irrespective of whether they are or are not determined to be discrete from each other) markedly separate from the whales that feed on the NFG and spend their entire lives in the eastern North Pacific (ENP) as a consequence of physical, physiological, ecological, or behavioral factors?*

The SRT found strong support for the existence of a WNP-only unit. Evidence supporting this judgment about the continued year-round existence of gray whales in the WNP included contemporary records of gray whales off Japan and China, including at least two individuals known to use the Sakhalin feeding ground; acoustic recordings from the east China Sea that experts have identified as containing gray whale calls, the timing of which aligns with migration through the area; and results of demographic modeling which indicated that approximately 52% of the gray whales feeding off Sakhalin do not migrate to the ENP. In addition, the historic occurrence of gray whales remaining in the WNP year-round is confirmed by whaling records, and there is no conclusive evidence to say that these whales were ever extirpated.

As mentioned above, under the DPS Policy, a population segment of a vertebrate species may be considered discrete if it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological or behavioral factors. In considering the evidence of marked separation as a consequence of any of these factors, the SRT found high support for the discreteness of all three of the units evaluated

The support for each of these units being considered discrete was largely driven by marked differences in behavioral and ecological factors. For all three units, the SRT concluded that the use of different migratory routes, and the associated differences in metabolic costs and predation risks, supported marked separation, even given that the WNP-ENP unit and the NFG unit overlap on part of their migration. The strong matrilineal fidelity exhibited by the whales feeding off Sakhalin Island, which includes whales of both the WNP-only unit and the WNP-ENP unit, was also regarded as strong evidence of behavioral separation of these two units from the NFG unit. In addition, each unit differs in the biogeographic realms used for at least part of their life cycle, with whales of the WNP-only unit overwintering in a different realm than all other gray whales, and both the WNP-only unit and the WNP-ENP unit feeding in a region that they share but that differs from that used by the NFG unit. There is also direct and/or indirect evidence that whales from each unit likely breed primarily with each other. For the WNP-only unit, which represents only a portion of the whales feeding off Sakhalin (where distinction between WNP-only individuals and WNP-ENP individuals is not possible), this evidence comes not from genetic analyses but is based on what is known about the timing of reproduction and migration in gray whales (Rice and Wolman 1971). This evidence is also considered as supporting a lack of substantial interbreeding between the WNP-ENP unit and the NFG unit. However, for the WNP-ENP unit and for the WNP-only + WNP-ENP combined unit, the nuclear genetic differentiation identified between the NFG unit and the whales sampled off Sakhalin, even when represented by only the subset of whales known to be part of the WNP-ENP unit, combined with the estimated small effective population size of the whales feeding off Sakhalin provide further support for a lack of substantial interbreeding with the NFG unit.

2.4.2 DPS Significance

Having determined that all three of the units under consideration met the criteria for being discrete, the SRT was then tasked with evaluating the significance of those units to the taxon as a whole. The DPS Policy is a set of sequential criteria designed to both capture the importance of populations below the subspecies level but also to do so 'sparingly'. As such, it is plausible that units can meet the discreteness criteria but not meet the significance criteria.

Prior to initiating the evaluation of significance, the SRT agreed that they needed to have a common understanding of how to interpret the significance and importance of each discrete unit or segment to the taxon as a whole. The DPS Policy puts the significance conditions in the context of factors that affect the overall welfare of the taxon. Wherein, welfare was agreed by the SRT to mean the persistence of the taxon as a whole, where persistence is defined as the taxon's ability to respond to challenges, both biological and physical, that the taxon has endured throughout its historical range in the past and/or is currently facing or could face in the future.

The SRT rephrased the conditions provided in the DPS Policy as the following questions:

(1) *Does the Unit persist in an ecological setting unusual or unique for the taxon such that persistence in this setting is important to the taxon?*

Where 'unique or unusual ecological setting' was agreed by the SRT to refer to habitats with distinctive ecological features that would likely result in the segment developing adaptations to its environment. Consideration of whether the adaptation to its environment is exclusive to the Unit was given when allocating likelihood points.

(2) *Would the loss of the Unit result in a significant gap in the range of the taxon such that maintaining this area as part of the range is important to the taxon?*

Where 'significant gap in the range' was agreed by the SRT to imply that the loss of the segment from this area would result in the loss of resiliency (ability to sustain itself while facing demographic and environmental stochasticity), redundancy (ability to withstand unforeseen catastrophes), and/or representation (ability to adapt over time to long-term changes in the environment) of the taxon as a whole, and where the importance of the range to the taxon considers its historical and future range.

(3) *Does the Unit differ markedly from other populations of the same species in its genetic characteristics, such that these genetic characteristics are important to the taxon?*

Where 'differ markedly' in genetic characteristics is understood by the SRT to mean that the segment contains components of genetic diversity that may be associated with adaptation to its environment and that are unlikely to be present in high frequencies in other population segments. Direct evidence for adaptation to their environment is rare for cetaceans, but genetic evidence of the segment being isolated from the rest of its taxon for a lengthy period of time can be used to infer that localized adaptation is plausible. One example, amongst others, of such indirect evidence could be a large magnitude of differentiation in both mitochondrial and nuclear genetic markers. Statistically significant differences between groups alone are not necessarily sufficient evidence of marked genetic differences.

(4) *Is the Unit significant to the species because of other biological or ecological factors that are important to the taxon?*

Other factors that could be important to the taxon were agreed by the SRT to include behavioral or cultural diversity, in which culture refers to knowledge passed through learning from one generation to the next. For instance, learned migratory behavior, bioenergetics, and differences in predation pressure could be considered under this question.

For clarity in the discussion that follows, these questions are referred to as: (1) ecological setting, (2) significant range gap, (3) marked genetic differences and (4) behavioral differences. The SRT found that all three discrete units had high support for significance.

Thus, the SRT recognized that the loss of the combined WNP-only unit + WNP-ENP unit would result in a significant gap in the range of the taxon and, in turn, be detrimental to the persistence of the species. Unlike other large baleen whales, gray whales do not occupy other ocean basins. The majority of gray whales depend on the high North Pacific Arctic to feed, which is an area predicted to change dramatically in the coming decades due to climate change. Thus, gray whales in the western North Pacific may be important to the resiliency of the species given the uncertainty of how summer feeding areas might change in suitability and how gray whales may respond to these changes. The high certainty expressed by the SRT in the significance of the WNP-only + WNP-ENP combined was based on the aim to ensure that gray whales are maintained in the western North Pacific and that having both units (WNP-only and WNP-ENP) provides the greatest chance of ensuring this objective.

2.4.3 Synthesis and Summary of DPS Analysis

Following the deliberations and an expert elicitation process used by the SRT as described above (see Weller et al. 2023), it was concluded that three gray whale units meet the DPS Policy criteria for discreteness and significance; these include: (1) Western North Pacific (WNP)-only unit (gray whales that spend their entire life in the WNP), (2) WNP-Eastern North Pacific (ENP) unit (gray whales that feed in the WNP in the summer and fall and migrate to the ENP (including Mexico) in the winter) and (3) WNP-only + WNP-ENP combined as a single unit.

Given this outcome, the SRT agreed that there are two mutually exclusive options for recommending a DPS listing that include: (1) a *Separate Option* where the WNP-only unit and the WNP-ENP unit are separate DPSs, or (2) a *Combined Option* where the WNP-only unit and WNP-ENP unit are combined into a single unit (i.e., WNP-only + WNP-ENP unit) and considered one DPS. The SRT considered the biological and practical merits of these options.

The *Separate Option* recognizes the importance of both the WNP-only unit and ENP-WNP unit. Both feed in the western North Pacific and thereby occupy an area significant to the welfare of the species and both have unique migratory routes. Further, the WNP-only unit occupies a unique wintering area also considered significant to the welfare of the species. It is unknown whether there is interbreeding between the WNP-only unit and WNP-ENP unit in the early winter months, but complete reproductive isolation is not required as a prerequisite to recognizing a DPS.

2.5 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.5.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Oil and Gas Exploration
Oil and gas exploration and production occur in or adjacent to important feeding areas off Sakhalin Island. The impacts to gray whales include disturbance from noise, risk of collisions with ships, potential exposure to oil either directly or through damage to their prey, and habitat damage (see review Reeves et al. 2005).

To mitigate the impact and collect data on behavioral responses to such activities, Sakhalin Energy, in consultation with the IUCN Western Gray Whale Advisory, developed a Monitoring and Mitigation Plan for the 2010 Astokh 4D seismic survey (Bröker et al. 2015). The plan included real-time monitoring of behavior including responses that may have been indicative of stress or avoidance in gray whales exposed to the seismic survey. During the survey, deviations from normal whale movement and respiration response variables related to vessel proximity, orientation of a vessel, and received sound levels were examined (Gailey et al. 2016, Muir et al. 2015a). Seismic or vessel sounds were not significantly associated with movement and respiration changes. Distance from shore (i.e., depth) or behavioral state were the best 'natural' predictors, while vessel proximity significantly affected a whale's distance from shore and its orientation relative to the closest vessel. No significant population-level responses were found; however, the study's sample size was too small to detect moderate or subtle changes in whale behavior (Bröker et al. 2015, Gailey et al. 2016). Bottom feeding activity, as measured by frequency of mud plumes, was not significantly affected by a seismic survey conducted off Sakhalin Island in 2001. Rather, water depth and swell height were found to have a greater effect on the frequency of bottom feeding activity (Yazvenko et al. 2007). Models of whale density suggested higher occupancy in areas with moderate sound exposure compared to high sound exposure. The differences in occupancy may reflect changes in prey availability, which was not accounted for in the model, and the results were based on a small sample size because seismic surveys were conducted early in the feeding season when few gray whales would be present (Muir et al. 2016).

Several earlier studies found that gray whales moved away from seismic surveys (Weller et al. 2002b, Ivashenko et al. 2003) and changed swimming speed (Gailey et al. 2007), orientation, blow intervals, and resting behavior in the presence of oil platforms and associated activities (Würsig et al. 1999 cited in Brownell 2004, Weller et al. 2006, Kryukova et al. 2007, Kryukova and Ivanov 2008). These studies indicate that while seismic survey activities are ongoing, whales may vacate important feeding areas. However, the long-term or cumulative effects of changes in distribution and behavior are not well understood. These changes appear to be related to underwater noise, but other natural biotic factors are also likely to contribute (Bröker et al. 2015, Gailey et al. 2016).

Amphipod biomass has decreased in nearshore areas on the Sakhalin feeding ground (WGWAP 2017, 2019; Blanchard et al. 2019). Amphipods are known to be sensitive to pollutants, but there is no direct evidence that the decrease in biomass is related to contaminants from oil and gas activities (see Blanchard et al. 2019). Benthic sampling done in 2011 in the Sakhalin feeding ground revealed low concentrations of petroleum hydrocarbons and heavy metals (copper, aluminum, arsenic, barium, cadmium, chromium, iron, mercury, lead and zinc), and no significant effect of pollutants on benthos was observed (Fadeev 2012).

The infrastructure is in place for year-round oil and gas exploration and production on Sakhalin Island and production is likely to grow in the coming decades. In addition, Russia intends to expand the development of the oil and gas potential in other areas of the Pacific Ocean (Bradshaw 2010). Year-round hydrocarbon production started in 2008, and average daily output of just one platform can exceed 47,000 barrels (Sakhalin Energy 2018). The government of Sakhalin expected the overall output in 2018 to reach 17.4 million tons of oil and 32.2 billion cubic meters of natural gas, but production for 2019 was expected to be lower at about 15.4 million tons and 29.3 billion cubic meters, respectively (Reuters September 20, 2018).

Unusual Mortality Event

Since 1 January 2019, higher than normal gray whale strandings have occurred along the west coast of North America from Mexico through Alaska. As of September 30, 2019, 212 gray whales have stranded. This event has been declared an Unusual Mortality Event (https://www.fisheries.noaa.gov/national/marine-life-distress/2019-gray-whale-unusual-mortality-event-along-west-coast). At this point, we do not know the cause of these strandings and the investigation will provide more information to hopefully aid in determining the cause. Full or partial necropsy examinations were conducted on a subset of the whales. Preliminary findings in several of the whales have shown evidence of emaciation. These findings are not consistent across all of the whales examined, so more research is needed. It is unknown at this point whether any of the stranded gray whales were from the western population.

In summary, western gray whales forage off Sakhalin Island, where amphipod biomass has decreased in recent years. Production of oil and gas and its related activities may impact this area. Recent elevated strandings of gray whales along the west coast of the North American continent may be partially related to prey availability and may include western gray whales, but more research is needed. Although the western gray whale population is increasing, we need to continue to monitor habitat quality and whale behavior in the long-term to evaluate whether anthropogenic activities result in cumulative impacts to the population.

2.5.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Scientific

Hayslip et al. (2012) satellite tagged 29 eastern gray whales (September to December 2009 and 2012) off the U.S. coast in the Pacific Northwest and seven western gray whales (1 in October 2010 and 6 August to September 2011) off Sakhalin Island with semi-implantable Argos tags. Tagged whales were monitored for signs of adverse effects from the tag application. The eastern gray whales were re-sighted during 43 months and two tagged western gray whales were re-sighted up to 336 days after tagging. Injuries at the tag sites included: visible swelling (10-15 cm in diameter), sloughed skin, pigmentation changes from 10-25 cm in diameter, and the presence of scars that ranged from barely visible to 1-5 cm deep and 4-15 cm in diameter. However, the scars appeared to shrink over time and no re-sighted whale was emaciated. Photographs of the tagging sites were reviewed by a panel of experienced marine mammal veterinarians who concluded that tagging did not result in adverse effects to the gray whales (Hayslip et al. 2012).

Whale Watching

Tourist activity was observed in 2014 near the Piltun feeding area off Sakhalin Island. A large vessel anchored within 1 km from shore and launched eight small boats with tourists, which approached groups of whales, including mothers with calves (Burdin and Sychencko (2015). Vessel proximity has been shown to significantly affect western gray whale distance from shore (Gailey et al. 2016). We were unable to locate information on size and potential growth of the whale watching industry for the region. A simple internet search in 2019 revealed several sites that offered whale watching trips to Sakhalin Island or Kamchatka Peninsula.

Commercial and Subsistence Harvest

Gray whales have been hunted in the western North Pacific at least since the mid-1500s. The western gray whale population was likely depleted by the start of modern whaling at the end of the 1800s. From 1890 to 1966, approximately 2,000 gray whales were killed by Japanese whalers working off the Korean Peninsula and Japan, with the vast majority (85%) taken off southeastern Korea (Kato and Kasuya 2002). Commercial whaling for the western population ceased in the 1960s. The last reported commercial catch was in 1966 in Korean waters (Brownell and Chun. 1977, Kato and Kasuya 2002). Opportunistic kills have occurred in the past. For example, in 1996 a gray whale stranded on the Sea of Japan coast of Hokkaido was killed with a porpoise harpoon and the tail section 'expertly' removed. Seven products sold in Japan in 1999 were identified through DNA analysis as gray whale meat (Baker et al. 2002). All seven products had the same haplotype, which is found among both eastern and western gray whales. In Japan, deliberate killing and commercial use of gray whales have been prohibited since 2008.

The Makah Indian Tribe requested NMFS waive the general moratorium on taking of marine mammals under the Marine Mammal Protection Act (16 USC 1371(a)(3)(A)) to allow hunting of a limited number of eastern gray whales (Makah Tribal Council 2005). The Makah request is consistent with its treaty right to hunt whales as defined in the 1855 Treaty of Neah Bay and with the International Convention for the Regulation of Whaling. The Tribe requested the waiver to hunt for eastern gray whales in the coastal portion of the Tribe's usual and accustomed fishing area in northwest Washington State for ceremonial and subsistence purposes and to allow the making and sale of handicrafts. NMFS recently proposed to issue the waiver and regulations that would authorize a limited Tribal hunt for eastern North Pacific gray whales over a 10-year period (84 FR 13604, April 5, 2019). Because some western gray whales migrate along the Pacific coast in the winter and spring, the proposed rule includes provisions to limit the likelihood that tribal hunters would strike or otherwise harm a western gray whale. NMFS proposed that hunting seasons would alternate between winter-spring hunts in even-numbered years and summer hunts during odd-numbered years. It is presumed that only in even-numbered years (thus, for 5 of the 10 years) would western gray whales potentially be encountered during the hunt. NMFS also proposed that only three eastern North Pacific whales may be struck during even-year hunts (total 15 over the proposed 10-year regulation). Under the proposed regulations, if any struck animals are confirmed to be a western gray whale, the hunt will cease until steps are taken to ensure such an event will not recur. With these measures in place, there is about a 7.4% probability of hunters striking one western gray whale over the 10 years of the regulations (Moore and Weller 2018; updated by declaration before Administrative Law Judge, Exhibit 4-15 Docket #19-NMFS-0001). This probability is the most likely point estimate; the 95% confidence interval ranges from 4.5 to 10.4%. Stated another way, the most likely point estimates indicate that one in 13.5 10-year hunt periods (i.e., one year out of 135) would result in an individual western gray whale being struck by Makah hunters, if the Tribe made the maximum number of strike attempts allowed in hunt years and the eastern and western population sizes and migration patterns remained constant (Moore and Weller, 2019). NMFS considers this risk of a lethal take or injury to western gray whales to be slight (84 FR 13604, April 5, 2019).

In summary, data do not indicate that scientific research is having a negative impact on western gray whales. We lack direct evidence on whether whale-watching activities are or will be a threat to western gray whales. Historical commercial kills for human consumption were the primary cause of the depletion of the gray whale population. Measures for monitoring U.S.

subsistence harvest will reduce the probability of a western gray whale kill. However, incidental bycatch and illegal harvest may occur. While the impact of these events are unknown, the western gray whale population has been increasing over the past several decades.

2.5.3 Disease or predation:

Killer whales commonly prey on gray whales. Photographs of gray whales off Sakhalin were examined to determine the frequency of killer whale predation and whether predation rates differed by age-class and sex. Of 169 photo-identified gray whales, 74 had visible killer whale rake marks. Of the attacks that were determined to have occurred during the study period (n=22), most attacks were on non-calves, but calves (n=4) were also attacked. The low number of calves documented with killer whale rake marks is likely due to the low probability of a calf surviving the attack. The proportion (43.8%) of known gray whales with killer whale rake marks is the highest reported for any baleen whale (Weller et al. 2018). As sea ice cover diminishes due to climate warming, killer whale presence in the Okhotsk Sea may increase adding to the predation pressure on western gray whales (Filatova et al. 2019).The data support that this threat could potentially impact western gray whales. However, as noted previously, recent population growth indicates births are outpacing deaths.

2.5.4 Inadequacy of existing regulatory mechanisms:

Commercial whaling is controlled under the 1937 International Agreement for the Regulation of Whaling and the 1946 International Convention for the Regulation of Whaling (ICRW). The ICRW came into effect for the United States, Canada, and the Soviet Union in 1948, Mexico in 1949, Japan in 1951, Republic of Korea in 1978, and China in 1980. Although Canada withdrew from the ICRW in 1981, the gray whale remains protected under Canada's Species At Risk Act enacted in 2002 (Cooke et al. 2018). In 1986, ICRW commercial catch limits were set to zero, and gray whales have not been hunted under reservation or scientific permit. On June 30, 2019, Japan withdrew from the IWC and resumed commercial whaling in its own waters, including the exclusive economic zone. In Japan, deliberate killing and commercial use of gray whales have been prohibited since 2008 (Cooke et al. 2018). In a May 2019 statement to the IWC, Japan declared they would only harvest those species whose populations have been assessed by the IWC Science Committee as abundant: i.e. minke, Bryde's and sei whales (IWC 2019). Thus, western gray whales should not be impacted by Japan's withdrawal from the IWC.

In Russia, the western gray whale is listed as endangered in the Russian Federation Red Book of Threatened Species (Cooke et al. 2018).

The western gray whale was listed in China as Category II of the National Key Protected Animals in 1988 and was listed under the Chinese Red List of Endangered and Threatened Wildlife and Plants in 1994 (Wang et al. 2015). According to Li (2007), China's Wildlife Protection Law enacted in 1988 is inadequate due, in part, to decentralized responsibilities and prohibitions (e.g., aquatic wildlife restrictions are established in each fisheries administration under the State Council).

In the United States, the western gray whale is protected under the ESA. The primary purpose of the ESA is to conserve at-risk species. The ESA prohibits take, with exceptions, of endangered species. Western gray whales are also protected under the Marine Mammal Protection Act of 1972 (MMPA). The MMPA established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. The MMPA section 118 requires the development of take reduction plans for commercial fisheries to ensure that bycatch of depleted stocks (e.g., a species listed under the ESA) does not exceed a potential biological removal target for each species. The western gray whale is listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Appendix I places strict regulations on trade in order not to endanger further a species survival, and trade must only be authorized in exceptional circumstances. Should the western gray whale be delisted, the provisions of the ESA would no longer exist, but the MMPA and CITES provisions would, albeit the level of protection may change.

In summary, the moratorium established in 1986, which set commercial catch limits to zero, and the recognition of a protected status by several range countries, appears to adequately protect the western gray whale. We would need to evaluate any future changes to the moratorium or protective status.

2.5.5 Other natural or manmade factors affecting its continued existence:

Fisheries Bycatch and Entanglement

Western gray whales become entangled in fishing gear and are injured or die. Photographs taken from 1995-2005 of western gray whales off Sakhalin Island showed 28 of 150 individual whales had visible scars resulting from fisheries entanglement (Bradford et al. 2009). Three females died in set nets off the Pacific coast of Japan in 2005 and one in 2007 (Weller et al. 2014; see Cooke et al. 2018). One of these females was identified as a calf during the 2006 summer feeding season off Sakhalin Island (Weller et al. 2014). Prior to the reports in 2005 and 2007, only two reports—one in 1955 and one in 1970—were of western grays taken in set nets on the coast of Japan, but these fisheries interactions are likely underreported (Brownell et al. 2007). In 2011, a female gray whale died from entanglement in a set net in the Taiwan Strait near the mainland coast of China, but the whale was not found in the photo-identification catalogue for either the western or eastern populations (Wang et al. 2015).

A salmon trap net fishery started operating in 2013 in the Sakhalin Island feeding area, and the Sakhalin Government permits 550-650 coastal set nets each year (Lowry et al. 2018). These nets are set perpendicular to shore and are approximately 1.5 km long--an area where most gray whales feed and where and mother and calf pairs are most often found. Although inconclusive, a male whale was sighted in 2013 off Sakhalin Island entangled in rope that had similar properties to the rope used in salmon trap nets, suggesting an interaction with the salmon fishery (Weller et al. 2014). This male was first sighted in 1995 on the Sakhalin feeding ground and was genetically assigned as the father of multiple calves. Disentanglement efforts were not possible due to logistics and weather conditions, but the male was sighted seven times in July and August of 2014 on the Piltun feeding area. The whale had no apparent evidence of injury from the entanglement event (Burdin and Sychencko 2015).

Based on a qualitative assessment of gear type, fishing effort, and geographic and temporal overlap with gray whales, Lowry et al. (2018) concluded that the coastal salmon net fishery off northeastern Sakhalin and Kamchatka pose a high risk to gray whales. Of particular concern are salmon nets set in nearshore areas adjacent to the Piltun Lagoon, which is in proximity to females and their calves at a critical time when the females are recovering from pregnancy, lactating and their calves are learning to feed and will soon be weaned. Another entanglement risk is from derelict gear. On August 18, 2017, Russian and U.S. researchers in collaboration with Sakhalin Energy removed three lengths of derelict 3.5 cm-thick rope (total length 250 meters) used in the salmon fishery (WGWAP 2017). Lowry et al. (2018) also concluded that other fisheries operating in the Russian Far East using such gear as bottom-set gillnets, demersal longlines, and trap and pots may pose a risk and should be monitored.

According to Cooke et al. (2007) if the mortality of western gray whale females entangled in fisheries were to continue at the same rate as that observed during 2005-2007 in Japan, the probability (>25%) of population declines and risk (>10%) of extirpation by 2050 is substantial. However, no additional gray whale entanglement-related mortalities have been reported from Japan since 2007.

In summary, several fishing gear types pose a threat to the western gray whale population, especially the salmon trap net fishery in the Sakhalin Island feeding area. Because the fishery became operational in 2013, effects to population health and growth may not be detected for several years.

2.6 Conservation Efforts

To mitigate the impact and collect data on behavioral responses to such activities, Sakhalin Energy, in consultation with the IUCN Western Gray Whale Advisory, developed a Monitoring and Mitigation Plan for the 2010 Astokh 4D seismic survey (Bröker et al. 2015). Outcomes from the Monitoring and Mitigation Plan include noise-exposure criteria (Nowacek et al. 2012), and mitigation zones based on sound exposure levels (Racca 2012, Racca et al. 2015). A component of the mitigation plan was to avoid seismic surveys in the Piltun nearshore feeding area at times when gray whales were present. Muir et al. (2015b) estimated feeding area boundaries based on relative gray whale densities from systematic and opportunistic survey data collected during June and July 2005 to 2007. Although feeding boundaries varied across years, the study was able to model whale abundance and provide reasonable predictions for times and areas to avoid to prevent behavioural disturbances from seismic surveys.

The IWC/IUCN drafted a Conservation Management Plan for the Western Gray Whales in 2010 (Brownell et al. 2010). The purpose of the plan is to manage human activities that may impact gray whales (e.g., entanglement in fishing gear, vessel strikes, and direct effects of oil spills). To implement the plan, the IWC developed a Memorandum of Cooperation on Conservation Measures for the Western Gray Whale Population among the range states. As of 2019, five range states have signed the memorandum: United States of America, Russian Federation, Japan, Mexico, and the Republic of Korea.

2.7 Synthesis

Based on review of the best available scientific and commercial information, the western gray whale population meets the discreteness and significance criteria of the DPS Policy. In addition to genetic discontinuity between the western and eastern populations, the best available scientific information indicates that the loss of the western gray whale population would represent a significant loss to the taxon due to a: (a) loss of winter migration pattern in the Northwest Pacific Ocean; and (b) significant gap in the range of gray whales in the North Pacific Ocean.

The western gray whale annual growth rate has been positive in recent years. However, estimates of reproductive females are low, between 51 and 72 (Cooke et al. 2018). The calf survival rate (0.65 ±0.07, Cooke et al. 2019) is low. Potential sources of calf mortality include entanglement in fishing gear, poaching, inadequate nutritional reserves, and killer whale predation (Bradford 2003, Bradford et al. 2006, Weller et al. 2018).

Threats to the western gray whale continue. Production of oil and gas and its related activities off Sakhalin Island may impact this area, particularly benthic biomass. Predation by killer whales on the feeding grounds is the highest reported for any baleen whale (Weller et al. 2018). Several fishing gear types pose a threat to the western gray whale population, especially the salmon trap net fishery in the Sakhalin Island feeding area (Lowry et al. 2018). Although the western gray whale population is increasing, we need to continue to monitor habitat quality and whale health, behavior, and mortality to evaluate whether anthropogenic activities result in cumulative impacts to the population (see Section 2.5 Five-Factor Analysis).

In summary, while the western gray whale population has slowly increased over the past several decades, recovering from a point of near extinction, ongoing threats from human activities such as entanglement in fishing gear, eco-tourism activities, and vessel strikes continue to impact this population’s recovery. This coupled with the population’s small size and limited reproductive output makes it highly vulnerable to extinction. For these reasons, we recommend that the western North Pacific gray whale DPS remain classified as endangered.

3.0 RESULTS

3.1 Recommended Classification

_____**Downlist to Threatened**
_____**Uplist to Endangered**
_____**Delist** *(Indicate reason for delisting per 50 CFR 424.11):*
    _____*Extinction*
    _____*Recovery*
    _____*Original data for classification in error*
___*X*__**No change is needed**

3.2 New Recovery Priority Number

NA

3.3 Listing and Reclassification Priority Number

NA

4.0 REFERENCES

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NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW
Eschrichtius robustus

Current Classification:

Recommendation resulting from the 5-Year Review

- [ ] Downlist to Threatened
- [ ] Uplist to Endangered
- [ ] Delist
- [x] No change is needed

Review Conducted By (Name and Office):

Therese Conant and Adrienne Lohe, Office of Protected Resources, Silver Spring, MD.

LEAD OFFICE APPROVAL:

Director, Office of Protected Resources, NOAA Fisheries

Approve MARZIN.CATHERINE.GAELLE.1365836082 Digitally signed by MARZIN.CATHERINE.GAELLE.1365836082 Date: 2023.03.14 13:41:30 -04'00' Date: ________

Cooperating Regional Administrator, NOAA Fisheries

[ ] Concur [ ] Do Not Concur [x] N/A

Signature____ Date: _______

HEADQUARTERS APPROVAL:

Assistant Administrator, NOAA Fisheries

[x] Concur [ ] Do Not Concur

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