North Pacific Right Whale
(Eubalaena japonica)

Five-Year Review:
Summary and Evaluation

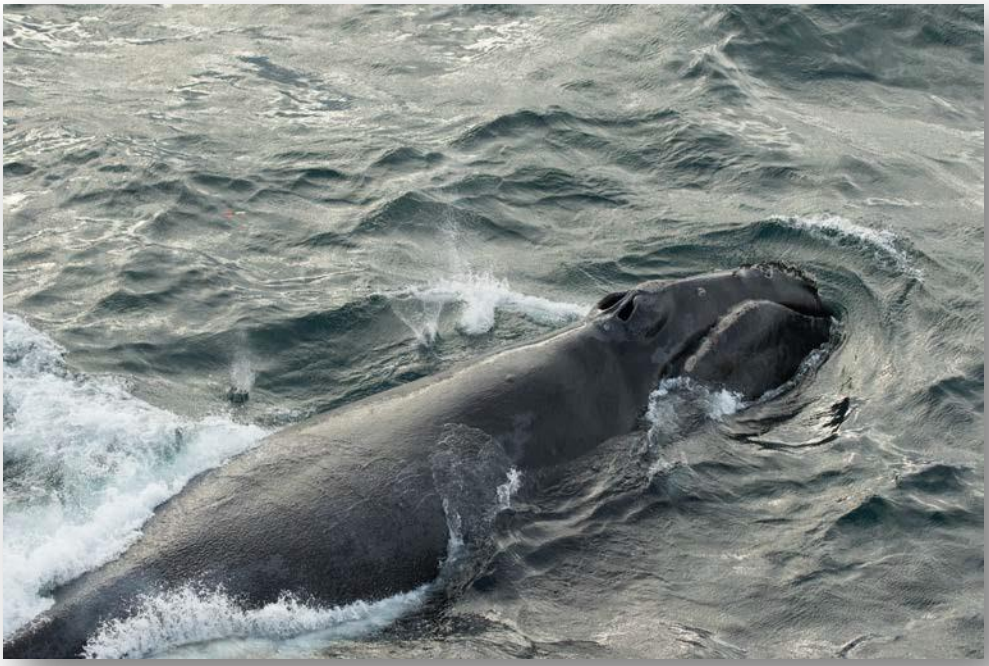

Photo: IWC© taken by Koji Matsuoka during the 2017 IWC POWER surveys. This North Pacific right whale, of unknown sex, was sighted on 8 August 2017 in the Bering Sea, and is a confirmed new individual.

National Marine Fisheries Service
Office of Protected Resources
Alaska Region

December 2017
5-YEAR REVIEW

North Pacific Right Whale (*Eubalaena japonica*)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional or Headquarters Office: Alaska Region - Verena Gill, 907-271-1937

Cooperating Science Center: Alaska Fisheries Science Center, Marine Mammal Laboratory - Phillip Clapham, 206-526-4037

1.2 Methodology used to complete the review

The review was completed by Verena Gill and Phillip Clapham and relied on research conducted by NOAA's Marine Mammal Laboratory and recent publications.

1.3 Background

Section 4(c)(2) of the Endangered Species Act (ESA) requires, at least once every five years, a review of all threatened and endangered species to determine if they should be removed from the list of threatened or endangered species or changed in their listing status. The five-year review is also used to help track the recovery of a species.

The following information identifies previous documentation of recovery actions, listing decisions, and status updates required under the ESA, and thus provides the foundation for analysis and incorporation of any relevant new information related to the recovery, listing status, and classification of North Pacific right whales.

1.3.1 FR Notice announcing initiation of this review:

82 FR 29842, June 30, 2017

1.3.2 Listing history

Original Listing
FR notice: 35 FR 18319[1]
Date listed: December 2, 1970
Entity listed: Northern Right Whale (*Eubalaena spp.*)
Classification: Endangered

[1] Northern right whales originally were listed under the Endangered Species Conservation Act of 1969, the precursor to the ESA.

Revised Listing
FR notice: 73 FR 12024
Date listed: March 6, 2008
Entity listed: North Pacific Right Whale (*Eubalaena japonica*)
Classification: Endangered

1.3.3 Associated rulemakings

- Critical habitat in the North Pacific Ocean was designated for the Northern right whale on July 6, 2006 (71 FR 38277)

- Critical habitat was designated for the North Pacific right whale on April 8, 2008 (73 FR 19000)

1.3.4 Review History

- Perry, S.L., DeMaster, D.P., and G.K. Silber. 1999. The Great Whales: History and Status of Six Species Listed as Endangered Under the U.S. Endangered Species Act of 1973. Marine Fisheries Review 61:1, pp.44-51. U.S. Department of Commerce. https://spo.nmfs.noaa.gov//mfr611/mfr6111.pdf

- National Marine Fisheries Service. 2006. Review of the Status of the Right Whales in the North Atlantic and North Pacific Oceans. U.S. Department of Commerce NOAA Technical Memorandum. http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/rightwhale2006.pdf

- National Marine Fisheries Service. 2012. North Pacific Right Whale. Five-Year Review: Status and Evaluation. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD. http://www.nmfs.noaa.gov/pr/pdfs/species/northpacificrightwhale_5yearreview.pdf

1.3.5 Species' Recovery Priority Number at Start of Five-Year Review

This species had a recovery priority number of 3 assigned in 2016.

1.3.6 Recovery Plan or Outline

Name of plan or outline: Recovery Plan for the North Pacific Right Whale (*Eubalaena japonica*)

Date issued: June 2013

Dates of previous revisions, if applicable: Final Recovery Plan for the Northern Right Whale, *Eubalaena glacialis*, 1991

2.0 REVIEW ANALYSIS

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

2.1.1 Is the species under review a vertebrate?

Yes

2.1.2 Is the species under review listed as a DPS?

No

2.1.3 Was the DPS listed prior to 1996?

No

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

No

2.2 Recovery Criteria

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

Yes

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

Yes

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

Yes

[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.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

Downlisting Objectives and Criteria

Objective 1: Achieve sufficient and viable populations in all ocean basins.

Criterion: Given current and projected threats and environmental conditions, each North Pacific right whale population (eastern and western) satisfies the risk analysis standard for threatened status (has no more than a 1% chance of extinction in 100 years) and there are at least 1,000 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males in each population). Mature is defined as individuals known, estimated, or inferred to be capable of reproduction.

Status:
Efforts to attain this criterion are ongoing, but data are insufficient to determine population abundance and trends and to conduct the risk analysis. Currently, North Pacific right whales are considered to exist in two populations based on geographic distribution: eastern and western North Pacific (Brownell et al. 2001). The range of eastern North Pacific right whales is believed to encompass the Gulf of Alaska and the Bering Sea, while the western population ranges from near the Commander Islands, the coast of Kamchatka, along the Kuril Islands, and in the Sea of Okhotsk. The most recent stock assessment report for the eastern stock provides a best estimate of abundance of 31, with a minimum population estimate of 26 right whales (Muto et al. 2017). The area inhabited by right whales from the western stock includes Russian and Japanese territorial and EEZ waters, and some international waters, even in the center of the Sea of Okhotsk. As a result, surveys for whales in the western North Pacific have generally not been able to comprehensively survey the region, particularly close to shore, as has been possible to do in the eastern North Pacific. Therefore, information on distribution and abundance from the western stock is limited, and its status is currently unknown. The only existing estimate of the western North Pacific right whale population comes from 3 Japanese minke whale *Balaenoptera acutorostrata* surveys in the Sea of Okhotsk conducted between 1989 and 1992 (Miyashita and Kato 1998). This estimate was 922 animals (CV = 0.433, CI: 404−2108); however, biases were identified in the survey methodology, and the estimate should be considered unreliable given its low precision (Best et al. 2001). The population estimate for the western stock is likely in the low hundreds (Brownell et al. 2001). See Section 2.3.1.2 for further details.

Objective 2: Ensure significant threats are addressed.

Criteria: Factors that may limit population growth, i.e., those that are identified in the threats analysis under relative impact to recovery as high or medium or unknown, have been identified and are being, or have been, addressed to the extent that they allow for continued growth of populations. Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before downlisting takes place. Specifically, the factors in section 4(a)(l) of the ESA are being or have been addressed as follows:

Factor A: The present or threatened destruction, modification, or curtailment of a species' habitat or range.

A1. Effects of anthropogenic noise continue to be investigated and actions taken to minimize potential effects, as appropriate.

Status: Efforts to attain this criterion are ongoing. Anthropogenic noise is believed to be increasing in the marine environment as a result of oil and gas exploration, shipping, construction, and naval exercises. Possible negative impacts to North Pacific right whales include changes in foraging behavior. NMFS developed guidance for assessing the effects of anthropogenic sound on marine mammal hearing, including the right whale (NMFS 2016). The guidance provides updated received levels, or thresholds above which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for all underwater anthropogenic sound sources. This guidance is intended to be used by NOAA analysts, managers, and other relevant user groups and stakeholders, including other federal agencies, when seeking to determine whether and how their activities are expected to result in particular types of impacts to marine mammals via acoustic exposure. NMFS also developed a cetacean and sound mapping tool to predict wide-ranging, long-term underwater noise contributions from multiple human activities. Information can be found at: http://cetsound.noaa.gov/. See Section 2.3.2.1 for additional information on actions taken to minimize effects of anthropogenic noise.

A2. Effects of contaminants and pollutants are determined to not affect the potential for continued growth or maintenance of North Pacific right whale populations.

Status: Efforts to attain this criterion are ongoing. The long-term impacts of the exposure to contaminants and pollutants on the population are currently unknown. See Section 2.3.2.1 for further detail.

A3. Effects of marine debris and commercial fishing continue to be investigated and actions taken to minimize potential effects, as appropriate.

Status: Efforts to attain this criterion are ongoing. Continued research is needed to provide data on what impacts, if any, occur to North Pacific right whales. See Section 2.3.2.5 for further detail.

A4. Effects of reduced prey abundance due to climate change continue to be investigated and action is being taken to address the issue, as appropriate.

Status: The impact climate change is having on North Pacific right whale prey continues to be studied. Continued research is needed to provide quantitative data on possible changes that could occur as a result of climate change, and what impacts, if any, would occur to right whales and their prey. See Section 2.3.2.5 for further detail.

Factor B: Overutilization for commercial, recreational, scientific, or educational purposes.

B1. Where possible within legal authority, management measures restrict any hunting that may over utilize the species (whether for commercial, subsistence, or scientific purposes).

Status: Efforts to attain this criterion are ongoing. Right whales have been protected by the International Whaling Commission (IWC) since 1946. See Section 2.3.2.2 for further detail.

Factor C: Disease or Predation.

C1. Effects of disease do not limit the potential for continued growth or maintenance of North Pacific right whale populations.

Status: Efforts to attain this criterion are ongoing. Continued research is needed to provide data on the magnitude of these issues for North Pacific right whales. See Section 2.3.2.3 for further detail.

Factor D: The inadequacy of existing regulatory mechanisms.

D1. Hunting is addressed under Factor B.

Status: Efforts to attain this criterion are ongoing. See Sections 2.3.2.2 and 2.3.2.4 for further detail.

Factor E: Other natural or manmade factors affecting its continued existence.

E1. Ship collisions continue to be investigated and actions taken to minimize potential effects, as appropriate.

Status: Efforts to attain this criterion are ongoing. In 2013, shipping lanes off Los Angeles/Long Beach and San Francisco, California, an area where North Pacific right whales may potentially migrate through, were modified to reduce the probability of colliding with large whales. While these measures were designed to protect mainly humpback, blue, and fin whales, they are expected to also reduce the risk of ship strikes to other marine mammals, including North Pacific right whales. Ship collisions continue to be recorded when reported or observed, and necropsies on dead whales are performed when possible to confirm cause of death. Federal agencies continue to consult with NMFS under the ESA on federally funded or permitted actions and to take measures to reduce the likelihood of ship strikes. See Section 2.3.2.5 for additional information.

E2. Entanglement with fishing gear continues to be investigated and actions taken to minimize potential effects, as appropriate.

Status: Efforts to attain this criterion are ongoing. Continued research is needed to provide data on the magnitude of this issue for North Pacific right whales. See Section 2.3.2.5 for further detail.

Delisting Objectives and Criteria

Because the downlisting objectives and criteria have not been met (discussed above and see Section 3.1 Recommended Classification) for the North Pacific right whale, an analysis is not required of the delisting objectives and criteria, which, if met, would indicate the species is recovered and delisting is warranted (50 CFR 424.11(d)(2)). The criteria for delisting the North Pacific right whale are listed in the 2013 final recovery plan, which is available at: http://www.nmfs.noaa.gov/pr/recovery/plans/rightwhale_northpacific.pdf.

2.3 Updated Information and Current Species Status

Where available, new information on North Pacific right whale biology, abundance, and habitat use is summarized below, followed by an analysis of any relevant changes in the threats that factor into the listing status determination.

2.3.1 Biology and Habitat

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

Little new information exists on the biology and life history of North Pacific right whales. Ivashchenko and Clapham (2012) analyzed Soviet whaling records from the 1960s, which provide rare data on length and sexual maturity for this species; catch totals for Soviet whaling on this species have recently been updated by Ivashchenko et al. (2017). LeDuc et al. (2012) provided data on the genetic characteristics of a sample of 24 North Pacific right whales, showing that the species has lost some genetic diversity, and that the eastern stock remains at severe risk of extinction with an effective population size (the number of individuals in a population who contribute offspring to the next generation) of only 11.6 animals.

As noted in the previous review, life history characteristics make these baleen whales very slow to adapt to changes in their habitat (Reynolds et al. 2002). Adults are generally between 45 and 55 feet in length, with females growing larger than males. The maximum recorded length of a North Pacific right whale was 19.8 m (65 feet) for a female killed by the USSR in the Gulf of Alaska in 1963 (Ivashchenko and Clapham 2012). Right whales have large heads, no dorsal fins, and are mostly black in color with callosities around the head region and a broad, deeply notched tail (NMFS 2006).

Right whales are thought to feed largely on copepods, at least in the Northern Hemisphere (IWC 1986). Right whales are skim ("ram") feeders, continuously filtering through their baleen while moving through a patch of zooplankton. This type of feeding strategy requires exceptionally high prey densities (Baumgartner *et al.* 2003; Baumgartner and Mate 2003; Baumgartner *et al.* 2011). As reported in previous status reviews, stomach content analysis revealed that whales feeding in the Gulf of Alaska, Sea of Okhotsk, and the eastern Aleutian Islands consumed primarily *Neocalanus plumchrus*, *Metridia sp*., and *N. cristatus*, respectively (Omura 1958; Omura 1986; Omura et al. 1969). The predominant prey species in the southeastern Bering Sea

has since been identified as *Calanus marshallae*, although other taxa consumed include *P. newmani, A. longiremis,* and *Pseudocalanus spp*. (Tynan 1999; Coyle 2000; Tynan et al. 2001; Baumgartner et al. 2013). North Pacific right whales were observed in three consecutive years (2004–2006) in late summer, apparently feeding in the Barnabus Trough area on Albatross Bank, south of Kodiak Island in the Gulf of Alaska (Wade et al. 2011b). In all three years, the whales were associated with a high-density demersal layer of zooplankton at ~175m depth. The only net tow through this layer in proximity to a right whale found a mix of euphausiids and late-stage calanoid copepods rich in depot lipids, with a copepod assemblage of *Neocalanus cristatus* (26%), *N. flemingeri* (14%), *N. plumchrus* (10%), and *Calanus marshallae* (10%), similar to previous observations of North Pacific right whale stomach contents.

Since the last Status Review in 2012, there have been several papers or reports published, some of which are referenced above. Others include acoustic detections of right whales in the eastern North Pacific (Rone et al. 2012; Širović et al. 2014; Crance and Berchok 2016; Wright 2015, 2016; Crance et al. 2017b; Rone et al. 2017; Thode et al. 2017), and sightings of right whales in the eastern (Ford et al. 2016) and western North Pacific (Matsuoka et al. 2014; Sekiguchi et al. 2014; Ovsyanikova et al. 2015). Other incidental sightings, as yet unpublished, have also been documented in the eastern North Pacific; during the 8th international research cruise in the IWC POWER (Pacific Ocean Whale and Ecosystem Research) survey series in the Bering Sea, and from citizens off of Kodiak (Happywhale 2017) and in California (CetalFauna 2017).

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:

As noted in the 2006 status review (NMFS 2006), the North Pacific right whale remains one of the most endangered whale species in the world, likely numbering fewer than 1,000 individuals between the eastern and western populations. Despite high levels of survey effort in the eastern North Pacific (Miyashita and Kato 1998; Perry et al. 1999; Zerbini et al. 2006; Ford et al. 2010), right whale sightings have been very rare and geographically scattered, leading to persistent uncertainty and data gaps. In the last three decades, right whale sightings have been so rare that single sightings have resulted in scientific publications (e.g., Herman et al. 1980; Rowntree et al. 1980; Rowlett et al. 1994; Goddard and Rugh 1998; Gendron et al. 1999; Salden and Mickelsen 1999; Waite et al. 2003; Carretta et al. 2007; Ford et al. 2016).

Small populations and the few sightings documented since 1964 (likely due to illegal Soviet catches that occurred throughout the 1960s; Ivashchenko and Clapham 2012) make population parameters difficult to estimate. The rarity of sightings and small numbers of individuals seen in any year strongly suggests that the population in the eastern North Pacific is very small. The largest number of individuals detected in a single year is 17 from multiple ship surveys in 2004 (Wade et al. 2006). Aerial surveys in 2008 documented 13 individuals, 10 of which were matched to previously identified whales (Clapham et al. 2009). More recently, Wade et al. (2011a) made the first abundance estimates for the eastern North Pacific population using mark-recapture data from the Bering Sea and Aleutian Islands, resulting in abundance estimates of 31 individuals (95% confidence interval 23–54 individuals) and 28 individuals (95% confidence

interval 24–42 individuals) using photographic and genetic identification techniques, respectively. Additionally, Marques et al. (2011) used passive acoustic cue counting to derive a similar abundance estimate of 25 individuals (CV 29.1%; 95% confidence interval 13–47). Those abundance estimates refer only to the Bering Sea and Aleutian Islands and may represent a sub-group with a habitat preference for that region; however, there is no evidence that the entire eastern North Pacific population is much larger. Between the 1960s and 2002, only two individuals were sighted in the Gulf of Alaska, and two others off the coast of Canada; none of these individuals had been seen in the Bering Sea (Wade et al. 2011b; Ford et al. 2016). Wade et al. (2011b) reported three additional visual sightings and one acoustic detection in the Gulf of Alaska between 2004 and 2006. During the 2017 July-September IWC POWER surveys, 18 right whales (three were duplicate sightings) were observed and photo-identification data was collected for 15 whales (12 unique individuals, 3 duplicates). Of these, eight were known whales and four were new to the catalog and will be given new ID numbers. However, two of these four will not be considered definite new individuals because there are not photos from both sides of the head. In July, 2017, one right whale was observed and photographed at Kilokak Rocks in the Gulf of Alaska between Kodiak Island and the Alaska Peninsula (Happywhale 2017). This could not be photographically matched to any previously identified whale and was given a new ID number, although limited imagery of the whale precludes calling this a definite new animal. In California in 2017 there were two additional sightings of right whales (CetalFauna 2017): one off La Jolla in April and one by the Channel Islands in May. The images obtained to date for the La Jolla whale were not of good enough quality to determine whether the animal matched animals in existing ID photos. However, the whale seen off the Channel Islands has been identified as a new animal and has been given a new ID.

In contrast, right whales have been sighted more regularly in the western North Pacific, notably in the Sea of Okhotsk, Kuril Islands, and adjacent areas (Brownell et al. 2001, Matsuoka et al. 2014, Ovsyanikova et al. 2015). Based on sightings data collected during minke whale surveys that covered a portion of the historic right whale range, the western population was estimated to contain approximately 900 individuals; however, the confidence intervals around this estimate are large (404 – 2,108 Miyashita and Kato 1998), and the generally low rate of sightings is consistent with a smaller population (Brownell et al. 2001).

Due to the logistical challenges of studying small populations, little is known about the reproductive rate, age structure, or sex ratio of North Pacific right whales. Very little new information is available, as there have been very few confirmed sightings of calves in the eastern North Pacific in the last several decades. The only available reports from the Bering Sea include one possible calf seen in 1996 (Goddard and Rugh 1998; Leduc 2004; Wade et al. 2006). The size of a right whale photographed in California was 12.2m, indicating it was a subadult (Caretta et al. 1994). Several of the right whales seen in the past few years also appear to be subadults (Shelden and Clapham 2006; Wade et al. 2006; Wade et al. 2011b), likely born after the cessation of Soviet whaling in the early 1960s, suggesting some successful reproduction within the population (Wade et al. 2006). During the 2017 IWC POWER surveys, photographs and a biopsy (results pending) were taken of and from a previously undocumented North Pacific right whale that is suspected to be a juvenile estimated to be between 1.5-4yrs old. However, the population reproduction rate remains unknown but is likely low due to a persistent uneven sex ratio. In 2002, the ratio of females to males biopsied in the Bering Sea was 1:9. In 2004, biopsy

results indicated a considerably higher ratio of 7:16. Most recently, photographic and genotypic survey data collected 1997-2008 suggest a ratio of 2:5 (Wade et al. 2011a). Low population estimates combined with the small number of females severely reduces the potential for North Pacific right whales to find viable mates.

As noted above, genetic analysis suggested an effective population size of only about a dozen individuals in the eastern North Pacific (LeDuc et al. 2012); this analysis also showed a male-biased sex ratio, and provided support for the hypothesis that eastern and western populations are largely separate.

Recent developments and research on cetacean metabolic energy systems can provide insights into physiological characteristics that inform ongoing management measures. Calves have been reported in the western North Pacific (Omura 1986; Brownell et al. 2001), but calculating meaningful reproduction rates remains impracticable. Right whales elsewhere in the world are known to calve every three to five years (Knowlton et al. 1994; Kraus et al. 2007). Studies have shown that calving success is tightly linked to maternal energy reserves, which is influenced by oceanographic oscillations that govern the whales' ability to locate prey (Kenney 1998; Fujiwara and Caswell 2001; Greene et al. 2003; Angell 2005; Miller et al. 2011). Klanjscek et al. (2007) modeled and compared energetic models between Southern and North Atlantic right whales and found that calving intervals and time of first parturition depended heavily on energy availability and feeding rate. Furthermore, modeled seasonal oceanographic variability had a significantly larger impact on reproductive success when feeding was presumed to be low, or when females were energy-limited (Klanjscek et al. 2007). These principles likely also apply to North Pacific right whales, where prevailing oceanographic conditions impact energy reserves and therefore reproductive output.

Similar to other life history characteristics, small population sizes and limited sampling opportunities have led to little new information on mortality rates within the eastern and western North Pacific populations. However, as reported in the previous review, North Pacific right whales' natural mortality, without anthropogenic sources, is likely similar to that of western North Atlantic right whales without anthropogenic sources, which has been calculated as 17 percent and 3 percent in yearling and subadult whales, respectively (Kraus 1990). With anthropogenic sources included, the overall subadult mortality rate for North Atlantic right whales has been estimated at 27 percent (Kraus 1990), although this may have increased over the last few years due to factors associated with the 2017 Unusual Mortality Event (http://www.nmfs.noaa.gov/pr/health/mmume/2017northatlanticrightwhaleume.html). The comprehensive mortality estimates for North Atlantic right whale yearlings and subadults is likely an overestimate for the North Pacific right whales, where ship strikes and entanglements appear to occur less frequently than in the North Atlantic. However, the small population size and low annual reproductive rate of all right whale populations suggest that human sources of mortality may have a greater effect relative to population growth rates than for other whales.

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

As stated in the previous review, past commercial whaling left the small, remnant populations vulnerable to low genetic variability due to genetic drift and inbreeding. Low diversity potentially affects individuals by depressing fitness, lowering resistance to disease and parasites, and diminishing the whales' ability to adapt to environmental changes. At the population level, low genetic diversity can lead to slower growth rates, lower resilience, and poorer long-term fitness (Lacy 1997). Marine mammals with an effective population size of a few dozen individuals likely can resist most of the deleterious consequences of inbreeding (Lande 1991). However, it has also been suggested that if the number of reproductive animals is fewer than 50, the potential for impacts associated with inbreeding increases substantially (IUCN 2003). From a dataset that included historical and contemporary samples, Rosenbaum et al. (2000) found genetic diversity in North Pacific right whales to be relatively high compared to North Atlantic right whales (*E. glacialis*). However, a small number of samples from surviving North Pacific right whales suggested lower genetic diversity when compared to the historic samples. More recent analysis by LeDuc et al. (2012) has confirmed this loss of diversity in the North Pacific right whale, although the loss appears to be considerably less than that documented in the North Atlantic right whale.

2.3.1.4 Taxonomic classification or changes in nomenclature:

There has been no new genetic information relevant to taxonomic classification or nomenclature since the definitive separation of right whales into three species (NMFS 2006; 73 FR 12024, March 6, 2008). This classification was based on the analysis of mitochondrial deoxyribonucleic acid (mtDNA) control sequences taken from skin tissue biopsies, stranded animals, and historical whaling samples and showed that these whale lineages are genetically distinct and demonstrate a relatively strong historical separation, with no shared haplotypes among the three right whale species (Rosenbaum et al. 2000). More recently, Gaines et al. (2005) examined both mtDNA and nuclear (nuDNA) introns containing single nucleotide polymorphisms and confirmed the reclassification of the Northern right whale in the North Pacific as its own taxon (*Eubalaena japonica*).

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.):

Due to small population sizes, much remains unknown about how right whales live, breed, and feed in the eastern and western portions of the North Pacific. Information on the historical range, current known distribution, and potential migratory routes and seasonal patterns is discussed below.

Historical Range

Recent studies investigating the potential historical range of North Pacific right whales are largely based on integrating past whaling catch data with recent sightings and oceanographic

models using innovative mapping techniques. It has been asserted that right whales historically ranged across the entire North Pacific Ocean from the western coast of North America to the Russian Far East and down to Baja California and the Yellow Sea (Woodhouse and Strickley 1982; Brueggeman et al. 1986; Scarff 1986; Goddard and Rugh 1998; Gendron et al. 1999; Brownell et al. 2001; Clapham et al. 2004; Shelden et al. 2005). However, Josephson et al. (2008a) present modeling data that suggest a pronounced longitudinal bimodal distribution, with fewer whales found in the central North Pacific compared to the eastern and western regions. Additionally, Shelden (2006) suggests that records of right whales in southern California and Hawaii likely represented vagrant individuals. Clapham et al. (2004) integrated 20th century sighting data with 19th century whaling records to reveal an extensive offshore distribution; however, some of these historical data are now known to involve species other than right whales (Josephson et al. 2008a). Overall, the species range has most likely contracted in the North Pacific relative to its spread during the peak period of whaling in the 19th century (Clapham et al. 2004). Analysis of Soviet illegal catch records (primarily from 1963/64) by Ivashchenko and Clapham (2012) show a broad offshore distribution in the Gulf of Alaska, consistent with 19th century historical whaling data (Townsend 1935).

Current Distribution and Research

Between 2010 and 2017, the majority of directed research on eastern North Pacific right whales was conducted by the NMFS Marine Mammal Lab (MML) under a program funded by the Bureau of Ocean Energy Management (Clapham et al. 2012) and the U.S. Marine Mammal Commission (Rone et al. 2015; Wright 2016; Crance et al. 2017a). Recent research using habitat modeling and acoustic monitoring has revealed finer-scale spatial information useful for conservation planning throughout the species' range. The western Gulf of Alaska and the southeastern Bering Sea are both frequently used areas, with 90 percent of Japanese and Russian encounters (1940s–1960s) occurring between 170°W and 150°W south to 52°N and between 173°W and 161°W south from 58°N (Clapham et al. 2006). Similarly, Zerbini et al. (2010, 2015) tracked six whales in the southeastern Bering Sea during the period 2004-2009; the animals moved over a relatively small area, primarily in the 50-100m isobaths. Two whales moved briefly into the northern Aleutian Basin, likely in search of prey. Though whales historically frequented the Gulf of Alaska, Albatross Bank is the only location within the Gulf where this species has been consistently identified for the last four decades (Wade et al. 2011b).

With little sighting data available for this species, it is not yet apparent what areas have been abandoned or not yet reinhabited by the current stocks (Clapham et al. 2006). Based on aerial surveys in 2008 and 2009, Rone et al. (2010) suggest that right whales consistently occupy a smaller area than would be predicted based on identified critical habitat in the southeastern Bering Sea. Claims that right whales had shifted their distribution within the last 50 years (Tynan et al. 2001) were based on inadequate survey coverage and were undermined by the discovery of 17 right whales outside the middle-shelf domain in the southeastern Bering Sea in the summer of 2004 (Wade et al. 2006), the observation of approximately 12 right whales just north of Unimak Pass in October 2005 (MML unpublished data), and the sightings of 18 right whales at the western edge of Bristol Bay and in the middle of the Bering Sea critical habitat in the summer of 2017 (IWC POWER surveys).

The IWC POWER surveys took place in the Bering Sea from July to September 2017 and gathered visual and acoustic data, biopsy samples, and photographs of North Pacific right whales. There were 18 sightings (in 9 groups) of right whales in the southeastern Bering Sea and Bristol Bay area. Five of the sightings were detected and localized using acoustics. Photo-identification data were collected for 12 North Pacific right whales (which included 4 individuals that may represent previously unidentified new animals). Biopsy (skin and blubber) samples were also collected from three individual whales (one new and two known whales). A total of 240 sonobuoys were deployed, and right whales were detected by 38 buoys.

Wright (2015, 2016) summarized results of year-round acoustic monitoring from passive acoustic recorders located in the Bering Sea and at Unimak Pass in the Aleutian Islands. Right whales were detected in Unimak Pass at various times, including in winter, supporting the idea that this pass is used by whales entering and leaving the Bering Sea, possibly including during seasonal migration to a currently unknown wintering ground. Numerous right whale detections occurred in the critical habitat area of the southeastern Bering Sea, consistent with satellite tagging results and with numerous sightings of the species in this area. Detections were also made in the northern Bering Sea, including in the vicinity of St. Lawrence Island (Wright, 2015, 2016), while some of these detections may have been bowhead whales, the occurrence of right whales in this region is not surprising given scattered (though somewhat ambiguous) historical whaling records. Overall, right whales were recorded in the Bering Sea in most months of the year, with a peak occurrence in known foraging habitats in summer.

Overall, while new information on distribution has come from MML surveys of the Bering Sea, there has been comparatively little effort in the Gulf of Alaska. Rone et al. (2016) summarized data from three surveys in the northern Gulf of Alaska between 2009 and 2015; although right whales were acoustically detected off Kodiak in both 2013 and 2015, none were visually documented during these three surveys. With the exception of the limited coverage of waters southeast of Kodiak by Rone et al. (2016), there has been effectively no visual survey coverage of the offshore waters of the Gulf that were habitat for right whales as recently as the period of Soviet illegal catches in the 1960s. However, on July 17, 2017, a potentially new individual was observed and photographed by a sailboat charter at Kilokak Rocks (57 10.5N 156 18W) in the Gulf of Alaska between Kodiak Island and the Alaska Peninsula (Happywhale 2017). In 2013, Širović et al. (2014) detected right whale calling on passive acoustic recorders at Quinn Seamount in the Gulf of Alaska, as well as off Washington State. Farther south, Ford et al. (2016) reported two separate sightings of right whales off British Columbia in 2013, the first recorded in that region since the last whaling catch in 1951. Comparison of photos with those in MML's North Pacific Right Whale Catalog showed that both whales were new, previously unknown individuals. One of the two animals had a healed wound on the head which likely originated from a serious entanglement in fishing gear. In southern California in 2017 there were two separate sightings of North Pacific right whales (CetalFauna 2017): one off La Jolla on April 15, 2017 and one by the Channel Islands on May 5, 2017. The images obtained for the La Jolla whale were not of good enough quality to match the animal. However, the whale seen off the Channel Islands has been positively identified as a new animal and has been given a new ID. Between February 2-14, 2015, there were also reports from the Channel Islands of two North Pacific right whales observed by a NMFS pinniped researcher at San Miguel Island, although

this was never confirmed. Overall, while there are clearly some right whales remaining in the Gulf of Alaska and areas to the south, all indications are that the extant population using these habitats is extremely small.

In the western North Pacific, recent sightings of right whales have been reported. These include five observations of a total of ten animals in June 2012 in offshore waters some 290 miles southeast of Kamchatka, together with a pair of whales recorded in June 2013 east of the Kuril Islands (Sekiguchi et al. 2014). Ovsyankova et al. (2015) summarized opportunistic sightings of right whales in Russian and international waters from 2003 to 2014. These included observations from the southern and central Okhotsk Sea, the Kuril Islands, the Commander Islands, and offshore waters southeast of Kamchatka (including the records reported by Sekiguchi et al. 2014). A breaching right whale was observed during a sightseeing cruise off the Shiretoko Peninsula, Japan in July 2013, making it the first confirmed sighting in the area for several decades and the first recorded in Hokkaido (Uni et al. 2014). A right whale, most likely the same individual, was seen in the area for the following two weeks until a pod of orcas arrived in the area. The observer noted that many of the local tour-operating boats cruising at high speeds did not seem to detect the right whale resting on the water surface and forced the right whale to submerge quickly to avoid collisions. In February 2015, a young right whale was found entangled in aquaculture gear at Namhae, South Korea, making it the first record of this species in the Sea of Japan in 41 years (Kim 2015). In October 2016, an entangled right whale was reported to have died while being disentangled in Volcano Bay, Hokkaido, Japan (pers. comm. from Dr. Tadasu Yamada to the Marine Mammal Commission). In 2015, there was a sighting of a right whale off Shenzhen, China, although the local media reported it as a humpback whale (https://v.qq.com/x/page/j0165vs5te2.html). Another right whale had previously been reported as stranded (dead) in Shandong Province, China, sometime between 2000 and 2006 (Wang et al. 2015).

Seasonal Migration

Little is known about the migratory behavior of either the western or eastern North Pacific right whales, and little new information has arisen since the most recent review (NMFS 2006). Historical sighting and catch records provide the only information on possible migration patterns for North Pacific right whales (Omura 1958; Omura et al. 1969; Scarff 1986). Because of infrequent sightings and because whalers have never reported winter calving areas, calving locations in the North Pacific remain unknown (Brownell et al. 2001; Scarff 2001; Clapham et al. 2004; Shelden et al. 2005). However, in an attempt to elucidate potential calving grounds, Good and Johnston (2010) conducted likelihood modeling of the North Pacific based on habitat preferences of North Atlantic right whales, and identified southern California, the Northwest Hawaiian Islands, the southern coast of China, and the northern coast of Vietnam as potential North Pacific right whale habitat based on depth, sea surface temperature, and surface roughness. These modeling results present only potential locations, as relatively few right whales have recently been seen in the North Pacific in fall, winter, or spring. However, there have been some sightings south of high latitudes in those seasons. Since 1950, there have been at least three sightings from Washington, fourteen from California, two from Baja California, Mexico, and three from Hawaii (Brownell et al. 2001, MML unpublished data). In the lower latitudes in the western North Pacific in fall, winter, and spring, since 1950 there have been two animals hunted and killed in the Yellow Sea in China, and one in Korean waters in the Sea of Japan. There have

also been two sightings in the Ryuku Islands, Japan (near Okinawa), four sightings in the Bonin Islands (Ogasawara, Japan), and four sightings on the Pacific side of Honshu, the main island of Japan (Brownell et al. 2001).

Unlike calving areas, more is known about right whale feeding areas. Based on recorded historical concentrations of whales in the Bering Sea and recent survey sightings, it is likely that feeding areas in the Okhotsk Sea and adjacent waters along the coasts of Kamchatka and the Kuril Islands together with the Gulf of Alaska have been important summer habitats for eastern North Pacific right whales (Scarff 1986; Goddard and Rugh 1998; Brownell et al. 2001; IWC 2001; Clapham et al. 2004; Shelden et al. 2005; Clapham et al. 2006). North Pacific right whales observed by Wade et al. (2011b) since 1998 in the Gulf of Alaska were all observed in shelf waters adjacent to Kodiak, Alaska. However, it should be noted that sightings in coastal or shelf waters may be partially a function of survey effort, and thus may not reflect current or historical distribution. In support of this caveat, sighting records also indicate that right whales can occur far offshore, with observed movements over abyssal depths (Scarff 1986; Mate et al. 1997). Acoustic recorders in the Gulf of Alaska detected right whale calls on 5 days out of a total of 70 months of recordings from 5 deep-water stations; the calls were heard at the deepwater station in the Gulf of Alaska ~500 km southwest of Kodiak Island on 5 days in August and September of 2000, but no calls were detected from 4 other instruments deployed in deep water farther east during 2000 and 2001 (Mellinger et al. 2004).

Based on acoustic recordings of right whale call patterns from 2000 to 2006, Munger et al. (2008) found that whales remain in the southeastern Bering Sea later in the year than was previously thought and move into mid-shelf waters intermittently throughout the summer. More recent year-round acoustic monitoring has detected right whale vocalizations virtually year-round in the Bering Sea, although calls become far less common in mid-winter (Wright 2015, 2016). Winter detections in Unimak Pass may indicate whales moving out of the Bering Sea en route to an unknown migratory destination (Wright 2016).

Fall and spring distribution is the most widely dispersed, with whales occurring in mid-ocean waters and extending from the Sea of Japan to the eastern Bering Sea. In February 2015, a young right whale was found entangled in aquaculture gear in South Korea and in October 2016 a right whale was found entangled in northern Japan. In April and May 2017, two different whales were documented in southern California.

In winter, right whales have been found in the Ryukyu Islands, the Bonin Islands, the Yellow Sea, the Sea of Japan, Honshu Island Japan, Washington, California, and Baja California, Mexico (Omura et al. 1969; Scarff 1986; NMFS 2006). Although this general northward migration for spring and summer feeding is apparent, Clapham et al. (2006) cites uncertainty as to whether all or only some of the whales follow this seasonal movement. One individual observed in both Hawaii and the Bering Sea in 1996 represents the only confirmed evidence of an annual migration (Kennedy et al. 2010). How these seasonal distribution patterns may have changed recently based on population structure, habitat availability, and prey resources is unknown.

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

North Atlantic and Southern right whales are observed primarily in low-latitude shallow coastal waters during winter calving and in higher-latitude, shelf waters during the summer when distribution is most tightly linked to patchily distributed zooplankton prey (Winn et al. 1986; Perry et al. 1999; Gregr and Coyle 2009). NMFS designated two areas as North Pacific right whale critical habitat in the Gulf of Alaska and the Bering Sea in 2006 (Allen and Angliss 2012; 73 FR 19000, April 8, 2008). Eastern North Pacific right whales have been observed during summer apparently feeding in shelf waters of the eastern Bering Sea and south of Kodiak Island in the Gulf of Alaska (Tynan et al. 2001; Wade et al. 2011a; Wade et al. 2011b; Baumgartner et al. 2013). Clapham et al. (2006) have observed that although the historic distribution of North Pacific right whales is significantly reduced, the waters of the western Gulf of Alaska and the Bering Sea remain critical habitat for this depleted species. This work to characterize and map critical habitat has resulted in an improved understanding of how these whales might be utilizing suitable habitat areas in the North Pacific.

As stated above (see section 2.3.1.2), right whales preferentially inhabit areas with high zooplankton abundance and must therefore adapt their behavior based on prevailing basin-scale oscillations and multi-year processes that govern currents, productivity, and food web structure (Kenney 1998; Greene et al. 2003; Angell 2005; Klanjscek et al. 2007; Gregr and Coyle 2009; Miller et al. 2011). Zooplankton abundance and density in the Bering Sea has been shown to be highly variable, and affected by climate, weather, ice extent, and oceanographic processes (Napp and Hunt 2001; Baier and Napp 2003; Baumgartner et al. 2013; Zerbini et al. 2015). Individuals tagged in the southeastern Bering Sea by Zerbini et al. (2015) in 2008−2009 (cold years) remained in the middle shelf domain, travelled at a slower rate, and showed more restricted habitat use than a whale tagged in 2004 (a warm year). The results of this study suggested that the right whales remained associated with the cold pool (remnant winter water in the bottom layer of the middle shelf domain) during cold years, probably because of higher copepod abundance and reduced competition from other copepod predators within the cold pool.

Shelden et al. (2005) plotted 20th century records and found that seasonal distribution between offshore and shelf waters largely depended on sea surface temperature, surface mixing, and the presence of upwelling canyons. In this case, they suggest that the location and timing of suitable habitat at the regional scale is determined by local oceanographic processes that would differ for the eastern and western populations. Similarly, Gregr (2011) overlaid whaling catches with ocean climate circulation models to show two non-overlapping areas of suitable habitat that consistently exhibited large water temperature gradients from year to year. In support of this idea, Gregr (2010) suggests that these right whale lineages may have developed different habitat preferences. Several potential hypotheses exist on how right whales successfully find and utilize dynamic and shifting habitat areas and then transmit this accumulated experience across generations (Gregr 2010). How these areas and processes will shift in a changing climate remains unknown, but these findings represent key information for present and future critical habitat designations.

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

Below is an analysis of the five factors that determine listing status per section 4(a)(1) of the ESA, as applied to North Pacific right whales.

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

Anthropogenic impacts on North Pacific right whales and their habitat remain largely unknown and unquantified. Oil and gas activities, natural resource extraction, chemical contaminants, and anthropogenic noise all potentially impact individual health and the quantity and quality of available habitat. Although these impacts are likely minimal, they may be compounded by future climatic changes and will each be discussed below.

Oil and Gas Activities

Oil and gas activities, including exploration, production, transport, spills, and spill responses, are potential sources of habitat degradation that could threaten North Pacific right whales. Oil and gas exploration activity is currently occurring in both state and federal waters (e.g. Cook Inlet) in areas which may impact right whales. Data on the effects of oil pollution on baleen whales remain inconclusive, but general concerns include ingestion of contaminated prey, irritation of skin and eyes, inhalation of toxic fumes, change in distribution to lower quality habitat, and compromised immune function (Geraci and Aubin 1980; Geraci 1990; Loughlin 1994). Fortunately, relatively few spills have occurred in the northern North Pacific Ocean to date, but the extent to which these activities may impact right whales is unknown. In addition to oil and gas activities, the demand for exploring and developing undersea mineral deposits has grown in recent years and may degrade habitat or adversely impact right whale behavior such as use of key feeding areas.

The development of oil fields off Sakhalin Island in Russia is occurring within habitat of the western North Pacific population of right whales (NMFS 2006). Within the range of the eastern population, past offshore oil and gas leasing has occurred in the Gulf of Alaska and Bering Sea in the northern areas of known right whale habitat. North Pacific right whale critical habitat overlaps both the St. George Basin and the North Aleutian Basin program areas in the Bering Sea and the Kodiak program area in the Gulf of Alaska, which are areas of the Outer Continental Shelf (OCS) subject to oil and gas exploration, leasing, and development, or withdrawal from leasing, under the Outer Continental Shelf Lands Act (OCSLA). The Bureau of Ocean Energy Management (BOEM), which manages OCS oil and gas under the OCSLA, proposed an OCS leasing plan for 2007-2012 that prioritized lease sales for the North Aleutian Basin program area in 2010 and 2012 (Aplin and Elliott 2007), but was withdrawn by Presidential Executive Order. On December 16, 2014, President Obama announced that, under authority granted him by Section 12(a) of the OCSLA, he was withdrawing the North Aleutian Basin from future oil and gas leasing, development, or production "for a time period without specific expiration." Therefore, the North Aleutian Basin program area was not included in the 2017-2022 national lease schedule by BOEM, and there are no residual active leases from past sales. However, in accordance with a directive in Executive Order 13795, dated April 28, 2017 (82 FR 20815),

BOEM has announced plans to replace the 2017-2022 OCS leasing plan (with a new 2019-2024 leasing plan) and to reconsider all current moratoria on offshore oil and gas exploration and extraction (82 FR 30886, July 3, 2017). The draft proposed leasing plan for 2019-2024 includes proposed lease sales in all fifteen of the OCS program areas in Alaska, except for the North Aleutian Basin program area (83 FR 829, January 8, 2018). Specifically, the draft leasing plan for 2019-2024 proposes conducting a lease sale in 2023 in both the St. George Basin and the Kodiak program areas, both of which overlap with North Pacific right whale critical habitat. It is noteworthy that when the IWC POWER surveys were conducted in the Bering Sea in 2017 the majority of North Pacific right whales were observed in or very close to their critical habitat, and North Pacific right whales tagged with satellites in 2004, 2008, and 2009 exclusively used critical habitat for the life of the tags; an average of 40 days between July and October (Zerbini et al. 2015).

Although there is currently no oil and gas activity in the Alaskan Chukchi Sea, three lease sales are proposed in the Chukchi Sea (in 2020, 2022, and 2024) under the draft proposed leasing plan for 2019-2024. Oil exploration and production is ongoing in the Beaufort Sea and Cook Inlet, and under the draft proposed leasing plan for 2019-2024 the Beaufort Sea will have three new lease sales (in 2019, 2021, and 2023) and Cook Inlet will have two new lease sales (in 2021 and 2023). BOEM (2016) recently conducted an oil spill model for lower Cook Inlet that suggested if a very large oil spill occurs in offshore waters it will impact right whale habitat around Kodiak Island and along the Alaska Peninsula. Any oil exploration and production in the Beaufort and Chukchi Seas will likely include an increased level of associated vessel traffic through the Bering Sea en route to and from the Arctic.

Chemical Contaminants

Chemical contaminants such as heavy metals, polychlorinated biphenyls (PCBs), and plastic debris are an additional potential source of habitat degradation for right whales that remains uncertain. Although additional research is needed, existing data indicate that the lower trophic level mysticetes should contain smaller contaminant burdens compared with many odontocetes (O'Shea and Brownell Jr. 1994; O'Shea 1999). The manner in which pollutants negatively impact animals is complex and difficult to study, particularly in animals for which many of the key variables and physiological pathways are unknown (Aguilar 1987; O'Shea and Brownell Jr. 1994). However, individuals with higher contaminant levels in tissues show increased susceptibility to infections, lesions, impairments, and even reproductive failure (De Guise et al. 1995; Moore et al. 1998; Aguilar et al. 2002; Jenssen et al. 2003).

The transgenerational accumulation of contaminants (Colborn and Smolen 1996) is a source for concern and has been modeled in right whales elsewhere by Klanjscek et al. (2007), who found that calves can assimilate as much as 30 percent of maternal toxicant load through nursing. Additionally, these metabolic models predict that the concentration of toxicants increases when energy reserves (i.e., blubber) are low and are further released into tissues during periods of fasting or starvation brought on by environmental variability (Klanjscek et al. 2007). This study suggests that the combination of seasonal nutritional stress and pollutant exposure may be negatively impacting reproductive success and limiting right whale recovery in the North Atlantic by increasing calving intervals and decreasing fertility. Weisbrod et al. (2000) found that the accumulation of PCBs and pesticides in North Atlantic right whales did not reach

significant levels but varied depending on where along the coast copepod prey was consumed. Additionally, Wise et al. (2008) studied accumulated chromium levels in North Atlantic right whale tissues and concluded that this toxin occurs in concentrations that could prove harmful.

The impacts of chemical contamination on cetaceans and habitat are a growing concern in the North Pacific Ocean. While high-latitude oceans receive less exposure to anthropogenic chemicals, global circulation brings these contaminants into polar regions where they are taken up into Arctic food webs (Tanabe 2002). In the North Pacific, PCB and DDT contamination more than doubled in the last decade, evidenced by rising concentrations in albatrosses (Finkelstein et al. 2006). Elliott and Scheuhammer (1997) found that concentrations of cadmium and lead were higher in seabirds living in the North Pacific compared with similar species on the east coast. Levels of PCBs and newly identified DDT-like micro contaminants in the blubber of some North Pacific cetaceans (including right whales) was greater than those in tropical locations, with levels exceeding those known to suppress immune function in harbor seals (Minh et al. 2000a; Minh et al. 2000b). However, contaminant levels were lower in humpback whales from Alaska than they were in whales from California and Washington, where there have been more known point sources of contaminants (Elfes et al. 2010). It is unknown how and if these effects are manifested at a population level relevant to recovery and management decisions.

Anthropogenic Noise

A review of the potential impacts of noise on cetaceans was published by Nowacek et al. (2008). Ship propulsion and electricity generation from engines, compressors, and pumps essential for ship operations all contribute to noise emissions into the marine environment. The uncertainty surrounding the impacts of anthropogenic noise on large whales becomes more problematic when considering the anticipated rise in ocean noise in the coming years. Ross (1976) estimated that between 1950 and 1975, shipping caused a rise in ambient noise levels of 10 decibels (dB) worldwide and scientists estimate that the background ocean noise level at 100 Hz has been increasing by about 1.5–3 dB per decade since the advent of propeller-driven ships (Andrew et al. 2002; McDonald et al. 2006; Andrew et al. 2008; McDonald et al. 2008).

While certain species of large whales have shown behavioral changes and adaptations to anthropogenic noise in the marine environment (Geraci and Aubin 1980; Geraci 1990), there have been few studies on how anthropogenic noise might affect right whales. However, existing data suggest that the level of sensitivity to noise disturbance and vessel activity appears related to the behaviors in which they are engaged at the time (Watkins 1986; NMFS 2006). In particular, feeding or courting right whales may be relatively unresponsive to loud sounds and, therefore, slow to react to approaching vessels. Clark et al. (2009) attempted to quantify the effects of masking on mysticetes (including the North Atlantic right whale) exposed to ship noise and reported that whale call rates diminished in the presence of passing vessels. Malme et al. (1983) speculated on the potential detrimental impacts of the noise created during oil and gas production, but in general, the impact of noise from shipping and industrial activities on the communication, behavior, and distribution of right whales remains unknown but likely has minimal population level effects.

Projected increases in trans-polar ship traffic routing through the Bering Sea as a result of continued loss of sea ice will likely result in additional noise and collision risk for right whales.

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

As discussed in the previous review, commercial whalers hunted North Pacific right whales heavily during the 19th and 20th centuries. The IWC estimates that 15,451 right whales were taken in the North Pacific in the 19th century, with 741 additional catches recorded in the early 20th century (Brownell 1986; Best 1987; Brownell et al. 2001; Josephson et al. 2008b). Scarff (2001) adjusted that previous analysis to account for whales that were struck and lost and estimated that between 26,500 and 37,000 North Pacific right whales were killed between 1839 and 1909.

Ivashchenko and Clapham (2012) reported that large illegal catches of right whales were made by the USSR in 1962-68 in the eastern North Pacific and in 1967/68 in the Okhotsk Sea. Their best estimate of total right whale catches was 661, consisting of 529 from the eastern North Pacific (compared to a previously published figure of 373 by Doroshenko 2000) and 132 from the Okhotsk Sea (cf. a previous figure of 126 from the same study). More recently, however, Ivashchenko et al. (2017) have updated that analysis with newly discovered records; they now estimate that 771 North Pacific right whales were killed by the USSR between 1935 and 1971. Soviet catches were distributed in the Bering Sea (116), eastern Aleutian Islands (28), Gulf of Alaska (366), Okhotsk Sea (132), Kuril Islands (100), Kamchatka (4), western coast of North America (6), and in unknown areas (19). Detailed information on catches of 112 right whales taken in May/June 1963 shows a broad distribution in offshore waters of the Gulf of Alaska, consistent with 19th century historical whaling records compiled by Townsend (Townsend 1935). Other major areas in which right whales were caught include south of Kodiak Island, western Bristol Bay (southeastern Bering Sea), and the central Okhotsk Sea off eastern Sakhalin Island. These illegal catches— which in many cases involved the taking of large, mature whales—must have drastically reduced the recovery potential for the species, notably in the eastern North Pacific.

Right whales were historically hunted by native peoples along the Northwest Pacific coast and in the Aleutian Islands, although the level of such take was likely insignificant. No additional information on aboriginal catches in the western North Pacific has arisen since the last review, but given the current status of this species, the North Pacific right whale populations could not withstand even a very low level of commercial or aboriginal hunting.

Continued scientific research efforts increase our knowledge about this species, but can involve close interactions with whales to obtain photographs and genetic samples or to deploy satellite tags. All of these activities are permitted and closely monitored in the U.S. and Canada, a process that ensures any potential negative impacts are minimized. The potential for disturbance or harassment through observing or approaching whales for behavioral studies, photography, satellite tagging, and data collection, including samples for health and genetic analysis, is likely minimal and is far-outweighed by the value of the information that it provides for use in managing and recovering the species. There are no recreational or educational uses of North Pacific right whales. However, if a right whale is seen in a highly accessible area, such as near the coast of California, there is the potential for an enthusiastic response from whale watching operations, which may increase disturbance and harassment of right whales.

2.3.2.3 Disease or predation:

Data does not currently exist to quantify the impact of predation and disease on the survivability of the North Pacific right whale, and no new information has arisen since the previous review. As reported previously, it is likely that North Pacific right whales experience occasional predatory attacks from killer whales and large sharks. Although incidences have never been observed, bodily scars reveal the likelihood of these events (Shelden and Clapham 2006). If these interactions do occur, they would likely have a larger impact on calf and subadult age classes. Bowhead whales, a pagophilic ("ice-loving") species, could be used as a conservative proxy for killer whale predation on right whales, which are far more exposed than bowhead whales to killer whale attacks given the right whales' lack of protection from pack ice. Of 367 bowhead whales examined from 1990-2012 from the Alaskan subsistence hunt, scarring from attempted killer whale predation was evident on about 8% (George et al. 2017). The frequency of killer whale scars was much higher (> 40%) on whales more than 16 m in length and statistically more frequent in the second half of the study (2002 – 2012). Increased killer whale injuries in the recent decade are consistent with studies conducted on bowheads of the Eastern Canada-West Greenland population. As conditions change in the Arctic and subarctic it is possible that killer whale predation may become more of a threat to right whales.

In terms of the impacts of disease, no recorded evidence exists of epizootics (an outbreak of disease affecting many animals of one kind at the same time) occurring in baleen whales. It has been suggested that the frequency of naturally-occurring red tide events that can lead to the ingestion of deleterious algal toxins may increase with the rise of coastal development and anthropogenic activities as freshwater runoff increases (NMFS 2006). While these natural toxins have led to mass mortalities of many pinnipeds and cetaceans, there is currently no evidence linking red tide toxins to deaths or chronic health problems in North Pacific right whales. However there is some concern about the emerging prevalence of algal toxins in habitat used by North Pacific right whales. Again using bowhead whales (n=25) as a conservative proxy for right whales, Lefebvre et al. (2016) documented domoic acid and saxitoxin in 68% and 32%, respectively, of bowhead whales examined from the Arctic; the highest prevalence of the 13 marine mammal species examined.

It is not known whether right whales suffer from stress-induced bacterial infections similar to those observed in captive cetaceans (Buck et al. 1987). The occurrence of skin lesions on North Atlantic right whales has been documented, but their origin and significance are unknown (Marx et al. 1999; Pettis et al. 2004). The system developed by Pettis et al. (2004) to assess health and body condition of North Atlantic right whales is currently being applied by NMML to photographs of North Pacific right whales.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Right whales are protected domestically under both U.S. and Canadian law and internationally by the International Whaling Commission (IWC). Although the IWC has set the catch quota at zero for all signatory nations and given all right whale stocks a Protected designation (IWC 1995), no recent regulatory mechanisms have been implemented to protect North Pacific right whales. Due to the scarcity of this species and persistent data gaps, there is not sufficient

information at this time to indicate what regulatory mechanisms could be implemented to hasten the recovery of this species. However, without regulatory mechanisms in place, it is likely that anthropogenic activities would have adverse effects on North Pacific right whales. If additional studies reveal that significant impacts are occurring, it may be necessary to enhance existing laws or promulgate new regulations to reduce or eliminate arising threats.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

As right whale sightings and research remain limited in the North Pacific, no new information exists on other natural or manmade threats since the latest review (NMFS 2006). In the North Atlantic, ship collisions and fishing gear entanglements are the most common known causes of right whale mortality (Kraus 1990; Gillespie and Leaper 2001; Knowlton and Kraus 2001), but little is known of the nature or extent of these problems in the North Pacific. The existing knowledge and persistent data gaps for each of these threats are described below.

Vessel Collisions

The impacts of vessel interactions on right whale mortality in the North Pacific remain unknown, and due to their rare occurrence and scattered distribution, assessing this threat is impractical at this time (Muto et al. 2017). Major shipping traffic does not currently cross into areas where right whales have most recently and most commonly been sighted. However, other known right whale habitat (e.g., Unimak Pass, frequently transited by vessels taking a Great Circle route to and from Asia) remains in close proximity to popular shipping lanes, suggesting that collisions with vessels may represent a threat to North Pacific right whales. Because of the rarity of right whales, the impact to the species from even low levels of interaction could be significant. Furthermore, the continued retreat of sea ice in the Arctic makes it inevitable that the Northwest Passage and Northern Sea Route to and from Europe will be regularly open during at least the summer in the foreseeable future. When this occurs, the volume of ship traffic transiting Arctic waters, through the Bering Strait and into the Bering Sea, may dramatically increase. This will bring with it greatly increased noise pollution as well as a rise in the probability of ship collisions with cetaceans, including North Pacific right whales. The U.S. Coast Guard is in the process of proposing through the International Maritime Organization (IMO) voluntary two-way routing measures that would end just north of North Pacific right whale critical habitat (USCG 2016). Other proposed voluntary measures include precautionary areas and areas to be avoided, none of which overlap with North Pacific right whale critical habitat. The proposed two-way routes are based on existing shipping lanes but are meant to reduce problems from already-increasing vessel traffic and from predicted future increases in vessel traffic, as economic activity in the Arctic continues to expand with reductions in sea ice. Because the proposed routes through the Bering Strait and Bering Sea would end north of Dutch Harbor, vessel traffic would thus be essentially funneled into North Pacific right whale critical habitat as ships continue south to Dutch Harbor and beyond.

Fisheries Interactions

The eastern Bering Sea supports extensive fisheries throughout the year, but the impact of these activities on North Pacific right whales remains unknown. As with other threats, any potential impacts pose a high risk to populations with low abundance.

Until 2011, only one case of entanglement had been confirmed from the western North Pacific (Kornev 1994; Perry et al. 1999; Brownell et al. 2001), though this number probably does not reflect the potential rate of interactions. However, in March 2011 a young right whale was killed when it was entangled in a net off Oita Prefecture on Kyūshū Island in Japan (Dr. Tadasu Yamada pers. comm. Dee Allen, Marine Mammal Commission). The right whale's meat was later observed being sold at a local market. In addition, on February 11, 2015, a right whale was safely disentangled and released from mussel grow-out ropes in Namhae, South Korea (Kim 2015). The mussel farm was located approximately 600 to 900 m from shore, at a water depth of 15 m. Four thick mussel grow-out ropes, measuring 240 mm in diameter with attached mussels, were wrapped around the caudal peduncle and fluke of the whale. The disentanglement team was able to cut three out of the four ropes but had to stop the operation at midnight due to safety precautions. The next morning, the forth rope was found at the site of the entanglement and the whale was nowhere to be found, leading researchers to conclude that the whale had freed itself of the last remaining rope (Young 2015). Video footage from this entanglement was obtained and can be viewed at https://www.youtube.com/watch?v=yvq5zNqHiJY and https://www.youtube.com/watch?v=TtvhBTOhi9o. In October 2016, a right whale entangled in fishing gear was reported to have died while being disentangled in Volcano Bay, Hokkaido, Japan (Dr. Tadasu Yamada pers. comm. to the Marine Mammal Commission). According to the Hokkaido Stranding Network meat from this animal was also sold at a local market (http://kujira110.com/?p=2175). Multiple live North Pacific right whales have also been observed with scarring indicative of fisheries interactions (Bownell et al 2001, Burdin et al. 2004).

Again using bowheads as a proxy for the less-commonly observed North Pacific right whales, several cases of bowhead entanglements have been recorded during the Alaska Native subsistence hunt (Philo et al. 1992). Aerial photographs in at least two cases have shown lines trailing from the mouths of bowheads (NMFS, NMML, unpublished data). George et al. (2017) analyzed scarring for 514 Bering-Chukchi-Beaufort Seas bowhead whales killed by Alaska Native hunters to quantify the frequency of line entanglement, and found that 12% of hunted bowheads showed entanglement scars. The frequency of entanglement scarring was highly correlated with body length and sex: about 50% of very large bowheads (> 17 m) showed such scars, while whales under 9 m rarely did, and males showed a significantly higher rate than females. Entanglements were primarily from pot fishing gear (crab or cod or both), and scarring rates were relatively high for very large and presumably older bowheads. A review of photographs of North Pacific right whales has shown a low apparent rate of interaction with fishing gear (Kennedy, unpublished data), but given the remoteness of the habitats concerned any mortalities would almost certainly pass unrecorded. Injuries and entanglements that are not initially lethal may result in a gradual weakening of entangled individuals, making them more vulnerable to other direct causes of mortality (e.g., predation, disease, infection of resulting wounds, etc.; Kenney and Kraus 1993). Additionally, entanglement-related stress may decrease an individual's reproductive success or reduce its life span, which may in turn depress population growth. Monitoring of scarring rates among North Pacific right whales is difficult due to the extreme rarity of this species, but this would provide significant insight into the extent of this problem in the region.

Climate Change

The impacts of climate change on baleen whales are as yet unknown, but it is considered one of the largest threats facing remote areas in the North Pacific (Macdonald et al. 2003; Moore 2008). Most notably, the temporal and spatial distribution of zooplankton prey is largely governed by sea ice coverage and could change dramatically with altered oceanographic conditions (Baier and Napp 2003). This could lead to nutritional stress and diminished reproduction. Additionally, changing water temperature and currents could impact the timing of environmental cues important for navigation and migration and the location of critical habitat within the North Pacific right whale species range. It is possible that changes in ice extent, density, and persistence may alter the dynamics of the Bering Sea shelf zooplankton community and in turn affect the foraging behavior and success of right whales (Clapham et al. 2006).

Cumulative Impacts

The cumulative impacts of the above threats remain unknown and have not been studied for large whales in the North Pacific. While none of the above threats is likely to significantly affect right whale recovery alone, it is possible that the cumulative burden of shifting natural processes and rising anthropogenic activities could impact right whales at the individual and population levels. Macdonald et al. (2003) suggest that the cumulative impacts of climate change, overfishing, and habitat modification alter the metabolic and physiological pathways involved in the absorption and bioaccumulation of chemical contaminants found in the North Pacific. As a proxy to the North Pacific right whale, in the North Atlantic Ocean, Kraus (2008) suggests that the cumulative impacts of all anthropogenic activities likely suppress right whale reproductive rates and compromise immune function, thus inhibiting recovery and making the population less resilient to future climate change and anthropogenic threats.

2.4 Synthesis

Given that the North Pacific right whale population is extremely small and little current information is available, recovery is not anticipated in the foreseeable future (e.g., several decades to a century or more). Despite the damage to the population caused by illegal Soviet whaling in the 1960s, recent sightings have shown that right whales are extant in the North Pacific, and there is evidence that some reproduction may be occurring in this population. Life history characteristics such as low reproductive rates, delayed sexual maturity, and reliance on high juvenile survivorship make long-lived species such as whales particularly vulnerable to demographic risks posed by anthropogenic-related mortalities. Risks from entanglement and ship strikes may currently pose little direct threat to recovery of North Pacific right whales, although injury or mortality from any of these sources would be noteworthy due to the limited size of the population. Oil and gas development activities, chemical pollution, harmful algal blooms, and climate change could potentially impact critical habitat, foraging success, and reproductive rates in the future. As noted above, increased trans-polar shipping through the Bering Sea could become a major risk to right whales in the future.

Many basic life history parameters and census data, including calving and growth rates, age structure, mortality, and distribution remain largely undetermined. These data are necessary to perform quantitative population analyses or develop surrogate models to evaluate the risk of

extinction. When such reliable information on the biology and ecology of this population becomes available, managers will be able to make informed decisions by applying specific criteria to address the survival and recovery of this species.

In this five-year review, NMFS considered the best scientific and commercial data available and concludes that the data does not substantiate downlisting or delisting the North Pacific right whale. As outlined in this review, the North Pacific right whale is not recovered, nor is it extinct, such that delisting is warranted; moreover, the data available when the species was listed, and the interpretation of such data, was not in error (50 CFR 424.11(d)). Therefore, based on the limited available new information and existing conservation and management measures, the North Pacific right whale retains its status as endangered, with the eastern population being critically endangered.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X No change is needed

3.2 New Recovery Priority Number: 3

Brief Rationale: Due to insufficient data, a high demographic risk, and major risks that are not well understood, this species remains endangered.

3.3 Listing and Reclassification Priority Number: N/A

Reclassification (from Threatened to Endangered) Priority Number:
Reclassification (from Endangered to Threatened) Priority Number:
Delisting (Removal from list) Priority Number: ____

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS -

The most urgent need is better information on the basic distribution and occurrence of right whales in the eastern North Pacific, including identification of their wintering areas and management of emerging threats to the population. Ship-based surveys should be continued and expanded, as well as the use of autonomous underwater recording devices and satellite-monitored radio tags.

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NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW
North Pacific Right Whale (*Eubalaena japonica*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change is needed

Review Conducted By: Verena Gill

REGIONAL OFFICE APPROVAL:

Alaska Regional Administrator, NOAA Fisheries

Approve: Robert D Mecum Date: 1/25/2018

HEADQUARTERS APPROVAL:

Assistant Administrator, NOAA Fisheries

✓ Concur _____ Do Not Concur

Signature Chris Oliver Date 2/21/18