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NORTH PACIFIC RIGHT WHALE (*Eubalaena japonica*): Eastern North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

A review of all 20th century sighting, catches, and strandings of North Pacific right whales was conducted by Brownell et al. (2001). Data from this review were subsequently combined with historical whaling records to map the known distribution of the species (Fig. 1; Clapham et al. 2004, Shelden et al. 2005). Although whaling records initially indicated that right whales ranged across the entire North Pacific north of 35°N and occasionally as far south as 20°N (Scarff 1986, 1991; Fig. 1), recent analysis shows a pronounced longitudinally bimodal distribution (Josephson et al. 2008a). Before right whales in the North Pacific were heavily exploited by commercial whalers, concentrations were found in the Gulf of Alaska, eastern Aleutian Islands, south-central Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham and Rice 1984). An analysis conducted on the North Pacific right whale fishery by Josephson et al. (2008b) showed that within the course of a decade (1840s), right whale abundance was severely depleted, particularly in the eastern portion of their range. Following large illegal catches (1962-1968) by the U.S.S.R. (Ivashchenko and Clapham 2012, Ivashchenko et al. 2013), only 82 sightings of right whales in the entire eastern North Pacific were reported from 1962 to 1999, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell et al. 2001). Additional sightings have been reported as far south as central Baja California and as far east as Yakutat Bay and Vancouver Island in the eastern North Pacific, as far south as Hawaii in the central North Pacific, and as far north as the sub-Arctic waters of the Bering Sea and Sea of Okhotsk in the summer (Herman et al. 1980; Rowntree et al. 1980; Berzin and Doroshenko 1982; Salden and Mickelsen 1999; Brownell et al. 2001; J. Ford, pers. comm., Department of Fisheries and Oceans, BC, Canada, 28 October 2013). However, most right whale sightings in the past 20 years have occurred in the southeast Bering Sea and in the Gulf of Alaska, particularly near Kodiak, AK (Waite et al. 2003; Shelden et al. 2005; Wade et al. 2011a, 2011b).

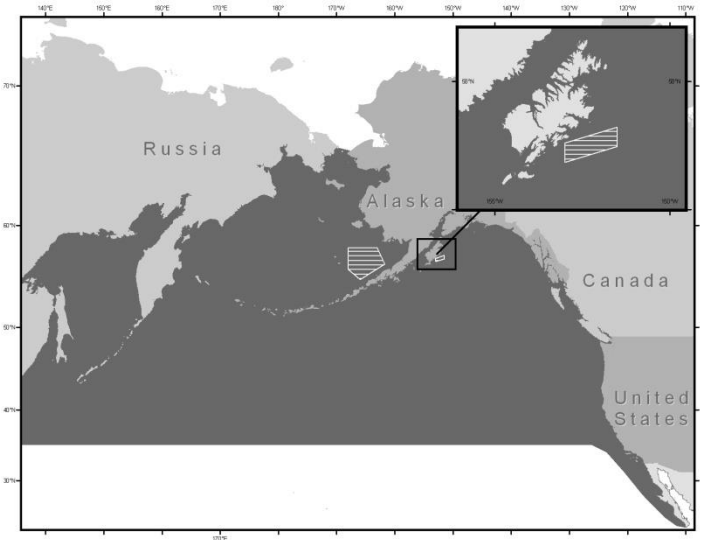

Figure 1. Approximate historical distribution of North Pacific right whales in the eastern North Pacific (shaded area). Striped areas indicate northern right whale critical habitat (71 FR 38277, 6 July 2006).

North Atlantic (*E. glacialis*) and Southern Hemisphere (*E. australis*) right whales calve in coastal waters during the winter months. However, in the eastern North Pacific no such calving grounds have been identified (Scarff 1986). Migratory patterns of North Pacific right whales are unknown, although it is thought they migrate from high-latitude feeding grounds in summer to more temperate waters during the winter, possibly well offshore (Braham and Rice 1984, Scarff 1986, Clapham et al. 2004). A right whale sighted off Maui in April 1996 was identified 119 days later and 4,111 km north in the Bering Sea (Salden and Michelsen 1999, Kennedy et al. 2011). While the photographic match confirms that Bering Sea animals occasionally travel south, there is no reason to believe that either Hawaii or tropical Mexico have ever been anything except extra-limital habitats for this species (Brownell et al. 2001).

Information on the summer and autumn distribution of right whales is available from dedicated vessel and aerial surveys, bottom-mounted acoustic recorders, and vessel surveys for fisheries ecology and management that have also included dedicated marine mammal observers. Aerial and vessel surveys for right whales have occurred in recent years in a portion of the southeastern Bering Sea (Fig. 1) where right whales have been observed most summers since 1996 (Goddard and Rugh 1998, Rone et al. 2012). North Pacific right whales are observed

consistently in this area, although it is clear from historical and Japanese sighting survey data that right whales often range outside this area and occur elsewhere in the Bering Sea (Clapham et al. 2004; LeDuc et al. 2001; Moore et al. 2000, 2002). Bottom-mounted acoustic recorders were deployed in the southeastern Bering Sea and the northern Gulf of Alaska starting in 2000 to document the seasonal distribution of right whale calls (Mellinger et al. 2004). Analysis of the data from those recorders deployed between October 2000 and January 2006 indicates that right whales remain in the southeastern Bering Sea from May through December with peak call detection in September (Munger and Hildebrand 2004). Data from recorders deployed between May 2006 and April 2007 show the same trends (Stafford and Mellinger 2009, Stafford et al. 2010). Recorders deployed from 2007 to 2013 have not yet been fully analyzed, but indicate the presence of right whales in the southeastern Bering Sea almost year-round, with a peak in August and a sharp decline in detections in early January (available Catherine Berchok, AFSC-NMML, 7600 Sand Point Way NE, Seattle, WA; unpublished data). Use of this habitat may intensify in mid-summer through early fall based on higher monthly and daily call detection rates. The probability of acoustically detecting right whales in the Bering Sea has been found to be strongly influenced by the abundance of the copepod *Calanus marshallae* (Baumgartner et al. 2013) and those authors propose that *C. marshallae* is the primary prey for right whales on the Bering Sea shelf. The seasonal development of these copepods into life history stages that can be exploited by right whales closely matches the peak timing of right whale call detections (Munger et al. 2008, Baumgartner et al. 2013). Additionally, right whale "gunshot" call detections increased shortly after peaks in copepod biovolume (Stafford et al. 2010). Baumgartner et al. (2013) suggest that the availability of *C. marshallae* on the middle shelf of the southeast Bering Sea is the reason right whales aggregate there annually. Satellite telemetry data from four whales tagged in 2008 and 2009 provide further indication of this area's importance as foraging habitat for eastern North Pacific right whales (Zerbini et al. in review). Right whales have not been observed outside the localized area in the southeastern Bering Sea during surveys conducted for fishery management purposes that covered a broader area of Bristol Bay and the Bering Sea (Moore et al. 2000, 2002; see Fig. 1 in the Northeast Pacific fin whale SAR for locations of tracklines for these surveys).

There are fewer recent sightings of right whales in the Gulf of Alaska than in the Bering Sea (Brownell et al. 2001), although little survey effort has been conducted in this region, notably in the offshore areas where right whales commonly occurred during whaling days (Ivashchenko and Clapham 2012). Waite et al. (2003) summarized sightings from the Platforms of Opportunity Program from 1959 to 1997. Additional lone animals were observed off Kodiak Island in the Barnabas Canyon area from NOAA surveys in August 2004, 2005, and 2006 (available A. Zerbini, AFSC-NMML, 7600 Sand Point Way NE, Seattle, WA; unpublished data). A single right whale was reported in Pasagshak Bay by a kayaker in May of 2010, and one was sighted in December 2011 by humpback researchers in Uganik Bay (A. Kennedy, AFSC-NMML, pers. comm., 7 October 2012). Acoustic monitoring from May 2000 to July 2001 at seven sites in the Gulf of Alaska detected right whale calls at only two: one off eastern Kodiak and the other in deep water south of the Alaska Peninsula (detection distance 10s of kilometers) (Mellinger et al. 2004).

Most of the illegal Soviet catches of right whales occurred in offshore areas, including a large area to the east and southeast of Kodiak (Doroshenko 2000, Ivashchenko and Clapham 2012); the Soviet catch distribution closely parallels that seen in plots of 19th century American whaling catches by Townsend (1935). Whether this region remains an important habitat for this species, or whether cultural memory of its existence has been lost, is currently unknown. The sightings and acoustic detection of right whales in coastal waters east of Kodiak indicates at least occasional continuing use of this area.

The following information was considered in classifying stock structure according to the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: distinct geographic distribution; 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: evidence for some isolation of populations. Based on this limited information, two stocks of North Pacific right whales are currently recognized: a Western North Pacific and an Eastern North Pacific stock (Rosenbaum et al. 2000, Brownell et al. 2001, LeDuc et al. 2012). The former is believed to feed primarily in the Sea of Okhotsk.

POPULATION SIZE

Illegal catches of an estimated 681 right whales in the eastern and western North Pacific between 1962 and 1968 severely impacted the populations concerned, notably in the east (Ivashchenko and Clapham 2012, Ivashchenko et al. 2013). Based on sighting data, Wada (1973) estimated a total population of 100-200 in the North Pacific. Rice (1974) stated that only a few individuals remained in the eastern North Pacific stock, and that for all practical purposes the stock was extinct because no sightings of a mature female with a calf had been confirmed since 1900. However, confirmed sightings over the last 14 years, starting in 1996 (Goddard and Rugh 1998), have

invalidated this view (Wade et al. 2006). Brownell et al. (2001) suggested from a review of sighting records that the abundance of this species in the western North Pacific was likely in the "low hundreds", including the population in the Okhotsk Sea.

There were several sightings of North Pacific right whales in the mid-1990s which renewed interest in conducting dedicated surveys for this species that included the collection of photo-IDs and biopsies. Right whales can be individually identified by photographs of the unique callosity patterns on their heads. In April 1996 a right whale was sighted off Maui (Salden and Mickelsen 1999), and that same animal was identified 119 days later and 4,111 km north (in the Bering Sea); this represents the first high- to low-latitude match of a North Pacific right whale (Kennedy et al. 2011). The April Maui sighting was the first documented sighting of a right whale in Hawaiian waters since 1979 (Herman et al. 1980, Rowntree et al. 1980) and, even though the photographic match confirms that Bering Sea animals occasionally travel south, there is no reason to believe that either Hawaii or tropical Mexico have ever been anything except extra-limital habitats for this species (Brownell et al. 2001).

A group of 3-4 right whales, that may have included a juvenile animal, was sighted in western Bristol Bay, southeastern Bering Sea, in July 1996 (Goddard and Rugh 1998). In July 1997, a group of 4-5 individuals was encountered one evening in Bristol Bay, followed by a second sighting of 4-5 whales the following morning in approximately the same location (Tynan 1999). During dedicated surveys in July 1998, July 1999, and July 2000, 5, 6, and 13 right whales, were again found in the same general region of the southeastern Bering Sea (LeDuc et al. 2001). Biopsy samples of right whales encountered in the southeastern Bering Sea were taken in 1997 and 1999. Genetic analyses identified three individuals in 1997 and four individuals in 1999; of the animals identified, one was identified in both years, resulting in a total genetic count of six individuals (LeDuc et al. 2001). Genetic analyses of samples from all six whales sampled in 1999 determined that the animals were male (LeDuc et al. 2001). Two right whales were observed during a vessel-based survey in the central Bering Sea in July 1999 (Moore et al. 2000).

During the southeast Bering Sea survey in 2002, there were seven sightings of right whales (LeDuc 2004). One of the sightings in 2002 included a right whale calf; this is the first confirmed sighting of a calf in decades (a possible calf or juvenile sighting was also reported in Goddard and Rugh 1998). This concentration also included two probable calves. In the southeast Bering Sea during September 2004, multiple right whales were acoustically located and subsequently sighted by another survey vessel approaching a near-real-time position of an individual located with a satellite tag (Wade et al. 2006). An analysis of photographs confirmed at least 17 individual whales (not including the tagged whales). Genetic analysis of biopsy samples identified 17 individuals: 10 males and 7 females. The discovery of 7 females was significant as only 1 female had been identified previously, and at least two calves were present. From 2007 to 2011, 12 individual right whales were seen (some individuals were seen many times over all survey years).

Photographic and genotype data through 2008 were used to calculate the first mark-recapture estimates of abundance for right whales in the Bering Sea and Aleutian Islands, resulting in estimates of 31 (95% CL 23-54, CV=0.22) and 28 (95% CL 24-42), respectively (Wade et al. 2011a). The abundance estimates are for the last year of each study, corresponding to 2008 for the photo-identification estimate, and 2004 for the genetic identification estimates. Wade et al. (2011a) also estimate the population consists of eight females (95% CL 7-18) and 20 males (95% CL 17-37). Wade et al. (2011a) summarized the photo-identification and genetic-identification catalogues as follows: twenty-one individuals were identified from genotyping from the Aleutian Islands and Bering Sea from 1997 to 2004, comprising 15 males and 6 females. In aggregate, there were 8 photo matches of individual whales across years involving 5 individuals. Wade et al. (2006) reported 17 individuals (including 7 females) identified from genotyping in 2004; that number was revised to 16 individuals (including 6 females) because a typographical error was subsequently discovered that masked a duplicate sample. There were 4 biopsies taken in 2008 and 2009 of 2 males and 2 females; three of these animals had been sampled in previous years. These samples were only recently processed and did not make it into the Wade et al. (2011a) abundance estimate (A. Kennedy, AFSC-NMML, pers. comm., 21 September 2011).

The photo-identification catalogue, for purposes of abundance estimation, was restricted to aerial or left-side oblique photographs of good or excellent photo quality. After this restriction, there were a total of 18 unique individuals identified from photographs of callosity patterns and scars from 1998 to 2008, with 10 resights across years involving 5 individuals.

Another 7 individuals were observed in the summer of 2009, and one individual was seen in the summer of 2010 (A. Kennedy, AFSC-NMML, pers. comm., 3 November 2010). Four individuals were seen in the summer of 2011 (B. Rone, AFSC-NMML, pers. comm., 7 October 2012). There were two sightings of right whales (one in June and one in October) in British Columbia waters in 2013, one of which was also seen off northern Washington state (J. Ford, Department of Fisheries and Oceans, BC, Canada, pers. comm.); these were the first sightings of this

species in this region in decades. Comparisons with the photo-identification catalogue curated at the National Marine Mammal Laboratory showed that neither individual had been previously photographed elsewhere. Whether this indicates that right whales are returning to these coastal waters where they were once hunted is unclear. One of the individuals was a large animal with a major injury on its rostrum, perhaps the result of an earlier entanglement in fishing gear (J. Ford, Department of Fisheries and Oceans, BC, Canada, pers. comm., 28 October 2013).

LeDuc et al. (2012) analyzed 49 biopsy samples from right whales identified as being from 24 individuals, of which all but one were from the eastern North Pacific. The analysis revealed a male-biased sex ratio, and a loss of genetic diversity that appeared to be midway between that observed for right whales in the North Atlantic and the Southern Hemisphere. The analysis also suggested a degree of separation between eastern and western populations, a male:female ratio of 2:1, and a low effective population size for the eastern North Pacific stock, which LeDuc et al. (2012) considered to be at "extreme risk" of extirpation.

Detections of right whales have been very rare in the Gulf of Alaska, even though large numbers of whales were caught there in the 1800s and 1960s. With the exception of the Soviet catches, primarily in 1963-1964 (Ivashchenko and Clapham 2012), from the 1960s through 2002, only two sightings of right whales occurred in the Gulf of Alaska: an opportunistic sighting in March 1979 near Yakutat Bay in the eastern Gulf (Shelden et al. 2005) and a sighting during an aerial survey for harbor porpoise in July 1998 south of Kodiak Island, Alaska (Waite et al. 2003). Both sightings occurred in shelf waters less than 100 m deep. However, from 2004 to 2006, four sightings of right whales occurred in the Barnabus Trough region on Albatross Bank, south of Kodiak Island, Alaska (Wade et al. 2011b). Sightings of right whales occurred at locations within the trough with the highest density of zooplankton, as measured by active-acoustic backscatter. Photo-identification (of two whales) and genotyping (of one whale) failed to reveal a match to Bering Sea right whales. Fecal hormone metabolite analysis from one whale estimated levels consistent with an immature male, indicating either recent reproduction in the Gulf of Alaska or movements between the Bering Sea and Gulf of Alaska.

In recent decades, the only detections of right whales in pelagic waters of the Gulf of Alaska came from passive acoustic recorders. These detections of calls were exceptionally rare; instruments in seven widespread locations detected right whale calls from only 2 of the locations on only 6 days out of a total of 80 months of recordings (Mellinger et al. 2004), and on only 5 days out of a total of 70 months of recordings from the 5 deep-water stations. The calls were heard at the deep-water 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). Calls classified as "probable" right whales were detected from an instrument deployed on the shelf at the location of the aerial visual detection on Albatross Bank on 6 September 2000 (Waite et al. 2003), but no calls were detected from two instruments deployed at the base of the continental slope off Albatross Bank just northeast of Barnabus Trough (Mellinger et al. 2004, Munger et al. 2008). Twenty sonobuoy deployments in 2004 throughout the Gulf of Alaska resulted in the detection of right whale calls only in Barnabus Trough, near the location of the visual sightings mentioned above (Wade et al. 2011b). The lack of detection of right whales from passive acoustic recorders does not provide indisputable evidence there were no right whales in the area, as the whales may not always vocalize or their calls may not always be detected by the automatic algorithms used or the call type targeted for detection. Until very recently, only a single call type, the "up call" was used to automatically detect right whales. The "gunshot" call has recently been identified as another candidate for right whale detections (Stafford et al. 2010). However, it is interesting to note the contrasting data from the southeastern Bering Sea where similar instruments on the middle shelf (<100 m depth) detected right whale calls on >6 days per month in July-October (Munger et al. 2008), despite a population estimated to be only 31 whales (Wade et al. 2011a). The lack of detections of right whales in pelagic waters of the Gulf of Alaska may still be partially due to a lack of survey and recording effort in those areas, but the lack of calls in passive-acoustic monitoring suggests that right whales are very rare in pelagic waters today. More extensive coverage of shelf and nearshore waters of the Gulf of Alaska during previous ship and airplane surveys for cetaceans (summarized in Wade et al. 2011b) have not detected right whales other than the single detection near Kodiak Island by Waite et al. (2003). Therefore, the Barnabus Trough/Albatross Bank area represents the only location in the Gulf of Alaska where right whales have been repeatedly detected in the last 4 decades, and those detections add only a minimum of two additional whales (from photo-identification in 2005 and 2006) to the total eastern population. However, there has been virtually no survey coverage of the offshore waters in which right whales commonly occurred during historical and recent whaling periods (Townsend 1935, Ivashchenko and Clapham 2012).

Minimum Population Estimate

The minimum estimate of abundance of North Pacific right whales is 25.7 based on the 20th percentile of the photo-identification estimate of 31 (CV=0.226; Wade et al. 2011a). The photo-identification catalogue used in the mark-recapture abundance estimate has a minimum of 20 unique individuals seen from 1998 to 2013, yet this number could be higher given that there are many animals with poor quality photos or poor coverage (one side only). The genetic-identification catalogue has a total of 23 individuals identified from 1997 to 2011 (LeDuc et al. 2012).

Current Population Trend

No estimate of trend in abundance is currently available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Due to insufficient information, the default cetacean maximum net productivity rate (R_{MAX}) of 4% is used for this stock (Wade and Angliss 1997). However, given the small apparent size, male bias, and low observed calving rate of this population, this rate may be unrealistically high.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the recommended value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). A reliable estimate of minimum abundance for this stock is 25.7 based on the mark-recapture estimate of 31 (CV = 0.226; Wade et al. 2011a). The calculated PBR level for this stock is therefore 0.05 which would be equivalent to one take every 20 years. Regardless of the PBR level, because this species is listed under the Endangered Species Act and no negligible impact determination has been made, no human-caused takes of this population are authorized; PBR for this stock is 0.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998, Andersen et al. 2008, NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*." Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

Gillnets were implicated in the death of a right whale off the Kamchatka Peninsula (Russia) in October of 1989 (Kornev 1994), which was presumably from the western North Pacific population. No other incidental takes of right whales are known to have occurred in the North Pacific, although one photograph from the catalog shows potential fishing gear entanglement (A. Kennedy, AFSC-NMML, pers comm., 21 September 2011). The right whale photographed on 25 October 2013 off British Columbia and northern Washington state, showed potential fishing gear entanglement (J. Ford, pers. comm., Department of Fisheries and Oceans, BC, Canada, 28 October 2013). Vessel collisions are considered the primary source of human-caused mortality of right whales in the North Atlantic (Cole et al. 2005). Any mortality incidental to commercial fisheries would be considered significant. Entanglement in fishing gear, including lobster pot and sink gillnet gear, is a significant source of mortality for the North Atlantic right whale stock (Waring et al. 2004).

There are no records of fisheries mortalities of eastern North Pacific right whales. Thus, the estimated annual mortality rate incidental to U.S. commercial fisheries approaches zero whales per year from this stock. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia are not reported to take animals from this stock.

Other Mortality

Ship strikes are significant sources of mortality for the North Atlantic stock of right whales, and it is possible that right whales in the North Pacific are also vulnerable to this source of mortality. However, due to their rare occurrence and scattered distribution it is impossible to assess the threat of ship strikes to the North Pacific stock of right whales at this time. There is concern regarding the effects of increased shipping through the Arctic waters and Bering Sea with retreating sea ice, which may increase the potential risk to right whales from shipping.

STATUS OF STOCK

The right whale is listed as "endangered" under the Endangered Species Act of 1973, and therefore designated as "depleted" under the MMPA. In 2008, NMFS relisted the North Pacific right whale as "endangered" as a separate species (*Eubalaena japonica*) from the North Atlantic species, *E. glacialis* (73 FR 12024, 06 March 2008). As a result, the stock is classified as a strategic stock. The abundance of this stock is considered to represent only a small fraction of its pre-commercial whaling abundance (i.e., the stock is well below its Optimum Sustainable Population size). The estimated annual rate of human-caused mortality and serious injury is considered minimal for this stock. The reason(s) for the apparent lack of recovery for this stock is (are) unknown. Brownell et al. (2001) noted the devastating impact of extensive illegal Soviet catches in the eastern North Pacific in the 1960s, and suggested that the prognosis for right whales in this area was "poor". Biologists working aboard the Soviet factory ships which killed right whales in the eastern North Pacific in the 1960s considered that the fleets had caught close to 100% of the animals they encountered (Ivashchenko and Clapham 2012); accordingly, it is quite possible that the Soviets wiped out the great majority of the animals in the population at that time. In its review of the status of right whales worldwide, the International Whaling Commission expressed "considerable concern" over the status of this population (IWC 2001), which is arguably the most endangered stock of large whales in the world.

HABITAT CONCERNS

NMFS conducted an analysis of right whale distribution in historic times and in recent years, and stated that principal habitat requirements for right whales are dense concentrations of prey (Clapham et al. 2006), and on this basis proposed two areas of critical habitat: one in the southeastern Bering Sea and another south of Kodiak Island (70 FR 66332, 2 November 2005). In 2006, NMFS issued a final rule designating these two areas as northern right whale critical habitat, one in the Gulf of Alaska and one in the Bering Sea (71 FR 38277, 6 July 2006; Fig. 1). In 2008, NMFS redesignated the same two areas as eastern North Pacific right whale critical habitat under the newly recognized species name, *E. japonica*.

There are no known current threats to the habitat of this population, although this partly reflects a lack of information about the current distribution and habitat requirements of right whales in the eastern North Pacific, as well as about the location and nature of any potential threats to the animal or its environment. The U.S. Department of the Interior has designated areas within the southeastern Bering Sea, including areas designated as right whale critical habitat, as one of their outer continental shelf oil and gas lease areas. This planning area, referred to as the North Aleutian Basin, was not included in the current 2012-2017 national lease schedule by the Bureau of Ocean Energy Management, and there are no residual active leases from past sales. The Mineral Management Service (currently Bureau of Ocean Energy Management) supported a series of surveys from 2007 to 2009 to better understand right whale distribution in this area so that potential impacts and mitigation measures can be better assessed.

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