Fin Whale
(Balaenoptera physalus)

5-Year Review:
Summary and Evaluation

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

December 2011

5-YEAR REVIEW
Finback Whale *(Balaenoptera physalus)*

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional or Headquarters Office:
Megan Milliken, Intern, Office of Protected Resources, 301-427-8403
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1.2 Methodology used to complete the review:

The first draft of this review was completed by two individuals (Megan Milliken and Susan Pultz) and relied heavily on the final recovery plan for the fin whale. After the first draft was completed, it was reviewed by others in the Office of Protected Resources and the Southwest Regional Office.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

72 FR 2649, January 22, 2007

1.3.2 Listing history

Original Listing
FR notice: None ("grandfathered" in from precursor to ESA)
Date listed: 1973
Entity listed: Finback Whale *(Balaenoptera physalus)*
Classification: Endangered

1.3.3 Associated rulemakings: N/A

1.3.4 Review History:

Previous review:

S.L. Perry, D.P. DeMaster, 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. Department of Commerce.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 9, which indicates that threats are low, recovery potential is high, and there is the potential for conflict

1.3.6 Recovery Plan or Outline

Name of plan or outline: Final Recovery Plan for the Fin Whale (*Balaenoptera physalus*)
Date issued: Final plan issued July 2010
Dates of previous revisions, if applicable: N/A

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?

__X_ ***Yes**, go to section 2.1.2.*
_____ ***No**, go to section 2.2.*

2.1.2 Is the species under review listed as a DPS?

____ ***Yes**, go to section 2.1.3.*
__X_ ***No**, go to section 2.1.4*

2.1.3 Was the DPS listed prior to 1996?

____ ***Yes**, give date and go to section 2.1.3.1.*
____ ***No**, go to section 2.1.4.*

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

____ ***Yes,** provide citation and go to section 2.1.4.*
____ ***No**, go to section 2.1.3.2.*

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

____ ***Yes**, discuss how it meets the DPS policy, and go to section 2.1.4.*
____ ***No**, discuss how it is not consistent with the DPS policy and consider the 5-year review completed. Go to section 2.4., Synthesis.*

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

_X_ ***Yes***

____ ***No****, go to section 2.2., Recovery Criteria.*

In order to qualify as a DPS, a unit must first be discrete and second, significant (61 FR 4722). On a global scale, populations in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere probably mix rarely, if at all. Indeed, because the fin whale makes seasonal migrations to lower latitudes on alternate schedules in each hemisphere, the northern and southern populations do not appear to come into contact (Aguilar *et al.* 2002). Although much evidence exists for discreteness, to date there has been no effort to identify DPSs for fin whales under the ESA.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan[1] containing objective, measurable criteria?

_X__ ***Yes****, continue to section 2.2.2.*

____ ***No***

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?

__X_ ***Yes,*** *go to section 2.2.2.2.*
____ ***No***

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)?

__X_ ***Yes****, go to section 2.2.3.*
____ ***No***

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:

[1] 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.

If you answered *yes* to both 2.2.2.1. and 2.2.2.2., evaluating whether recovery and/or downlisting criteria have been met in section 2.2.3 may be sufficient to evaluate the species listing classification and no further analysis may be necessary; *go to section 2.4., Synthesis***.**

If you answered *no* to either 2.2.2.1 or 2.2.2.2, *continue to section 2.3.*

Downlisting Criteria from the Final Fin Whale Recovery Plan:

1. Given current and projected threats and environmental conditions, the fin whale population in each ocean basin in which it occurs (North Atlantic, North Pacific and Southern Hemisphere) satisfies the risk analysis standard for threatened status (has no more than a 1% chance of extinction in 100 years) *and* has at least 500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males) in each ocean basin. Mature is defined as the number of individuals known, estimated or inferred to be capable of reproduction. 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.

While NMFS acknowledges that MMPA stock structure does not align with the ESA listed entity for fin whales, MMPA stock assessment reports contain the best available demographic information for fin whales in U.S. waters. The final 2010 stock assessment reports provide the following minimum population estimates for fin whales in U.S. waters: western North Atlantic stock: 3,269; California/Oregon/Washington stock: 2,624; Hawaii stock: 101; and Northeast Pacific stock: 5,700. While there is currently no accepted recent abundance estimate for fin whales, the best available information indicates that there were an estimated 85,200 fin whales in the Southern Ocean in 1970 (IWC 1979). More detailed abundance information by ocean basin follows.

<u>North Atlantic</u>

Based on survey data, about 5,000 fin whales were estimated to inhabit the northeastern United States continental shelf waters in the spring and summer of 1978–1982 (Hain *et al.* 1992). Combined shipboard and aerial surveys from Georges Bank to the mouth of the Gulf of St. Lawrence in the summer of 1999 (designed for harbor porpoise, *Phocoena phocoena*, abundance estimation), resulted in an estimate of 2,814 (CV=0.21) fin whales (Palka 2000). The best abundance estimate available for the Western North Atlantic stock, as defined in the 2010 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments is 3,985 (CV=0.24) with a minimum population estimate of 3,269 (Waring *et al.* 2011).

The International Whaling Commission (IWC) has continued to use Mitchell's (1974) mark-recapture data from 1965 to 1972 for estimating abundance of fin whales in eastern Canadian waters, with no attempt at updating the estimates to account for possible changes in abundance since 1972, when whaling ended in this area (IWC 1992). The central estimate was about 11,000 individuals, interpreted to refer only to whales longer than 50 ft. This presumably included at least some whales that moved seasonally into U.S. waters. Mitchell (1974) reported shipboard survey estimates of 340 fin whales (of all sizes) for the Gulf of St. Lawrence and 2,800 for "the remainder of the Nova Scotia area." Two line-transect aerial survey programs have been conducted in Canadian waters since the early 1970s, giving negatively biased estimates of 79 to 926 fin whales on the eastern Newfoundland-Labrador shelf in August 1980 (Hay 1982) and a few hundred in the northern and central Gulf of St. Lawrence in August 1995 and 1996 (Kingsley and Reeves 1998).

Estimates of the number of fin whales in West Greenland waters during the summer range between about 500 and 2,000 (IWC 1995; Larsen 1995). Jonsgård (1974) considered the fin whales off western Norway and the Faroe Islands to "have been considerably depleted in postwar years, probably by overexploitation." The evidence of depletion around Iceland, however, was much less conclusive, and it was suggested that the population had undergone only a moderate decline since the early 1960s (Rorvik *et al.* 1976; Rorvik and Sigurjónsson 1981). Large-scale shipboard sighting surveys in the summers of 1987 and 1989 produced estimates in the order of 10,000 to 11,000 fin whales in the northeastern Atlantic between East Greenland and Norway (Buckland *et al.* 1992a). This compares with an estimate of 6,900 "fully recruited" whales in the East Greenland-Iceland stock in 1976 (only including animals longer than 50 ft) made using catch per unit effort (CPUE) data from the Icelandic whaling industry (Rorvik *et al.* 1976). The CPUE data were interpreted as indicating a "slight" decrease in the population size since 1948 (Rorvik *et al.* 1976).

The most recent estimates for the British Isles-Spain-Portugal stock area in summer have ranged from about 7,500 (Goujon *et al.* 1995) to more than 17,000 (Buckland *et al.* 1992b). An estimation of the entire Mediterranean Sea population of fin whales is unknown, but the western basin portion of the population, where most of the population is found, is estimated to be 3,500 animals (Notarbartolo-Di-Sciara *et al.* 2003).

<u>North Pacific</u>

Before whaling, the total North Pacific fin whale population has been estimated at 42,000–45,000, based on catch data and a population model (Ohsumi and Wada 1974; Omura and Ohsumi 1974). Of this total, the "American population" (*i.e.,* the component centered in waters east of 180° W) was estimated to be 25,000–27,000. Based on sighting and CPUE data and a population model, the same authors estimated that there were 8,000–11,000 fin whales in the eastern North Pacific in 1973 (Ohsumi and Wada 1974). From a crude analysis of catch statistics and whaling effort, Rice (1974) concluded that the population of fin whales in the eastern North Pacific declined by more than half between 1958 and 1970, from about 20,000 to 9,000 "recruited animals" (*i.e.,* individuals longer than the minimum length limit of 50 ft). Chapman (1976) concluded that the "American stock" had declined to about 38% and the "Asian stock" to 36% below their Maximum Sustainable Yield (MSY) levels (16,000 and 11,000, respectively) by 1975. As noted by Barlow (1994), citing IWC (1989), CPUE techniques for estimating abundance are not certain, therefore, the absolute values of the cited abundance estimates should not be relied upon.

Shipboard sighting surveys in the summer and autumn of 1991, 1993, 1996, and 2001 produced estimates of 1,600–3,200 fin whales off California and 280–380 fin whales off Oregon and Washington (Barlow 2003). The most recent estimate for California/Oregon/Washington is 3,044 (CV=0.18) whales, which is the geometric mean of the line transect estimate from summer/autumn ship surveys conducted in 2005 (Forney 2007) and 2008 (Barlow 2010). The minimum estimate for the California/Oregon/Washington stock, as defined in the 2010 U.S. Pacific Marine Mammal Stock Assessments, is approximately 2,624 (Carretta *et al.* 2011). An increasing abundance trend between1979/80 and 1993 was suggested by the available survey data, but it was not statistically significant (Barlow *et al.* 1997). There is no evidence of a population trend from recent line-transect abundance surveys conducted in 1996, 2001, 2005, and 2008 in California, Oregon, and Washington waters out to 300 nmi (Barlow 2010; Barlow and Forney 2007; Forney 2007). The best estimate of fin whale abundance for the Hawaiian stock is 174 (CV=0.72) (Carretta *et al.* 2011). The minimum population estimate, based on the 2002 abundance estimate, is 101 fin whales within the Hawaiian Islands Exclusive Economic Zone.

An aerial survey of the former Akutan whaling grounds around the eastern Aleutians in 1984 produced no sightings of fin whales (Stewart *et al.* 1987). The absence of sightings in this area of former high abundance (at least 2,500 fin whales were taken there between 1912 and 1939 even though whaling was not conducted in five of these years (Reeves *et al.* 1985)) was interpreted to mean that the local density of fin whales remained far below that of the early twentieth century (Stewart *et al.* 1987). A ship cruise south of the Aleutians in August 1994 also failed to find appreciable numbers of fin whales (Forney and Brownell 1996). However, large numbers of fin whales were seen in the Gulf of Alaska during the Structure of Populations, Levels of Abundance and Status of Humpback whales surveys (SPLASH) in 2004 (Barlow *et al.* 2011). Seabird surveys near the Pribilof Islands in the Bering Sea indicated a substantial increase in the local abundance of fin whales between 1975–1978 and 1987–1989 (Baretta and Hunt 1994). A rough estimate of the size of the population west of the Kenai Peninsula could include the combined estimates from Moore and Clarke (2002) and Zerbini *et al.* (2006). Using this approach, the provisional estimate of the fin whale population west of the Kenai Peninsula would be 5,700 (Carretta *et al.* 2011). This is a minimum estimate for the entire stock because it was estimated from surveys that covered only a small portion of the range of this stock.

Zerbini *et al.* (2006) estimated rates of increase of fin whales in coastal waters south of the Alaska Peninsula (Kodiak and Shumagin Islands). An annual growth rate of 4.8% (95% CI: 4.1–5.4%) was estimated for the period 1987–2003. This estimate is the first available for North Pacific fin whales and is consistent with other estimates of population growth rates of large whales. It should be used with caution, however, due to uncertainties in the initial population estimate for the first trend year (1987) and due to uncertainties about the population structure of fin whales in the area. Also, the study represented only a small fraction of the range of the northeast Pacific stock.

Southern Hemisphere

From 1904 to 1975, there were 703,693 fin whales taken in Antarctic whaling operations (IWC 1990). Whaling in the Southern Hemisphere originally targeted humpback whales, but by 1913, this target species became rare and the catch of fin and blue whales began to rise (Mizroch *et al.* 1984). From 1911 to 1924, there were 2,000–5,000 fin whales taken per year. After the introduction of factory whaling ships in 1925, the number of whales taken per year increased substantially. From 1931 to 1972, approximately 511,574 fin whales were caught (Kawamura 1994). In 1937 alone, over 28,000 fin whales were taken. From 1953 to 1961, the number of fin whales taken per year continued to average around 25,000. In 1962, sei whale catches began to increase as fin whales became scarce. By 1974, less than 1,000 fin whales were being caught per year. The IWC prohibited the taking of fin whales from the Southern Hemisphere in 1976.

Recently released Soviet whaling records indicate a discrepancy between reported and actual fin whale catch numbers by the Soviets in southern waters between 1947 and 1980 (Zemsky *et al.* 1995). The USSR previously reported 52,931 whales caught, whereas the new data indicates that only 41,984 were taken. Catches of fin whales were likely overreported to hide the illegal catches of other species like the pygmy blue, humpback, and right whale.

The most current population estimate calculated in 1979 is 85,200 (no CV given) based on the history of catches and trends in CPUE (IWC 1979). In addition, 15,178 whales (no CV given and uncorrected for probability of sighting) were estimated to occur within surveyed areas south of 30°S by combining data from Japan Scouting Vessels and IWC/International Decade of Cetacean Research 1978–88 ship-based estimated to contain 400,000 fin whales (IWC 1989). The current abundance estimate (1979) should be considered a poor estimate because CPUE-based abundance estimates are no longer accepted in IWC stock assessments and the historical back calculation was based on historical catches known to be seriously flawed. Also, when abundance estimates become many years old, at some point they will no longer meet the requirement that they provide reasonable assurance that the stock size is presently greater than or equal to that estimate (NMFS 2005). Therefore, there is low confidence in this abundance estimate for the Southern Hemisphere. There are no currently accepted estimates of trends in abundance.

and

2. Factors that may limit population growth, *i.e.*, those that are identified in the threats analysis in the recovery plan as high or medium or unknown under relative impact to recovery, have been identified and are being or have been addressed to the extent that they allow for continued growth of populations. Specifically, the factors in 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.

- *Competition with fisheries for resources is being addressed through fishery management plans and other measures.* (Threat discussed in Recovery Plan section G.10.)

This criterion has not been met.

The severity of this threat was ranked as unknown and the uncertainty is high in the recovery plan, thus the relative impact to recovery of fin whales due to this threat is ranked as unknown.

In a review of the evidence for interspecific competition in baleen whales, Clapham and Brownell (1996) found it to be extremely difficult to prove that interspecific competition comprises an important factor in the population dynamics of large whales. The prey species taken by fin whales are also taken by other baleen whales. Thus, competitive interactions are possible; however, there is no basis for assuming that competition for food among baleen whales, per se, is a factor in determining their population trend and abundance.

Fin whales feed on a fairly broad spectrum of prey, but fishery-caused reductions in prey resources (*e.g.,* herring and mackerel in the North Atlantic) could have an influence on fin whale abundance (Waring *et al.* 1997). The effect on fin whales' foraging efficiency resulting from disruption of large prey aggregations due to commercial fishing is not well known. Commercial removal of prey species may have a limited effect on fin whales, particularly if a large biomass remains unharvested and accessible. Furthermore, the disruption of large prey aggregations into multiple smaller aggregations by fishing activity could enhance fin whale foraging success. The species-specific duration and degree of prey disruption due to commercial harvest are also unknown and it is not known what impact switching to alternate prey may have on fin whales. Other threats that could be confounded with fisheries are environmental variability and interspecific competition. Research is needed to reduce these uncertainties.

- *Effects of reduced prey abundance due to climate change continue to be investigated and action is being taken to address the issue, as necessary.* (Threat discussed in Recovery Plan section G.11.)

This criterion has not been met.

The threat severity posed by environmental variability to fin whale recovery was ranked as medium in the recovery plan due to the oceanographic and atmospheric conditions that have changed over the last several decades. Uncertainty was ranked as high, due to the unknown potential impacts of climate and ecosystem change on fin whale recovery and regime shifts on fin whale prey. Thus, the relative impact to recovery was ranked as unknown but potentially high.

Climate change has received considerable attention in recent years, with growing concerns about global warming and the recognition of natural climatic oscillations on varying time scales, such as long term shifts like the Pacific Decadal Oscillation or short term shifts, like El Niño or La Niña. Evidence suggests that the productivity in the North Pacific (Mackas *et al.* 1989; Quinn and Niebauer 1995) and other oceans could be affected by changes in the environment. Increases in global temperatures are expected to have profound impacts on arctic and sub-arctic ecosystems, and these impacts are projected to accelerate during this century (ACIA 2004; IPCC 2007). The potential impacts of climate and oceanographic change on fin whales will likely affect habitat and prey availability. Site selection for migration, feeding, and breeding for fin whales may be influenced by factors such as ocean currents and water temperature. Any changes in these factors could render currently used habitat areas unsuitable. Changes to climate and oceanographic processes may also lead to decreased productivity in different patterns of prey distribution and availability. Such changes could affect fin whales that are dependent on those affected prey. Recent work has found that copepod distribution has showed signs of shifting in the North Atlantic due to climatic changes (Hays *et al.* 2005). The feeding range of fin whales is larger than that of other large whale species and consequently, it is likely that the fin whale may be more resilient to climate change, should it affect prey, than a species with a narrower range.

- *Effects of anthropogenic noise continue to be investigated and actions taken to minimize potential effects, as necessary.* (Threat discussed in Recovery Plan section G.2.)

This criterion has not been met.

The relative impact of anthropogenic noise to the recovery of fin whales is ranked in the recovery plan as unknown due to an unknown severity and a high level of uncertainty. The effects of anthropogenic noise are difficult to ascertain and research on this topic is ongoing. Recent controlled exposure experiments are being conducted to evaluate the effect of mid-frequency sound on a variety of marine mammals, including large whale species (Southall *et al.* 2011). The possible impacts of the various sources of anthropogenic noise have not been well studied on fin whales and remain unknown. As human activities increase in the ocean, so does the potential for noise. For example, in some regions, low-frequency ambient noise levels thought to be associated with increased levels of commercial shipping activity have increased on average of 3 dB per decade (McDonald *et al.* 2006).

<u>Oil and Gas Exploration</u>

Drilling for oil and gas generally produces low-frequency sounds with strong tonal components. The relative impact to recovery of fin whales due to this threat remains unknown because the severity of this threat is unknown and the uncertainty is high.

There are few available data on the noise from conventional drilling platforms. Recorded noise from an early study of one drilling platform and three combined drilling production platforms found that noise levels were so low that it was almost undetectable alongside the platform at Beaufort scale sea states of three or above. The strongest tones were at very low frequencies near 5 Hz (Richardson *et al.* 1995).

Oil and gas exploration activities, including seismic surveys, typically operate with marine mammal observers as part of required mitigation measures detailed in permits issued for the activity. There have been no reported seismic-related or industry ship-related deaths or injuries to fin whales in areas where marine mammal observers are present.

A variety of devices and technologies exist which introduce sound energy into the water for purposes of geophysical research, bottom profiling, and depth determination. They are often characterized as high-resolution or low-resolution systems. Low-resolution systems such as 2-D and 3-D seismic surveys put appreciable sound energy into the water and operate at low frequencies, which overlap with those used by baleen whales. All of these systems require a vessel platform (or several vessels) which themselves may impact whales. See section on ship strikes for direct impacts from ships, other than noise.

Baleen whales are known to detect the low-frequency sound pulses emitted by airguns and have been observed reacting to seismic vessels (e.g., McCauley *et al.* 2000; Stone 2003). However, in a study off Oregon, fin whales continued to produce their normal sounds despite the presence of seismic air gun pulses (McDonald *et al.* 1995). Field observations have suggested that the behavior of whales at the moment of exposure may influence the degree to which they may react to seismic surveys. The best information indicates that responses to air gun noise is variable and may be context specific.

Anthropogenic noise near prey aggregations may also affect fin whale feeding. The results of collaborative research conducted by several scientists from a variety of nations and the Cornell Lab of Ornithology from 1999–2000 in the Sea of Cortez suggest that the long, low-frequency songs of male fin whales function to attract females to dense patches of food, where mating then occurs. The findings of that study helped to bring attention to the potential effects of human-produced underwater noise on large whales because if whales rely on long-distance acoustic signals to find each other for mating, the recovery rate of fin whale populations from past exploitation could be impeded by low-frequency sounds generated by human activities such as seismic surveys (for a discussion of masking, see section G.2.2 in the Fin Whale Recovery Plan). Seismic surveys have also occurred in areas of krill abundance in Australia, where fin whales have occasionally been seen feeding (Department of the Environment and Heritage 2005).

Military Sonar and Explosives

The severity of the effect of military sonar and detonations on fin whales remains largely unknown. Therefore, the relative impact to recovery of fin whales due to this threat is ranked as unknown in the recovery plan.

Military training activities by the U.S. Navy regularly occur in the Atlantic (including the Gulf of Mexico and the Mediterranean Sea), Indian, and Pacific Oceans. These activities include anti-submarine warfare, surface warfare, anti-surface, mine warfare exercises, missile exercises, sinking exercises, and aerial combat exercises. In addition to these training activities, the U.S. Navy conducts ship shock trials, which involve detonations of high explosive charges, and operates several permanent and temporary (portable) undersea warfare training ranges that employ acoustic sensors.

As part of its suite of training activities, the U.S. Navy employs low-frequency, mid-frequency, and high-frequency active sonar systems. The primary low-frequency sonar active sonar system is the Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar system, which produces loud signals in the 100–500 Hz range, and has operated in the western and central Pacific Ocean. The U.S. Navy employs several mid-frequency sonar systems that range from large systems mounted on the hulls of ships (*e.g.*, AN/SQS-53 and -56), to smaller systems that are deployed from helicopters and fixed-wing aircraft, sonobuoys, and torpedoes. These sonar systems can produce loud sounds at frequencies of between 1 and 10 k Hz and higher (Evans and England 2001; U.S. Department of the Navy 2008).

The effect of active sonar on fin whales has not been studied extensively and remains uncertain; however, active sonar associated with naval training activities might adversely affect fin whales in several different ways. First, low-frequency sonar transmissions that overlap with fin whale vocalizations might mask communication between whales which would affect the social ecology and social interactions of fin whale groups. Second, overlap between fin whale hearing and low- and mid-frequency active sonar might result in noise-induced losses of hearing sensitivity or behavioral disturbance as fin whales avoid or evade sonar transmissions. Nevertheless, studies of the effects of SURTASS LFA sonar on foraging blue and fin whales in California did not detect biologically significant responses to the LFA sonar in fin whales (U.S. Department of the Navy 2007).

Underwater detonations associated with military training activities range from large high explosives such as those associated with sinking exercises or ship shock trials, to missile exercises, gunnery exercises, mine warfare, disposal of unexploded ordnance, and grenades. Detonations produce shock waves and sound fields of varying size. Animals that occur close to a large detonation might be killed or seriously injured. Animals that are further away might suffer lesser injury (*i.e.,* tympanic membrane rupture, or slight to extensive lung injury), while animals that are even further away might experience physiological stress responses or behavioral disturbance whose severity depends on their distance from the detonation.

Various measures are being developed to prevent fin whales from being exposed to active sonar transmissions or underwater detonations. For example, the SURTASS LFA sonar system employs a high-frequency active sonar that allows the U.S. Navy to detect large and most small cetaceans and shut down sonar transmissions until whales have moved away from the sonar source. Tests of this sonar system suggest that it detects more than 96 percent of the whales that occur within 1 kilometer of the sonar system. As another example, the suite of monitoring protocols the U.S. Navy developed during the ship shock trial on the *U.S.S. Winston Churchill* were effective at preventing fin whales, other cetaceans, and sea turtles from being exposed to the shock wave associated with those detonations. Other measures are being developed and tested to reduce the probability of exposing fin whales and other cetaceans to active sonar transmissions and shock waves of underwater detonations.

The relatively large spatial scale, frequency, duration, and diverse nature of these training activities in areas in which fin whales occur suggest that these activities have the potential to adversely affect fin whales. Preliminary results of ongoing controlled exposure experiments indicate variable responses, depending on species, type of sound, and behavioral state during the experiments. Some observations in certain conditions suggest avoidance responses, while in other cases subjects seemed unresponsive (Southall *et al.* 2011).

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

- *Management measures are in place that ensure that any direct harvest (commercial, subsistence, and scientific) is at a sustainable level.* (Threat discussed in Recovery Plan section G.9.)

This criterion has been partly met as long as the U.S. remains a party to the IWC (*i.e.*, management measures are in place). The threat of direct harvest of fin whales occurs at a medium severity and there is a medium level of uncertainty. Thus, the relative impact to recovery of fin whales due to direct harvest is ranked as medium in the recovery plan.

Direct harvest, although rare today, was the main cause of initial depletion of fin whales and other large whales. The IWC's moratorium on the commercial hunting of fin whales in most of their range has been in force for more than two decades, and it has almost certainly had a positive effect on the species' recovery.

In accordance with the IWC moratorium, fin whales are presently commercially hunted in the Northern Hemisphere only in Greenland under the IWC's procedure for aboriginal subsistence whaling (Caulfield 1993; Gambell 1993). Meat and other products from whales killed in this hunt are widely marketed within the Greenland economy, but export is illegal. The IWC Scientific Committee has repeatedly expressed concern about the small central estimate and lower confidence limit (1,096, 95% CI, 520–2,106) for this stock (IWC 1998b). In the absence of scientific management advice, the IWC has continued to set a quota of 19 fin whales per year for Greenland (IWC 1998a). As stated above, Iceland and Norway do not adhere to IWC's moratorium on commercial whaling because both countries filed objections to that moratorium. Iceland resumed commercial whaling after whalers caught a fin whale and issued a quota of 9 fin whales in 2006–2007 (7 reportedly killed), and at least two fin whales were killed in 2009.

Fin whales are a target species for Japanese Antarctic Special Permit whaling for the 2005/2006 and 2006/2007 seasons at 10 fin whales per year. The proposal for the following 12 years includes 50 fin whales per year; despite this higher target, Japan took zero fin whales in the 2007/2008 season, one in the 2008/2009 season, and possibly one in the 2009/2010 season.

Well-documented pirate whaling in the northeastern Atlantic was last documented in 1979 (Best 1992; Sanpera and Aguilar 1992), and attempted illegal trade in baleen whale meat was documented several times during the 1990s (Baker and Palumbi 1994). Since the mid-1970s, there has been some demand in world markets (most of it centered in Japan) for baleen whale meat (Aguilar and Sanpera 1982). Therefore, it cannot be assumed that fin whales have been fully protected from commercial whaling since 1986 or that their current legal protection from commercial whaling will continue into the future.

Factor C: Disease or Predation.

- *There are no criteria for this factor because there are no data to indicate that disease or predation are threats.*

Factor D: The inadequacy of existing regulatory mechanisms.

- *Ship collisions continue to be investigated and actions taken to minimize potential effects as necessary*. (Threat discussed in Recovery Plan section G.3.)

This criterion has not been fully met. Ship collisions continue to be recorded when reported or observed, and necropsies on stranded whales are performed when possible to confirm cause of death. Federal agencies continue to consult with NMFS on federally funded or permitted actions and take measures to reduce the likelihood of ship strikes. However, no new ship strike prevention regulations specific to fin whales have been implemented.

The threat of ship strikes occurs at a medium severity, but with the high level of uncertainty according to the recovery plan. Thus, the relative impact to recovery of fin whales due to ship strikes is unknown but potentially high.

Laist *et al.* (2001), Jensen and Silber (2004), Vanderlaan and Taggart (2007), and Van Waerebeek and Leaper (2008) compiled information available worldwide regarding documented collisions between ships and large whales. Of the 292 ship strike records compiled by Jensen and Silber (2004), 75 of the records (26%) indicated that fin whales had been struck. In some areas studied, one-third of all fin whale strandings appeared to involve ship strikes.

From 1993–2002, a minimum of 15 fin whales were struck and killed by ships off the east coast of the U.S. During the same time frame, a minimum of five whales were killed off the west coast of the U.S. (Jensen and Silber 2004). One was killed off the Gulf Coast, another was hit but appeared uninjured in Alaska, and 12 were hit in foreign waters (Canada, UK, France and Italy) (Jensen and Silber 2004). From 2004–2008, ten fin whales from the North Atlantic stock were struck and killed by ships off the east coast (Waring *et al.* 2009). During 2004–2008, ship strikes were implicated in the deaths of four fin whales from the California/Oregon/Washington stock and the injury of another four (Carretta *et al.* 2011). Two additional fin whales from the California/Oregon/Washington stock stranded dead in California in 2007, but the cause of death was not determined. From 2005–2010, an additional seven unidentified cetaceans (likely baleen whales) were killed due to ship strikes and were reported in California. Four fin whales were struck off the Northwest coast of the U.S.; three were identified in Washington and one was identified in Oregon (U.S. Department of Commerce 2011) . In Alaska, two fin whales stranded dead in 2003, but were too far decomposed to adequately determine the cause of death. Between 2006–2010, three fin whale deaths in Alaska were attributed to ship strike. Two of these whales were discovered on bulbous bows (a cruise ship and an oil tanker), while the third was a floater which was towed and necropsied to reveal ante-mortem fracturing of the skull indicative of vessel strike. Because many ship strikes go either undetected or unreported, these cases represent minimums for vessel interactions with fin whales.

Within specified areas of U.S. waters in the Atlantic, NMFS has established ship speed restrictions, mandatory ship reporting systems, recommended routes, and an extensive sighting advisory system to protect North Atlantic right whales. While these measures were designed to protect right whales specifically, they are expected to also reduce the risk of ship strikes to other marine mammals, including fin whales (NMFS 2008).

The possible impacts of ship strikes on the recovery of fin whale populations is not well understood. Many ship strikes go unreported or undetected for various reasons and the offshore distribution of fin whales may make collisions with them less detectable than with other species, thus the estimates of serious injury or mortality should be considered minimum estimates. As a result, there is a high level of uncertainty associated with the evidence presented above.

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

No other factors are known to be threats.

2.3 Updated Information and Current Species Status

Covered in Section 2.1.

2.4 Synthesis

Recovery criteria outlined in the fin whale recovery plan (NMFS 2010) are current and meet the ESA standards of objective and measurable recovery criteria by including both “biological” criteria on abundance and trends or risk analysis, and “threats-based” criteria that address the five factors outlined in section 4 of the ESA. However, whether these criteria have been met is unknown because of data deficiencies.

With regard to the biological criteria, no reliable trend information is available for any of the three ocean basins (Criterion 1), and a risk analysis has not been conducted (Criterion 1) because sufficient information is not available at this time to conduct a robust analysis. With regard to the threats-based criteria, the magnitude and impact of the threat is uncertain (e.g., ship strikes, anthropogenic noise, competition for resources, and loss of prey base due to climate change), thus making the degree of threat unknown. This problem is exacerbated by the lack of information on the status and trends of the species, which, if known to be increasing steadily, would assist in determining whether these factors are limiting the recovery of the species. Finally, while actions have been taken to address some of the factors that may be limiting recovery as required by the threats-based criteria (*e.g.*, ship strike rule, fishing gear entanglement risk reduction measures), additional measures may be necessary to fully mitigate these threats.

3.0 RESULTS

3.1 Recommended Classification: *Given your responses to previous sections, particularly section 2.4. Synthesis, make a recommendation with regard to the listing classification of the species*

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
 ____ *Extinction*
 ____ *Recovery*
 ____ *Original data for classification in error*
_X_ No change is needed

3.2 New Recovery Priority Number *(indicate if no change; see Appendix E)*: 9

Brief Rationale: Based on threats assessments contained in the recovery plan, overall the threats are low and recovery potential is high, but there is still the potential for conflict due to competition with fisheries, anthropogenic noise, and ship strikes.

3.3 Listing and Reclassification Priority Number, if reclassification is recommended *(see Appendix E)*

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (Removal from list regardless of current classification) Priority Number: ____

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The lack of ocean-wide status and trend information called for under Criterion 1 underscores the need for ocean-wide surveys for fin whales (which could be combined with surveys for other large whale species). This is necessary to ascertain the status of fin whales and to gain an understanding of the effect of the whaling moratorium, which has now been in place for nearly three decades. While ocean-wide surveys are of the utmost importance, continuing surveys in U.S. waters could also enhance information on U.S. populations and their threats, and provide trend data on a subset of North Atlantic and North Pacific fin whales. These surveys should be conducted in such a way as to collect comparable data periodically to ensure that trend data are meaningful.

Additionally, it is necessary to support existing studies and initiate new studies to investigate population discreteness and population structure of fin whales. Existing knowledge of the population structure of fin whales is insufficient, and a more comprehensive understanding is essential for developing strategies to promote recovery and for classifying the populations according to their recovery status.

The degree of several potential threats to fin whales is currently unknown and should continue to be researched. These include 1) anthropogenic noise from vessels, oil and gas activities, and military sonar and explosives, 2) ship strikes, 3) competition for resources, and 4) loss of prey resources due to climate and ecosystem change.

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NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW
Finback whale

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: Larissa Plants, Office of Protected Resources, Silver Spring, MD; Shannon Bettridge, Office of Protected Resources, Silver Spring, MD; Susan Pultz, Office of Protected Resources, Silver Spring, MD;

REGIONAL OFFICE APPROVAL:

Lead Regional Administrator, NOAA Fisheries Service

Approve: ____ Date: ________

The Lead Region must ensure that other Regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. Written concurrence from other regions is required.

Cooperating Regional Administrator, NOAA Fisheries Service

_____Concur _____ Do Not Concur

Signature____ Date_______

HEADQUARTERS APPROVAL:

Assistant Administrator, NOAA Fisheries

__✓__Concur _____ Do Not Concur

Signature____ Date 12/21/11