BLUE WHALE (*Balaenoptera musculus musculus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of the blue whale, *Balaenoptera musculus musculus,* in the western North Atlantic generally extends from the Arctic to at least mid-latitude waters. Blue whales are most frequently sighted in the waters off eastern Canada, with the majority of recent records from the Gulf of St. Lawrence (Sears *et al.* 1987). The species was hunted around Newfoundland in the first half of the 20th century (Sergeant 1966). The present Canadian distribution, broadly described, is spring, summer, and fall in the Gulf of St. Lawrence, especially along the north shore from the St. Lawrence River estuary to the Strait of Belle Isle and off eastern Nova Scotia. The species occurs in winter off southern Newfoundland and also in summer in Davis Strait (Mansfield 1985). Individual identification has confirmed the movement of a blue whale between the Gulf of St. Lawrence and western Greenland (Sears and Larsen 2002), although the extent of exchange between these two areas remains unknown. Similarly, a blue whale photographed by a NMFS large whale survey in August 1999 had previously been observed in the Gulf of St. Lawrence in 1985 (R. Sears and P. Clapham, unpublished data) and there have been additional photographic resightings between the Gulf of Maine, Scotian Shelf and Gulf of St. Lawrence (R. Sears, pers. comm.).

The blue whale is best considered as an occasional visitor in US Atlantic Exclusive Economic Zone (EEZ) waters, which may represent the current southern limit of its feeding range (CETAP 1982; Wenzel *et al.* 1988). All of the five sightings described in the foregoing two references were in August. Yochem and Leatherwood (1985) summarized records that suggested an occurrence of this species south to Florida and the Gulf of Mexico, although the actual southern limit of the species' range is unknown.

Using the U.S. Navy's SOSUS program, blue whales have been detected and tracked acoustically in much of the North Atlantic, including in subtropical waters north of the West Indies and in deep water east of the US Atlantic EEZ, indicating the potential for long-distance movements (Clark 1995). Most of the acoustic detections were around the Grand Banks area of Newfoundland and west of the British Isles. Historical blue whale observations collected by Reeves *et al*. (2004) show a broad longitudinal distribution in tropical and warm temperate latitudes during the winter months, with a narrower, more northerly distribution in summer. Sigurjónsson and Gunnlaugsson (1990) note that North Atlantic blue whales appear to have been depleted by commercial whaling to such an extent that they remain rare in some formerly important habitats, notably in the northern and northeastern North Atlantic.

Photo-identification in eastern Canadian waters indicates that blue whales from the St. Lawrence, Newfoundland, Nova Scotia, New England and Greenland all belong to the same stock, while blue whales photographed off Iceland and the Azores appear to be part of a separate population (CETAP 1982; Wenzel *et al.* 1988; Sears and Calambokidis 2002; Sears and Larsen 2002).

POPULATION SIZE

Little is known about the population size of blue whales except for the Gulf of St. Lawrence area. From 1979 to the summer of 2009, a total of 440 blue whales was photo-identified mainly in the St. Lawrence estuary and northwestern Gulf of St. Lawrence (R. Sears, pers. comm.). Biopsies were taken on nearly 40% of this population (R. Sears, pers. comm.). Each year, from 20 to 105 blue whales are identified in this region. Approximately 40% of the identified blue whales return frequently to the study area, the others have been observed during fewer than three seasons between 1979 and 2002, which suggests that these individuals range mostly outside the St. Lawrence, possibly in the waters at the edge of the continental shelf, from the Labrador Sea and Davis Strait in the north, east to the Flemish Cap and south to New England (Sears and Calambokidis 2002). Photo-identification data from outside the estuary and Gulf of St. Lawrence are limited. A few blue whales have been photographed along the coast of Newfoundland, on the Scotian Shelf and in the Gulf of Maine, and some are not included among the 440 blue whales that have been identified in the estuary and northwest of the Gulf of St. Lawrence (Sears and Calambokidis, 2002; J. Lawson, pers. comm.). Ramp *et al*. (2006) estimated the survival rate at 0.975 and the gender ratio of the 139 biopsy sampled individuals at 79 males for 67 females (Sears 2003). Given the small proportion of the distribution range that has been sampled and considering the low number of blue whales encountered and photographed, the current data, based on photo-identification, do not allow for an estimate of abundance of this species in the Northwest Atlantic with a minimum degree of certainty (Sears *et al.* 1987; Hammond *et al.* 1990; Sears *et al.* 1990; Sears and Calambokidis 2002; Fisheries and Oceans Canada 2009). Mitchell (1974) estimated that the blue whale population in the western North Atlantic may number only in the low hundreds. R. Sears (pers. comm.) suggests that 400 to 600 individuals may be found in the western North Atlantic.

Minimum Population Estimate

The catalogue count of 440 recognizable individuals from the Gulf of St. Lawrence is considered to be a minimum population estimate for the western North Atlantic stock.

Current Population Trend

There are insufficient data to determine population trends for this species. Off western and southwestern Iceland, an increasing trend of 4.9% a year was reported for the period 1969-1988 (Sigurjonsson and Gunnlaugsson 1990). Pike *et al*. (2009) conducted ship surveys in the Central and Northeast Atlantic in 1987, 1989, 1995 and 2001. Blue whales were most commonly sighted off western Iceland, and to a lesser extent northeast of Iceland. They were very rare or absent in the Northeast Atlantic. Sightings were combined over all surveys to estimate the detection function using standard line-transect methodology, with the addition of a covariate to account for differences between surveys. Total abundance was highest in 1995 (979, 95% CI 137-2,542) and lowest in 1987 (222, 95% CI 115-440). Uncertainty in species identity had little effect on estimates of abundance. There was a significant positive trend in abundance northeast of Iceland and in the total survey area. These estimates should be treated with caution given the effort biases underlying the sightings data on which it was based.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 440. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for stocks which are endangered, depleted, or threatened or of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.10 because the blue whale is listed as endangered under the Endangered Species Act (ESA). PBR for the Western North Atlantic stock of blue whale is 0.9.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Threats for North Atlantic blue whales are poorly known, but may include ship strikes, pollution, entanglement in fishing gear, and long-term changes in climate (which could affect the abundance of their zooplankton prey). During winter and early spring, ice-related strandings and entrapments have been documented on the southwestern and eastern coasts of Newfoundland (Sears and Calambokidis 2002). There are no recent confirmed records of mortality or serious injury to blue whales in the US Atlantic EEZ. However, in March 1998 a dead 20-m (66-ft) male blue whale was brought into Rhode Island waters on the bow of a tanker. The cause of death was determined to be ship strike. Although it appears likely that the vessel concerned was responsible, the necropsy revealed some injuries that were difficult to explain in this context. The location of the strike was not determined; given the known rarity of blue whales in US Atlantic waters, and the vessel's port of origin (Antwerp), it seems reasonable to suppose that the whale died somewhere to the north or east of the US Atlantic EEZ.

Fishery Information

No fishery information is presented because there are no observed fishery-related mortalities or serious injury.

STATUS OF STOCK

The status of this stock relative to OSP in the US Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine population trends for blue whales. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant and approaching a zero mortality and serious injury rate. This is a strategic stock because the blue whale is listed as an endangered species under the ESA. A Recovery Plan has been published (Reeves *et al.* 1998) and is in effect.

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