May 2016

MINKE WHALE (*Balaenoptera acutorostrata acutorostrata*): Canadian East Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Minke whales have a cosmopolitan distribution in temperate, tropical and high-latitude waters. In the North Atlantic, there are four recognized populations—Canadian East Coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). These divisions were defined by examining segregation by sex and length, catch distributions, sightings, marking data, and pre-existing ICES boundaries. However, there were very few data from the Canadian East Coast population. Anderwald *et al.* (2011) found no evidence for geographic structure comparing these putative populations but did, using individual genotypes and likelihood assignment methods, identify two cryptic stocks distributed across the North Atlantic. Until better information is available, minke whales off the eastern coast of the United States are considered to be part of the Canadian East Coast stock, which inhabits the area from the western half of the Davis Strait (45ºW) to the Gulf of Mexico. It is also uncertain if there are separate sub-stocks within the Canadian East Coast stock.

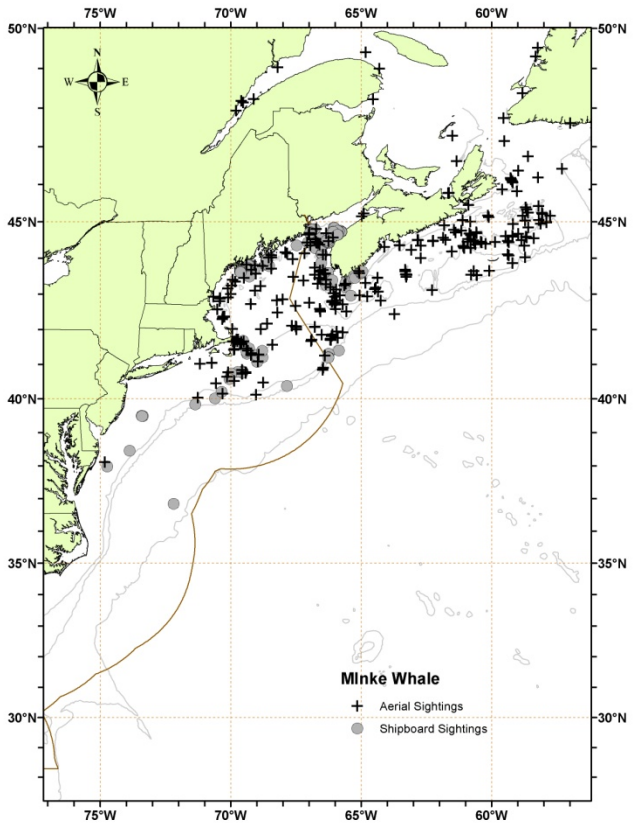

Figure 1. *Distribution of minke whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The minke whale is common and widely distributed within the U.S. Atlantic Exclusive Economic Zone (EEZ) (CETAP 1982). There appears to be a strong seasonal component to minke whale distribution. Spring to fall are times of relatively widespread and common occurrence, and when the whales are most abundant in New England waters, while during winter the species appears to be largely absent (e.g., Risch *et al.* 2013). Like most other baleen whales, minke whales generally occupy the continental shelf proper (< 100 m deep), rather than the continental shelf-edge region. Records summarized by Mitchell (1991) hint at a possible winter distribution in the West Indies, and in the mid-ocean south and east of Bermuda. As with several other cetacean species, the possibility of a deep-ocean component to the distribution of minke whales exists but remains unconfirmed.

POPULATION SIZE

The best recent abundance estimate for this stock is 20,741 (CV=0.30) minke whales. This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007 and is considered best because, while it did not cover any U.S. waters, the survey covered more of the minke whale range than the other surveys reported here.

Earlier estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions As recommended in the GAMMS II Workshop Report (Wade and Angliss 1997), estimates older than

eight years are deemed unreliable for the determination of the current PBR.

Recent surveys and abundance estimates

An abundance estimate of 20,741 (CV=0.30) minke whales was generated from the TNASS in July-August 2007. This survey covered from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling, and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake *et al.* (1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 2,591 (CV=0.81) minke whales was generated from a shipboard and aerial survey conducted during June-August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent-observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple-covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of recent abundance estimates for the Canadian East Coast stock of minke whales (*Balaenoptera acutorostrata acutorostrata*) by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation. (CV).

Month/Year	Area	N_{best}	CV
Jul-Aug 2007	N. Labrador to Scotian Shelf	20,741	0.30
Jul-Aug 2011	Central Virginia to lower Bay of Fundy	2,591	0.81

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Canadian East Coast stock of minke whales is 20,741animals (CV=0.30). The minimum population estimate is 16,199 animals.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity are that females mature between 6 and 8 years of age, and pregnancy rates are approximately 0.86 to 0.93. Based on these parameters, the calving interval is between 1 and 2 years. Calves are probably born during October to March after 10 to 11 months gestation and nursing lasts for less than 6 months. Maximum ages are not known, but for Southern Hemisphere minke whales maximum age appears to be about 50 years (IWC 1991; Katona *et al.* 1993).

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 16,199. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 , the default value for stocks of unknown status relative to OSP, and the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the Canadian east coast minke whale is 162.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During 2009 to 2013, the average annual minimum detected human-caused mortality and serious injury was 7.9 minke whales per year (0.2 minke whales per year from observed U.S. fisheries, 6.5 minke whales per year (unknown CV) from U.S. and Canadian fisheries using strandings and entanglement data, and 1.2 per year from ship strikes.

Data to estimate the mortality and serious injury of minke whales come from the Northeast Fisheries Science Center Observer Program, the At-Sea Monitor Program, and from records of strandings and entanglements in U.S. and Canadian waters. For the purposes of this report, mortalities and serious injuries from reports of strandings and entanglements considered confirmed human-caused mortalities or serious injuries are shown in Table 2 while those recorded by the Observer or At-Sea Monitor Programs are shown in Table 3.

Detected interactions in the strandings and entanglement data should not be considered an unbiased representation of human-caused mortality. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate, which is almost certainly biased low.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

For more details on the historical fishery interactions prior to 1999, see Waring *et al.* (2007).

In 2002, one minke whale mortality and one live release were attributed to the lobster trap fishery. A June 2003 mortality, while wrapped in lobster gear, cannot be confirmed to have become entangled in the area, and so is not attributed to the fishery. Annual mortalities due to the northeast/mid-Atlantic Lobster Trap/Pot fishery, as determined from strandings and entanglement records that have been audited, were 1 in 1991, 2 in 1992, 1 in 1994, 1 in 1995, 0 in 1996, 1 in 1997, 0 in 1998 to 2001, 1 in 2002, and 0 in 2003 through 2011. See Appendix V for more information on historical takes.

U.S.

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

During July 2013, one minke whale was observed dead in the mid-water otter trawl on Georges Bank. Due to the small sample size of observed takes, an expanded estimate was not calculated. Annual average estimated minke whale mortality and serious injury from the mid-Atlantic mid-water trawl (including pair trawl) during 2009 to 2013 was 0.2 (Table 3).

Pelagic Longline

In 2010, a minke whale was caught but released alive (no serious injury) in the pelagic longline fishery, South Atlantic Bight fishing area (Garrison and Stokes 2012).

Other Fisheries

The audited NE Regional Office/NMFS entanglement/stranding database contains records of minke whales, of which the confirmed mortalities and serious injuries from the last five years are reported in Table 2. During 2009 to 2013, as determined from stranding and entanglement records confirmed to be of U.S. origin or first sighted in U.S. waters, the minimum detected average annual mortality and serious injury was 3.75 minke whales per year in U.S. fisheries (Table 2). Most cases where gear was recovered and identified involved gillnet or pot/trap gear.

CANADA

Read (1994) reported interactions between minke whales and gillnets in Newfoundland and Labrador, in cod traps in Newfoundland, and in herring weirs in the Bay of Fundy. Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in

Canadian waters, on between 25% and 40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. During 1991 through 1996, no minke whales were observed taken.

Herring Weirs

During 1980 to 1990, 15 of 17 minke whales were released alive from herring weirs in the Bay of Fundy. During January 1991 to September 2002, 26 minke whales were trapped in herring weirs in the Bay of Fundy. Of these 26, 1 died (H. Koopman, pers. comm.) and several (number unknown) were released alive and unharmed (A. Westgate, pers. comm.). Weir interactions that may have resulted in serious injury to minke whales are reported in Table 2.

Other Fisheries

Mortalities and serious injuries that were likely a result of an interaction with an unknown Canadian fishery are detailed in Table 2. During 2009 to 2013, as determined from stranding and entanglement records confirmed to be of Canadian origin or first sighted in Canadian waters, the minimum detected average annual mortality and serious injury was 2.75 minke whales per year in Canadian fisheries (Table 2; prorated value).

Table 2. Confirmed human-caused mortality and serious injury records of minke whales (*Balaenoptera acutorostrata acutorostrata*): 2009–2013[a]

Date[b]	Injury determination	ID	Location[b]	Assigned Cause[f]	Value against PBR[c]	Country[d]	Gear Type[e]	Description
4/19/2009	Prorated Injury	-	Grand Le Pierre, Labrador	EN	0.75	CN	PT	Partial disentanglement. Original and final configuration unknown.
5/20/2009	Mortality	-	off Point Pleasant, NJ	VS	1	US	-	Large hemorrhage at right pectoral
6/3/2009	Serious Injury	-	Tadoussac, Quebec	EN	1	CN	NR	Tight wrap on rostrum.
7/16/2009	Prorated Injury	-	Grand Manan Island, New Brunswick	ET	0.75	CN	WE	Live in weir. Not present the next day. Unclear if whale swam out or drowned.
8/11/2009	Serious Injury	-	off Plymouth, MA	EN	1	XU	NR	Constricting wrap; health decline: poor skin condition
9/2/2009	Prorated Injury	-	off Pumpkin Island, ME	EN	0.75	XU	NR	Full configuration unknown.
10/11/2009	Serious Injury	-	off Truro, MA	EN	1	US	MT	In net & on deck for short period. Released & swam off.
6/16/2010	Mortality	-	Goose River, Prince Edward Island	EN	1	CN	NP	Deep laceration consistent w/ entanglement at base of fluke w/ associated hemorrhage

7/2/2010	Mortality	-	Naufrage, Prince Edward Island	EN	1	CN	NP	Evidence of body entanglement & constriction at mouthline
7/9/2010	Mortality	-	Fire Island Inlet, NY	VS	1	US	-	3-4 large dorsal lacerations associated w/ fractured ribs
7/27/2010	Prorated Injury	-	off Bliss Island, New Brunswick	ET	0.75	CN	WE	Live in weir. Not present next day. Unclear if whale swam out or drowned.
8/21/2010	Serious Injury	-	off Plymouth Harbor, MA	EN	1	XU	NR	Embedded rostrum wrap.
5/6/2011	Mortality	-	off Martha's Vineyard, MA	EN	1	US	PT	Anchored in gear. Embedded line at fluke. Evidence of entanglement w/ associated hemorrhaging at mouth corners & insertion of pectorals
6/3/2011	Serious Injury	-	Tadoussac, Quebec	EN	1	CN	NR	Tight rostrum wrap.
7/17/2011	Prorated Injury	-	off Nahant, MA	EN	0.75	XU	NR	Full configuration unknown.
7/24/2011	Prorated Injury	-	off North Truro, MA	EN	0.75	XU	NR	Full configuration unknown
8/4/2011	Mortality	-	Sandy Hook Bay, NJ	VS	1	US	-	4 propeller lacerations across dorsal surface. Fractured ribs w/associated hemorrhaging
8/26/2011	Mortality	-	Horseshoe Cove, NJ	EN	1	US	NP	Fresh carcass w/ evidence of extensive entanglement
8/29/2011	Mortality	-	Moriches Bay, NY	VS	1	US	-	Extensive hemorrhage & edema along dorsal & both lateral surfaces
9/7/2011	Prorated Injury	-	Greenspond, Newfoundland	EN	0.75	CN	GN	Partially disentangled from anchoring gear. Final configuration unknown.

9/19/2011	Prorated Injury	-	Northumberland Strait, Prince Edward Island	EN	0.75	CN	NR	Partially disentangled from anchoring gear. Final configuration unknown
10/6/2011	Mortality	-	off Matinicus Island, ME	EN	1	US	PT	Fresh carcass anchored in gear
12/7/2011	Mortality	-	Carolina Beach, NC	VS	1	US	-	Healed deep & superficial propeller lacerations; internal lesions associated w/ deep lacerations indicative of peritonitis & infection
12/19/2011	Mortality	-	off Grand Manan Island, New Brunswick	EN	1	CN	PT	Live entanglement; recovered dead in gear the following day. Constricting peduncle wraps
2/4/2012	Prorated Injury	-	off Virginia Beach, VA	EN	0.75	XU	CE	Reported with hook/monofilament gear. Attachment point unknown
3/16/2012	Mortality	-	Ipswich, MA	EN	1	US	NP	Evidence of extensive, constricting gear w/ associated hemorrhaging
5/15/2012	Serious Injury	-	Sable Island Bank, Canada	EN	1	CN	PT	Disentangled from gear embedded down to bone of peduncle.
6/21/2012	Serious Injury	-	off Frenchboro, ME	EN	1	XU	NR	Constricting body wrap, flipper pinned, embedded in mouthline; emaciated
6/23/2012	Mortality	-	Newark, NJ	VS	1	US	-	Fresh carcass on bow of ship. Deep laceration across ventral surface; COD - disembowlment & hypovolemic shock
6/26/2012	Mortality	-	Renews Rock, Newfoundland	EN	1	CN	PT	Fresh carcass w/ constricting gear around peduncle

6/30/2012	Mortality	-	off Naufrage, Prince Edward Island	EN	1	CN	PT	Fresh carcass anchored in gear
7/1/2012	Prorated Injury	-	off Portsmouth, NH	EN	0.75	XU	NR	Full configuration unknown
7/1/2012	Mortality	-	Northern Lake Harbor, Prince Edward Island	EN	1	CN	PT	Constricting gear w/ associated hemorrhaging; COD - drowning
7/13/2012	Prorated Injury	-	off Jonesport, ME	EN	0.75	US	NR	Anchored. Partial disentanglement; Final configuration unknown
7/17/2012	Serious Injury	-	off Chatham, MA	EN	1	XU	NR	Tight wrap across back; health decline: emaciated
8/2/2012	Prorated Injury	-	off Provincetown, MA	EN	0.75	XU	NR	Full configuration unknown
8/5/2012	Mortality	-	Chatham, MA	EN	1	US	NR	Multiple constricting wraps through & around mouth and on fluke blades; COD - acute underwater entrapment
10/4/2012	Mortality	-	Cliff Island, ME	EN	1	US	NR	Evidence of constricting gear at mouthline, across ventral pleats, & at peduncle
7/23/2013	Prorated Injury	-	off Newport, RI	EN	0.75	XU	NR	Full configuration unknown
8/17/2013	Serious Injury	-	off Newburyport, MA	EN	1	XU	NR	Constricting rostrum wrap cutting into upper lip
8/31/2013	Mortality	-	Miminegash, Prince Edward Island	EN	1	CN	NP	Fresh carcass w/ evidence of extensive, constricting gear
10/04/2013	Prorated Injury	-	off Seal Harbor, ME	EN	0.75	US	NR	Anchored, partially disentangled, final configuration unknown
Five-year averages		Ship strike (US/CN/XU/XC)			1.20 (1.20/ 0.00/ 0.00/ 0.00)			
		Entanglement (US/CN/XU/XC)			6.5 (1.70/ 2.75/ 2.05/ 0.00)			
a. For more details on events please see Henry *et al.* 2015.								
b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.								

c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, MT=midwater trawl, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir

f. Assigned cause: EN=entanglement, VS=vessel strike, ET=entrapment.

Table 3. Summary of the incidental mortality and serious injury of Canadian East Coast stock of minke whales (*Balaenoptera acutorostrata acutorostrata*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the serious injuries and mortalities recorded by on-board observers, the estimated annual serious injury and mortality, the estimated CV of the combined annual mortality and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type[a]	Observer Coverage[b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Northeast Mid-water Trawl - Including Pair Trawl	09-13	Obs. Data Weighout Trip Logbook	.42, .41, .17, .45, .37	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0.2 (0)
TOTAL										0.2 (0)

[a] Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Observer Program and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort.

[b] Northeast mid-water trawl (including pair trawl) fisheries coverage is ratios based on trips.

Other Mortality

North Atlantic minke whales have been and continue to be hunted. From the Canadian East Coast population, documented whaling occurred from 1948 to 1972 with a total kill of 1,103 animals (IWC 1992). Animals from other North Atlantic minke populations are presently being harvested.

U.S.

Minke whales inhabit coastal waters during much of the year and are thus susceptible to collision with vessels. During 2009, one minke whale was confirmed dead due to a ship strike off New Jersey. In 2010 a juvenile male minke was discovered killed by ship strike off Fire Island, New York. In 2011, three juvenile minkes were confirmed dead due to ship strikes: a female off Sandy Hook, New Jersey, a female off Moriches, New York, and a male off Carolina Beach, North Carolina. In 2012, a confirmed vessel strike resulted in a mortality off Newark, New Jersey. Thus, during 2009–2013, as determined from stranding and entanglement records, the minimum detected annual average was 1.2 minke whales per year struck by ships in U.S. waters or first seen in U.S. waters (Table 2; Henry *et al.* 2015).

In October 2003, an Unusual Mortality Event was declared involving minke whales and harbor seals along the coast of Maine; since then, the number of minke whale stranding reports has returned to normal.

On 11 October 2009, the NOAA research vessel FSV Delaware II captured a minke whale during mid-water trawling operations associated with the 2009 Atlantic Herring Acoustics survey. Although brought on deck, the

animal was released alive and appeared to exhibit healthy behavior upon release. This record was evaluated under the serious injury determination guidelines (NOAA 2012) and included in Table 2 as a serious injury.

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia between 1991 and 1996 (Hooker *et al.* 1997). Researchers with the Department of Fisheries and Oceans, Canada documented strandings on the beaches of Sable Island (Lucas and Hooker 2000). Starting in 1997, minke whales stranded on the coast of Nova Scotia were recorded by the Marine Animal Response Society (MARS) and the Nova Scotia Stranding Network. For the time period of they reported the following: 5 in 2009 (including one minke released alive from a weir), 0 in 2010, 4 in 2011 (including 2 animals released or relocated), 12 in 2012 (including one minke released alive from a weir), and 0 in 2013. The events that are determined to be human-caused serious injury or mortality are included in Table 2.

The Whale Release and Strandings program has reported the following minke whale stranding mortalities in Newfoundland and Labrador for the time period of this report: 1 in 2009, 1 in 2010, 0 in 2011, 3 in 2012, and 0 in 2013. Those that have been determined to be human-caused serious injury or mortality are included in Table 2 (Ledwell and Huntington 2010, 2011, 2012, 2012b, 2013). The 2011 Bay of Fundy minke whale entanglement mortality reported in Table 2 was reported by the Nova Scotia Marine Animal Response Society (T. Wimmer, pers. comm.).

During 2009–2013, as determined from stranding and entanglement records, the minimum detected annual average was 0 minke whales per year struck by ships in Canadian waters or first seen in Canadian waters (Table 2; Henry *et al.* 2015).

STATUS OF STOCK

Minke whales are not listed as threatened or endangered under the Endangered Species Act, and the Canadian East Coast stock is not considered strategic under the Marine Mammal Protection Act. The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of minke whales relative to OSP in the U.S. Atlantic EEZ is unknown.

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