



### Supplement 3. Oil yields from walruses

Walruses were hunted commercially for the oil that could be rendered from their blubber (fat). This oil was typically mixed with generic seal or beluga oil (Wakeham 1898) and was seldom reported separately. No conversions of walrus oil to walrus numbers were needed for our work, since walrus numbers were always reported with yields of walrus oil, but the conversion data obtained are reported here as they may be useful for future studies.

Oil yield varied with catch composition (size, age, sex) and season. In Atlantic walruses from Greenland the proportion of the total body weight that is comprised of blubber is negatively correlated to total body weight (Knutsen and Born 1994). Sub-adults of both sexes have the highest blubber (and hence oil) yield per unit body weight (mean = 24%, SD = 1.7, n = 4, range: 22-26%), followed by adult females (mean = 19%, SD = 2.9, n = 5, range: 16-24%), and adult males (mean = 15%, SD = 2.8, n = 7, range: 11-19%). A female and a male walrus sampled from northern Hudson Bay fell within these same percentage ranges (Freeman 1962). These differences will add uncertainty to any catch estimates based on oil yields.

No information was found on rendering efficiency for walruses but Scoresby (1820a:503) had "never met with any [walrus] that afforded above 20 or 30 gallons of oil." In general, the specific gravity of extracted animal oil varies with the purity of oil and its temperature (Scoresby 1820b). Early whalers used volume to measure oil, despite the error introduced by temperature-related changes in specific gravity (warmer = lower). They considered 252 Br. gallons of oil to be equivalent to a "ton" of oil (Scoresby 1820b:525), where a "ton" or "tun" was the largest barrel size available and ranged in volume from about 210 to 256 Br. gallons. Doan and Douglas (1953) took the weight of beluga oil as 9.25 lbs per Br. gallon. This corresponds well to the specific gravity of whale oil at about 15.6°C (0.920 to 0.931 g/cm<sup>3</sup>) (Dieterichs 1916). The Hudson Bay Company (HBC) used a rough estimate of 9 lbs = 1 Br. gallon of oil (HBC Archives A.95/61, Fo. 148) (Table S3-1). Records since ca. 1920 may refer to actual ton weights rather than gallon volumes, since they were used interchangeably for wet and dry measures. Barrel sizes were seldom stated. Data from the *St. Hilda* and *Erme* suggest an average yield of about 161 lbs or 17.9 British gallons of oil per walrus (Table S3-1). We could not determine if the average oil yield per walrus remained constant over time, and we assumed it did not change.

**Table S3-1.** Conversion factors for walrus oil yield.

Number of walrus	Oil yield (tons of oil)*	Weight (lbs/walrus)*	Volume (Br. Gal./walrus)	Source/Comments
238	20.5	195	21.7	In 1908 the <i>St. Hilda</i> reported a catch of 238 walrus and oil yield of 20.5 tons (= 193 lbs/walrus; Bernier 1910). No other marine mammal catches were reported for the voyage.
370	24.0	147	16.3	In 1910 the <i>St. Hilda</i> reported a catch of 370 walrus and oil yield of 24 tons (Ingram's Whaling and Sealing undated). No other marine mammal catches were reported on this voyage.
160	10.0	142	15.8	In 1912 the <i>Erme</i> reported a yield of 10 tons of blubber from 160 walrus ( <i>Erme 1912</i> ).
768	54.5			<b>Total</b>
		<b>161</b>	<b>17.9</b>	<b>Average yield</b>

\*Assumed liquid tons at 252 imperial gallons per ton, and a rough weight of 9 lbs of oil per gallon (HBC Archives A.95/61, Fo. 148).

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