

Bering-Chukchi-Beaufort Seas Bowhead Whales

Summary of data available

Date this document compiled: 13 February 2006

Summary of available bowhead whale data

Data type	Years covered	Approx. <i>n</i>	File name	Key Fields	Contact person	Original explanation file ¹
Individual master for sampled whales	1969-2005	962 (some 2005 need checking)	bh.individual master.1974-2005.xls	Whale ID, Date, sex, length, village, how sample obtained	George Craig.George@north-slope.org	Bh_individual.README.2005.doc
Age determination	Need to link with whale ID 1978-2000	178	Bh.agemaster05.xls	Whale ID, length, baleen length, age aging technique	George Craig.George@north-slope.org	
Age determination	1978-2000	105	Bh.aspartic_age rev04.xls	Whale ID, Info (e.g. foetus, left/right), length, dextro-rotary/levo-rotary ratio, batch, year, village, comments	George Craig.George@north-slope.org	Bh.aspartic_age.readme-06.doc
Reproductive data ²						
Foetal data	1960-2000	28	bh.fetus.txt	Whale ID, foetus ID, date, length foetus, length mother	George Craig.George@north-slope.org	Bh.reproduction.README.doc
Pregnant females	1976-2002	34	bh.pregfem.txt	Whale ID, date, length m, pregnant, village	George Craig.George@north-slope.org	Bh.reproduction.README.doc
Mature females <=15m	1976-2000	25	bh.matfemLT15m.xls	Whale ID, date, length, pregnant, comment	George Craig.George@north-slope.org	Bh.reproduction.README.doc
Aerial surveys ³	1979, 1981,1985,1986 1979, 1981,1985,1986	120 records	Bh.transectkm.txt	date, time, flight/transect numbers	Zeh zeh@stat.washington.edu	Readme.bh_aerial surveys.txt
Visual census	1978-88, 1993, 2001	68 records	Bh.transecthr.txt	dates, effort, no. whales seen, comments	Zeh zeh@stat.washington.edu	Readme.bh_aerial surveys.txt
		Very large!	Bh.visual_census.zip,	All aspects of the visual census. Extremely well described in details.new.pdf so I have not attempted to summarise here. The zip file unzips to 32 files incl. 7 for north perch (1978-83, 1985) and 9 for south perch (1978-83, 1985-88, 1993 and 2001), two useful Fortran programs and their input files	Zeh zeh@stat.washington.edu	details.new.pdf and readme.bh.visual_census.pdf
Genetics data ⁴ (sequence)	1992-2003	137	Bh.bcb_genetics_sequence.xls	Whale ID, SWFSC ID, date, sex, length, village, sequence	George Craig.George@north-slope.org	Readme.bh.bcb_genetics.tds_JCG.doc
Genetics data (microsatellite)	Need to link with whale ID	215	Bh.bcb_genetics_mic rosats_Jan26.xls	Whale ID, sample ID, loci	George Craig.George@north-slope.org	Readme.bh.bcb_genetics.tds_JCG.doc

¹ These have been compiled into the remainder of this document by GPD which some of you may find useful

² The three files have been put into one Excel file by GPD which some of you may find useful

³ The two text files have been put into one Excel file by GPD which some of you may find useful

⁴ Craig George notes that new genetics data will rapidly develop over the next 6 months.

Explanatory notes

INDIVIDUAL MASTER FOR SAMPLED WHALES

Created by J. George and R. Suydam
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Date: updated January 30, 2006 NB. The data file is subject to change as corrections are made and new data become available. A 'version' number will appear in the Excel file as a date. The file name may not change

File readme.bh_individual.doc is a listing of basic data primarily for landed bowhead whales from 1974 - 2005 by Alaskan Eskimos. However, also included are basic data for fetuses, dead-stranded, and biopsied whales from Alaska, Chukotka and the Commander Islands for which genetic data are available. Please also read file the "readme.bh_genetics" files as well for information on identifications of genetic samples.

Note: Data for 2005 still need verification!

Column descriptions are as follows:

whale_ID	year + village code + sequential catch number; an "F" indicates that it is a fetus from the female with the same whale_id
harv_date	date when whale was landed (not when struck); whales are sometimes pulled ashore a day or more after the kill. Date is BLANK if unknown.
year	4 digit year
sex	M=male, F=female, blank=unknown, P = pseudohermaphrodite (two pseudohermaprodites have been harvested; see Tarpley et al., 1995).
len_m	standard cetacean length (m), rounded to 0.1 m. Blank if unknown.
village	village associated with harvest.
type	indicates how the sample was obtained H= harvested by whale hunters; FH a fetus from a harvested whale; B= biopsy; S=Stranded or 'beach-cast'.

Notes: Whale_ID is common across all files that include information derived from these individual whales. For fetuses, the code takes on the whale_ID of the mother with an "F" added (these are highlighted in blue in the .xls file; FED4392 and FED4398 are ID's for fetuses sampled by Dr. F. Durham with NOAA). Not all values are available for all whales. The harvest date is blank if the date-landed is unknown.

Length measurements come from different sources and methods. Nearly all whales landed at Barrow since 1974 have been measured with a tape measure by biologists. Between roughly 1975 and 1985, many whales landed in other villages were examined by biologists, but the records in this file do not indicate which whales these were. For most whales landed in the villages (outside of Barrow) since 1985, the lengths given are measurements or estimates provided by the AEWG.

Note that the Whale_id for whales before 1978 was changed from the old NOAA system (where fall whales were designated with an "F") to the new NOAA system (see whale_ID). The 1974 data includes 2 harvested whales subsequently 'lost to moving ice'. Whale 96S3 was taken on 4 Jan 97; changed here to 97S1. 91KK1 is listed as a landed whale but was recovered dead (died from natural causes) by Kaktovik crews. Whales 02B21 and 02B22 were taken at Barrow for the village of Point Hope and are designated as Point Hope whales in the AEWG records. Savoonga takes whales near the village in autumn, and at SW Cape in Spring. Crews in other villages take most whales within a ~40 km range of the village site. Struck and lost whales are not included in this file.

References:

Tarpley, R.J., Jarrell, G.H., George, J.C., Cabbage, J. and Stott, G.G. 1995. Male pseudohermaphroditism in the bowhead whale, *Balaena mysticetus*. *Journal of Mammalogy* 76 (4): 1267-1275

AGE DETERMINATION: ASPARTIC ACID

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Created 15 December 2003; revised 10 March 2004; revised 31 January 2006

The **bh.aspartic_age-rev.xls** file (MS Excel) contains the raw data used to compute aspartic acid racemisation ages for bowhead whales as in George et al. (1999). Age estimates are not included because new parameters (e.g., D/L at age 0) have to be estimated. The Excel file contains 3 'sheets':

- (1) basic data, giving the D/L ratios and metadata described here;
- (2) metadata, giving the description of the basic data as given below; and
- (3) Fin whale data, giving D/L data for paired right and left eyes from fin whales. These data, along with paired bowhead samples from the basic data sheet, are used to estimate measurement error variance for the D/L ratios (Nerini, 1983a,b; George *et al.*, 1999).

The columns in the basic data sheet of the file are as follows:

whale_id:	whale identification number = year+village+sequence number
Info:	F=fetus; L=left; R=right; A=side unknown for paired eyes; B=side unknown for paired eye; 1=first estimate; 2=second estimate; NA=no information on orientation (only 1 eye recovered).
length_m:	body length (m) of whale from which eye was taken
sex:	F=female, M=male
baleen:	length (cm) of the longest available baleen plate from the whale
D/L:	D and L enantiomer ratio for aspartic acid
batch:	Batch number, 1=first batch of eye lenses run at J. Bada laboratory (ca 1998), S. Brown did dissections; 2=Second batch of eye lenses run at Bada Lab (ca 2001); C. Rosa did dissections
year:	year whale taken
village:	village where whale taken
comments:	additional information on whale

The **update bh.agemaster.xls** contains age estimates using three methods: baleen ageing, aspartic acid ageing and corpora ageing (George et al. 2004). This file was assembled by Susan Lubetkin, Judy Zeh, and Cheryl Rosa. Please find their SC papers in the 2004 Indepth Assessment for more details. Columns in this data archive include those above plus a "technique" column which has the following.

CBL	Calf baleen length
CC1	Cycle counting, 1 observer (Lubetkin)
CC2	Cycle counting, 2 observers (Lubetkin and Rosa)
AAR	Aspartic acid racemization
CO	Corpora counts
AARCO	Aspartic acid and corpora counts
AARCC	Aspartic acid and cycle counts
GI	Growth increment model
NL	Net length model
NLnoAAR	Net length model fit without AAR data

References

- George, J.C., Bada, J., Zeh, J., Scott, L., Brown, S.E., O'Hara, T., and Suydam, R. 1999. Age and growth estimates of bowhead whales (*Balaena mysticetus*) via aspartic acid racemization. *Can. J. Zool.* 77:571-580.
- Nerini, M. K. 1983. Age determination techniques applied to mysticete whales. MS Thesis. University of Washington, School of Fisheries, Seattle, WA.
- Nerini, M.K. 1983. Age determination of fin whales (*Balaenoptera physalus*) based upon aspartic acid racemization in the lens nucleus. *Rep. int. Whal. Commn* 34:47-448.

REPRODUCTIVE DATA

Information for files: Bh.fetus, bh.pregfem, bh.matfem<15m

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Created: December 17 2003

This readme file provides information for 3 files with bowhead reproductive data. The files are:

File bh.fetus.txt is a complete listing of all fetuses examined since ~1970.

File bh.pregfem.txt is a complete listing of all known pregnant females since 1974.

File bh.matfemLT15m.xls is a listing of all 'confirmed' mature females and pregnant females that are <= 15 meters in length.

This last file is useful for estimating the length at maturity for females. It is assumed that all females > 15m were mature. The following whales are confirmed IMMATURE females listed in Tarpley and Hillmann (1999), these are: 80B7,80B9,81B1,81B2,81B3,81H2,1H3,82G2,82S1,83B1,83B2,84B2,84B4,84KK1,86B3,86B6,86KK1,87WW4,88B1,88B4,88B6,88B7,and 92B12. Length data for these females can be found in bh_individual(master).

Column headers for bh.fetus.txt are:

whale_id:	year+village code+sequential catch number. (Codes:B=Barrow, (kk=Kaktovik, N=Nuiqsut, W=Wainwright, H=Point Hope, K=Kivilina, W=Wales, D=Diomedede, S=Savoonga, G=Gambell)
mothers ID.	
Fetus_id:	whale_id + 'F' to designate fetus (e.g., 89B2F)
harv_date:	date that the whale was landed
fet_ln_cm:	fetus length in cm (to 0.1 cm);crown-rump length for small fetus
mom_ln_m:	length of mother in meters

Column headers for bh.pregfem.txt are:

whale_id	as above
harv_date	as above
length_m	whale length in meters
Pregnant_yn	data on whether the female was pregnant (y= yes, n=no, ?=unsure). For some whales, a large corpus was found but no fetus. In such cases could be that these whales were pregnant but the fetus was too small to detect. Such whales are designated as "?" in terms of pregnancy status.
village	village where whale was harvested.

Column headers for bh.matfemLT15m.xls are:

whale_id	as above
harv_date	as above
length_m	whale length in meters
length_cm	whale length in cm (where available)
Pregnant_yn	as above
Comments	brief notes on the maturity status.

References:

Tarpley, R.J. and Hillmann, D.J. 1999. Observations on ovary morphology, fetal size and functional correlates in the bowhead whale Balaena mysticetus. Final Report to the Department of Wildlife Management, North Slope Borough, Box 69, Barrow, AK.

AERIAL SURVEYS

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Created by Zeh on 14 December 2003

This describes the contents of the folder `bh.aerial_surveys`. This folder is obtained by unzipping `bh.aerial_surveys.zip`; `bh.aerial_surveys.zip` contains aerial survey data collected during the censuses of bowhead whales conducted during their spring migrations in 1979, 1981, 1985 and 1986 off Point Barrow, Alaska. These surveys were conducted to assess the distribution of bowhead sightings offshore from the nearshore ice edge. The distances measured can be used to estimate the proportion of bowheads passing within 4km offshore from the census perches. Since visual census observers rarely see whales beyond 4km offshore, bowhead abundance is estimated by $N4/P4$, where $N4$ is the estimate computed from visual census data and $P4$ is the estimated proportion of whales passing within 4km offshore (Raftery and Zeh, 1991, 1993, 1998; George et al., 2003).

The 1979 survey is described by Braham et al. (1980), the 1981 survey by Marquette et al. (1982), the 1985 survey by Nerini and Rugh (1986) and the 1986 survey by Withrow and Goebel-Diaz (1989). The data on distances of the sightings from the ice edge used by Braham et al. (1980) could not be found and were recomputed from the original survey records. This resulted in small differences in the resulting distribution when compared to that given in Braham et al. (1980).

The folder `bh.aerial_surveys` includes 3 files. All are text files that can be opened with either NotePad or WordPad on a PC. The data files `transecthr.txt` and `transectkm.txt` are tab-delimited. NA indicates missing data. The files and their contents are as follows:

Name	Description
<code>transecthr.txt</code>	Header and 68 data records; the data records give dates of flights, hours of transect survey effort, number of whales seen, and comments about whether the effort was off Point Barrow and therefore useful for computation of $P4$. If there is no comment, all sightings on that date are useful.
<code>transectkm.txt</code>	Header and 120 data records; the data records give date, time, flight and transect numbers if known, number of whales seen, and distance offshore from the ice edge (km) for each sighting. Only sightings off Point Barrow are included.

References:

- Braham, H., Krogman, B., Johnson, J., Marquette, W., Rugh, D., Nerini, M., Sonntag, R., Bray, T., Brueggeman, J., Dahlheim, M., Savage, S. and Goebel, C. 1980. Population studies of the bowhead whale (*Balaena mysticetus*): results of the 1979 spring research season. Rep. int. Whal. Commn 30:391-404.
- Marquette, W.M., Braham, H.W., Nerini, M.K. and Miller, R.V. 1982. Bowhead whale studies, autumn 1980--spring 1981: harvest, biology and distribution. Rep. int. Whal. Commn 32:357-70.
- Nerini, M.K. and Rugh, D.J. 1986. Distribution of bowhead whales in the vicinity of Point Barrow, Alaska: aerial observations 1984 and 1985. Rep. int. Whal. Commn 36:359-61.
- Withrow, D. and Goebel-Diaz, C. 1989. Distribution of bowhead whales near Point Barrow, Alaska, 1984--1986. Rep. int. Whal. Commn 39:305-8.
- George, J.C., Zeh, J., Suydam, R. and Clark, C. 2003. $N4/P4$ abundance estimate for the Bering-Chukchi-Beaufort Seas stock of bowhead whales (*Balaena mysticetus*) based on the 2001 census off Point Barrow, Alaska. Paper SC/55/BRG7 presented to the IWC SC, May 2003. 16 pp.
- Raftery, A.E. and Zeh, J.E. 1991. Bayes empirical Bayes estimation of bowhead whale population size based on the visual and acoustic census near Barrow, Alaska, in 1986 and 1988. Paper SC/43/PS8 presented to the IWC SC, May 1991. 51 pp.
- Raftery, A.E. and Zeh, J.E. 1993. Estimation of bowhead whale, *Balaena mysticetus*, population size (with discussion). pp. 163-240. In: C. Gatsonis, J.S. Hodges, R.E. Kass, and N.D. Singpurwalla (eds). Case Studies in Bayesian Statistics. Springer-Verlag, New York.
- Raftery, A.E. and Zeh, J.E. 1998. Estimating bowhead whale population size and rate of increase from the 1993 census. J. Am. Stat. Assoc. 93:451-63.

GENETICS DATA

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Created by George on 12 February 2006

This file (readme.archive 4.doc) describes the data in archive 4, bh.bcb_genetics. That archive includes data used for genetic analyses of bowheads in the Bering/Chukchi/Beaufort Seas (BCBS). Two types of data are included, mitochondrial sequence data and microsatellite data, variously for the different specimens. Suitable samples included roughly 200 whales from mainland Alaska, along with 13 from St. Lawrence Island, four from Chukotka and four from the Commander Islands.

Not all measurements were made on all samples. Location and other sampling details are given for all whales based on the bh.bcb_individual.xls file. Two whales were designated 03H3-4 and 96G? due to uncertainty about their exact identification. Whale 03H3-4 is either 03H3 or 03H4; whale 96G? was taken in Gambell April 2003 but could not be assigned a specific whale_ID.

The data are the results of laboratory analyses conducted over the past year by Rick LeDuc at Southwest Fisheries Science Center and by John Bickham at Texas A & M. Results from previous analyses conducted earlier (prior to 1999) by Alex Rooney are not included, for reasons outlined below.

The mitochondrial sequence data consist of 397 bp of the 5' end of the mitochondrial control region. Information about the data generation is given in LeDuc et al. (1998), Rooney and Derr (1998) and Rooney et al. (2001). Sequences from samples of whales not previously analyzed are presented. The file is bh.bcb_genetics_sequence.

The microsatellite data consists of several variable nuclear microsatellite loci as in LeDuc et al., 1998; Rooney et al., 1999, 2001; and McLean 2002. Results from 12 loci were evaluated for samples of whales most of which were not previously analyzed. The file is bh.bcb_genetics_microsats.

We planned to include microsatellite and mitochondrial data developed by Rooney and colleagues earlier (1998, 1999, 2001) for whales that were sampled and analyzed earlier. However, we did not include those data because we have recently identified some uncertainties. For the mitochondrial sequence data we were unable to reproduce the sequences reported by Rooney from 4 of 17 test samples. For the microsatellite data we were unable to reproduce the summary data presented in Rooney et al. (1999) from the data file that he supplied us and from 8 test samples. These differences may be due to several possible causes, including the use of newer more modern laboratory techniques, sample identification mix ups and laboratory errors. We are working to resolve those uncertainties as soon as possible, by reanalyzing Rooney's tissue samples if necessary. We will make data from the additional samples available as soon as possible. Note that this is contrary to our intentions described in Tim Smith's memo to Greg Donovan dated 26 Dec 2003, where before we determined the extent of these uncertainties, we had planned to submit Rooney's data.

References:

- LeDuc, R. G., A. Rosenberg, A. E. Dizon, A. M. Burdin, S. A. Blokhin, and R. L. Brownell, Jr. 1998. Preliminary genetic analyses (mtDNA and microsatellites) of two populations of bowhead whales. Report to the International Whaling Commission Scientific Committee. 1998.
- MacLean, S. A. 2002. Occurrence, behavior and genetic diversity of bowhead whales in the western Sea of Okhotsk, Russia. MS Thesis (Texas A&M University), College Station, TX.
- Rooney, A. P. and Derr, J. N. 1998. Evaluating the likelihood of a presumed bottleneck in the Bering-Chukchi-Beaufort Seas stock of bowhead whales. 1998. Paper SC/50/AS14, presented to the International Whaling Commission Scientific Committee, May 1998.
- Rooney, A. P., R. L. Honeycutt, S. K. Davis, and J. N. Derr. 1999. Evaluating a putative bottleneck in a population of bowhead whales from patterns of microsatellite diversity and genetic disequilibria. *Journal of Molecular Evolution* 49:682-690.
- Rooney, A. P., Honeycutt, R. L. and Derr, J. N. 2001. Historical population size change of bowhead whales inferred from DNA sequence polymorphism data. *Evolution* 55:1678-1685.

Microsatellite data

This file (readme.bh.bcb_genetics_microsat) documents the file bh.bcb_genetics_microsat.xls.

That file consists of nuclear microsatellite data collected in Bickham's lab in 2003. The table includes data from 12 loci which were previously used in studies by Rooney et al. (1999) and LeDuc et al. (1998). The TV loci were all used in the study of Rooney et al. (1999) and were applied here to whales not used in that study (131). Additional loci include GATA28, EV1 and EV104, and we examined 96 whales for these three loci that were part of the Rooney et al. (1999) study (rows 133 to 228 in the table), as well as the 131 whales new to this study. Thus, for these three loci the grand total of whales examined is 227.

For all loci, alleles are recorded as to their estimated sizes as numbers of base pairs. Because these are all diploid loci, the number of alleles equals twice the number of individuals. Some individuals yielded no results (7 of the 131 new samples). We have included these individuals simply to inform the investigator using the table that DNA samples for these individuals are in our possession but were not successfully analyzed.

References:

- LeDuc, R. G., A. Rosenberg, A. E. Dizon, A. M. Burdin, S. A. Blokhin, and R. L. Brownell, Jr. 1998. Preliminary genetic analyses (mtDNA and microsatellites) of two populations of bowhead whales. Report to the International Whaling commission Scientific Committee. 1998.
- Rooney, A. P., R. L. Honeycutt, S. K. Davis, and J. N. Derr. 1999. Evaluating a putative bottleneck in a population of bowhead whales from patterns of microsatellite diversity and genetic disequilibria. *Journal of Molecular Evolution* 49:682-690.

Summary of data provided:

Whale id: the identity of each sample, corresponding to the bh.individual data file.

Loci	Sample size	Alleles
TV7	N=119	Alleles: 147=2; 155=9; 157=6; 159=5; 161=99; 163=9; 165=90; 167=3; 171=3; 181=2; 183=1; 185=2; 187=3; 189=4
TV11	N=91	Alleles: 239=5; 241=28; 243=48; 245=98; 247=3
TV13	N=101	Alleles: 295=6; 299=83; 301=31; 303=5; 305=74; 307=3
TV14	N=108	Alleles: 93=5; 95=14; 97=123; 99=4; 101=51; 103=17; 105=1; 107=1
TV16	N= 116	Alleles: 184=6; 186=155; 190=56; 192=15
TV17	N=97	Alleles: 193=61; 195=3; 197=14; 199=58; 201=11; 203=20; 205=14; 207=8; 209=4; 211=1
TV18	N=72.5	Alleles: 73=2; 75=1; 77=2; 79=8; 81=68; 83=59; 85=5
TV19	N=107	Alleles: 172=5; 174=27; 176=37; 178=59; 180=47; 182=13
TV20	N=116	Alleles: 156=119; 164=9; 166=13; 168=53; 170=38
GATA28	N=163	Alleles: 115=77; 130=53; 158=19; 162=45; 166=28; 170=35; 174=43; 178=23; 180=1; 182=2
EV1	N=156	Alleles: 135=65; 137=34; 139=26; 141=56; 143=124; 147=7
EV104	N=184	Alleles: 140=1; 142=3; 143=1; 144=73; 146=70; 148=64; 150=54; 152=69; 154=19; 156=11; 160=3