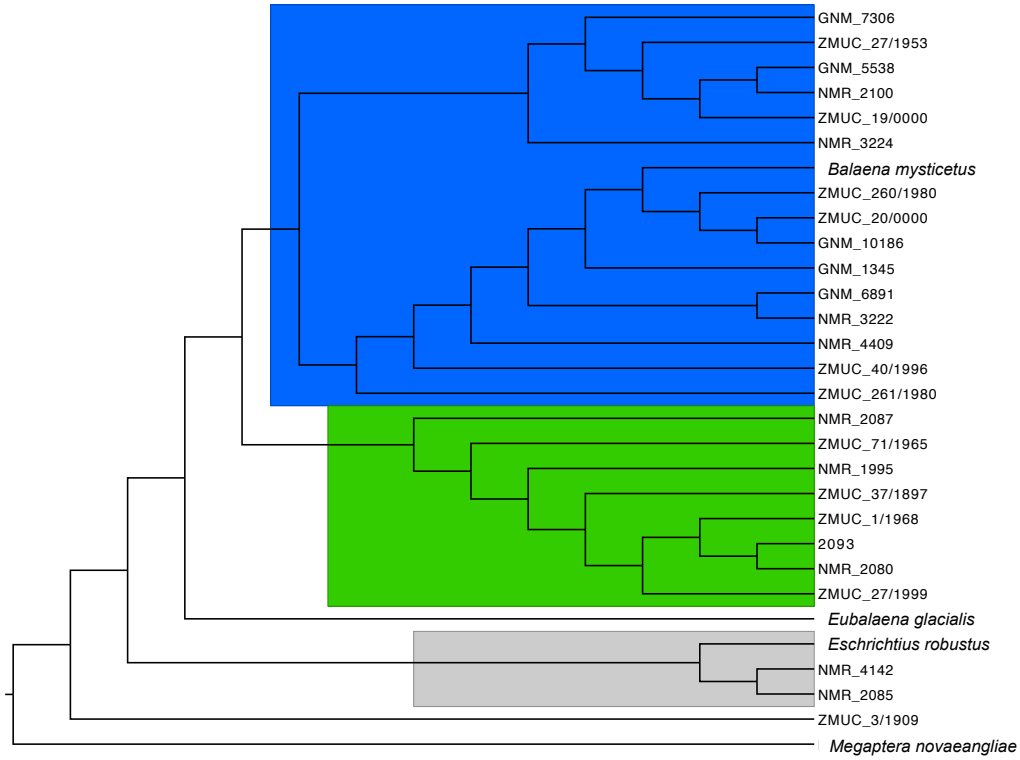
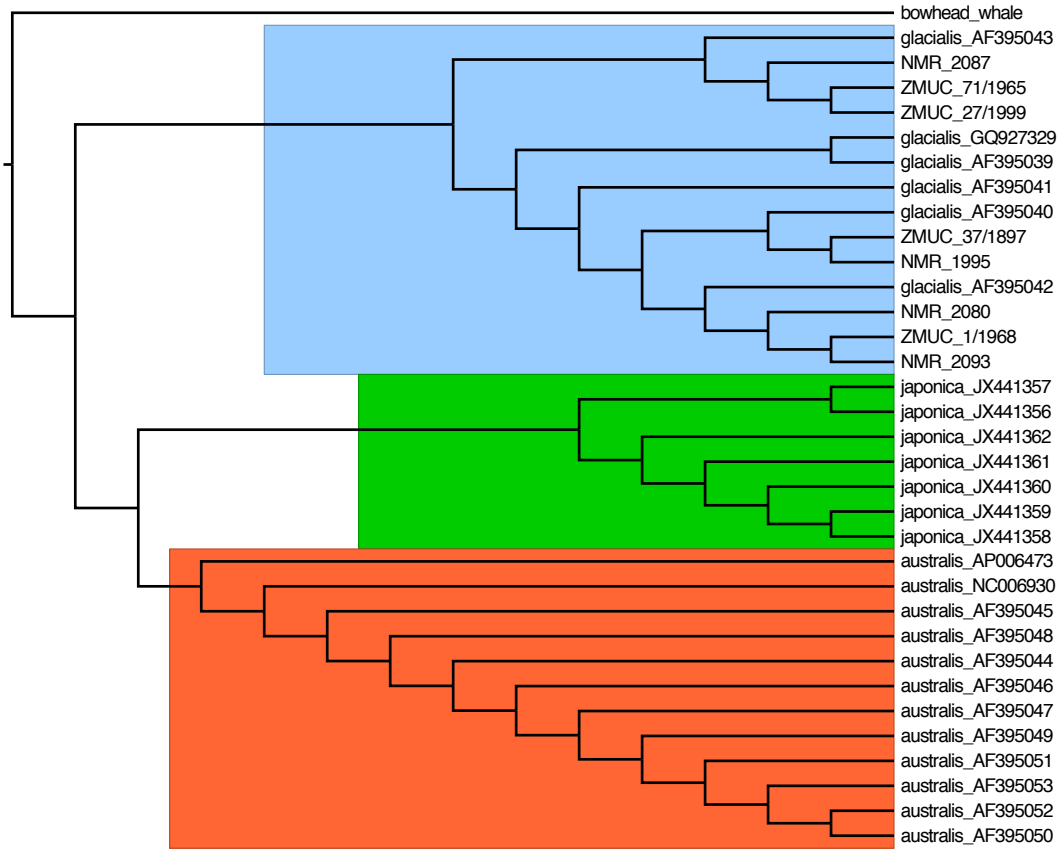
Supplementary Figures



Supplementary Figure S1 | Maximum likelihood phylogenetic tree of all taxa sequenced in this study. Reference sequences from GenBank are included for bowhead whale (JF767369), North Atlantic right whale (X72199), Pacific grey whale (AF326820), humpback whale (HQ241484).



Supplementary Figure S2 | Maximum likelihood phylogenetic tree of right whales *Eubalaena sp.* for which sufficient sequence data were generated in this study and from GenBank.

**Supplementary Table S1 | List of samples analysed in this study, their location and their genetically determined species identification. ***sequences were too short to submit to GenBank and are given below.

Sample ID	Region	Site	Species identification / Genbank accession code	
GNM 10186	Sweden	Edshultshall	*Balaena mysticetus*	KC573762
GNM 10408	Sweden	Tanum	-	
GNM 1345	Sweden	Essunga	*Balaena mysticetus*	KC573763
GNM 14892	Sweden	Håsten, Varberg	-	
GNM 16319	Sweden	Vårhögen, Slöinge	-	
GNM 5538	Sweden	Ellös, Orust	*Balaena mysticetus*	KC573772
GNM 6891	Sweden	Göteborg	*Balaena mysticetus*	KC573766
GNM 7306	Sweden	Göteborg	*Balaena mysticetus*	KC573775
GNM 8617	Sweden	Bohus Län	-	
NMR99911995	North Sea	Southern Bight	*Eubalaena glacialis*	KC573779
NMR99912080	North Sea	Southern Bight	*Eubalaena glacialis*	KC573777
NMR99912085	North Sea	Southern Bight	*Eschrichtius**	
NMR99912086	North Sea	Southern Bight	*Eubalaena glacialis**	
NMR99912087	North Sea	Southern Bight	*Eubalaena glacialis*	KC573780
NMR99912093	North Sea	Southern Bight	*Eubalaena glacialis*	KC573777
NMR99912096	North Sea	Southern Bight	-	
NMR99912100	North Sea	Southern Bight	*Balaena mysticetus*	KC573771
NMR99912103	North Sea	Southern Bight	-	
NMR99912239	North Sea	Southern Bight	-	
NMR99913222	North Sea	Southern Bight	*Balaena mysticetus*	KC573764
NMR99913224	North Sea	Southern Bight	*Balaena mysticetus*	KC573776
NMR99914142	North Sea	Southern Bight	*Eschrichtius**	
NMR99914409	North Sea	Southern Bight	*Balaena mysticetus*	KC573765
NMR99916224	North Sea	Southern Bight	-	
ZMUC 1/1934	Denmark	Staurby Skov, Odense	-	
ZMUC 1/1968	Denmark	Ballerum, Thisted	*Eubalaena glacialis*	KC573778
ZMUC 103/1946	Denmark	Strandby, Hjørring	-	
ZMUC 16/1928	Denmark	Frederiksborg	-	
ZMUC 18/1997	Denmark	Tværsted, Hjørring	-	
ZMUC 19/0000	Denmark	Råholte, Hjørring	*Balaena mysticetus*	KC573770
ZMUC 20/0000	Denmark	Borgbakke, Hjørring	*Balaena mysticetus*	KC573768
ZMUC 21/0000	Denmark	Ravnsholt, Hjørring	-	
ZMUC 260/1980	Denmark	Hjørring	*Balaena mysticetus*	KC573773
ZMUC 261/1980	Denmark	Sømder Vrå, Hjørring	*Balaena mysticetus*	KC573769
ZMUC 27/1953	Denmark	Dronninglund, Hjørring	*Balaena mysticetus*	KC573774
ZMUC 27/1999	Denmark	Lyngby, Thisted	*Eubalaena glacialis*	KC573781
ZMUC 3/1909	Denmark	Sparkær, Viborg	*Megaptera novaeangliae**	
ZMUC 31/1997	Denmark	Hirtshals, Hjørring	-	
ZMUC 325/1982	Baltic Sea	Poulsker, Bornholm	-	
ZMUC 33/1997	Denmark	Emmersbæk, Hjørring	-	
ZMUC 37/1897	Denmark	Lønstrup, Hjørring	*Eubalaena glacialis*	KC573779
ZMUC 40/1996	Denmark	Krarup, Hjørring	*Balaena mysticetus*	KC573767
ZMUC 66/2000	Sweden	Rörvik, Bohus Län	-	
ZMUC 71/1965	Denmark	Ballerum, Thisted	*Eubalaena glacialis*	KC573780

NMR99914142 / NMR99912085
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ZMUC_3/1909
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ACCGGGCCCATCAATCGTGGGGGTAGCTATTTAATGATCTTTATAAGACATCTGGTTC
TTACTTCAGGGCCATATTAAT

NMR99912086
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ATCAATTGTGGGGGTACCTATTTAATGGTCTTTACA

Supplementary Table S2 | Calibrated age ranges for samples of dated whales shown in Table S1. The results were calibrated using the INTCAL09 modelled marine curve[46].

Lab code (radiocarbon age and error)	Calibrated age range (68.2% prob.)		Calibrated age range (95.4% prob.)	
	From	to	From	to
GNM 10186 (12250 ± 240)	13947	13418	14522	13190
GNM 10408 (10695 ± 120)	12337	11765	12550	11417
GNM 1345 (11245 ± 100)	12837	12614	13060	12561
GNM 14892 (11870 ± 120)	13438	13196	13625	13105
GNM 16319 (12620 ± 130)	14484	13857	14885	13785
GNM 5538 (12805 ± 135)	14790	14143	15075	14004
GNM 6891 (10210 ± 80)	11288	11123	11623	10943
GNM 7306 (12640 ± 110)	14488	13900	14878	13815
GNM 8617 (11980 ± 90)	13566	13299	13692	13245
NMR 1995 (2207 ± 31)	1868	1736	1938	1679
NMR 2080 (3305 ± 43)	3243	3064	3319	2974
NMR 2085 (2277 ± 41)	1960	1815	2036	1730
NMR 2086 (3243 ± 39)	3155	2976	3237	2895
NMR 2087 (6099 ± 40)	6605	6455	6663	6390
NMR 2093 (4098 ± 40)	4240	4060	4336	3971
NMR 2100 (30687 ± 368)	35125	34596	36236	34105
NMR 3222 (46914 ± 2876)**				
NMR 3224 (31823 ± 512)	36446	35319	36874	34885
NMR 4409 (32127 ± 480)	36705	35412	37315	35043
ZMUC 1/1934 (17830 ± 590)	21504	20062	22235	19472
ZMUC 1/1968 (4610 ± 85)	4961	4694	5114	4535
ZMUC 103/1946 (1500 ± 65)	1137	962	1230	905
ZMUC 16/1928 (28140 ± 1280)	33687	31105	36131	30263
ZMUC 18/1997 (12100 ± 185)	13744	13374	13940	13200
ZMUC 19/0000 (11590 ± 115)	13215	12925	13304	12745
ZMUC 20/0000 (11960 ± 115)	13571	13278	13709	13182
ZMUC 21/0000 (14110 ± 215)	17078	16577	17461	15968
ZMUC 260/1980 (12950 ± 195)	15057	14241	15543	13980
ZMUC 261/1980 (13670 ± 205)	16682	15655	16801	15234
ZMUC 27/1953 (12540 ± 155)	14452	13752	14876	13658
ZMUC 27/1999 (4250 ± 90)	4498	4220	4645	4066
ZMUC 31/1997 (12780 ± 215)	14864	14071	15173	13811
ZMUC 325/1982 (1015 ± 70)	651	532	722	481
ZMUC 33/1997 (11320 ± 165)	13045	12633	13192	12547
ZMUC 37/1897 (1400 ± 75)	1052	857	1149	757
ZMUC 40/1996 (12710 ± 185)	14791	13961	15060	13820
ZMUC 66/2000 (4210 ± 80)	4415	4165	4555	4047
ZMUC 71/1965 (6410 ± 110)	7036	6739	7180	6625

** out of range

Supplementary Table S3 | AquaMaps input environmental envelope input settings for mapping bowhead and North Atlantic right whale distributions during all time periods.

Bowhead whales	FAOAreas: 18 | 21 | 27 | 61 | 67					
	Bounding Box (NSWE):	90	0	-180	180	
		Used	Min	Pref Min (10th)	Pref Max (90th)	Max
	Depth (m)	1	0	10	200	6000
	Temperature (°C)	1	-1.79	-1.76	0	5
	Salinity (psu)	1	27.71	30.7	34.11	36.585
	Primary Production	0	47	88	649	1500
	Sea Ice Concentration	1	0.01	0.3	0.75	0.77
North Atlantic right whales	FAOAreas: 21 | 27 | 31 | 34 ,					
	Bounding Box (NSWE):	90	10	-180	180	
		Used	Min	Pref Min (10th)	Pref Max (90th)	Max
	Depth (m)	1	0	10	200	4000
	Temperature (°C)	1	0	5	20	25
	Salinity (psu)	1	19.62	31.65	35.95	37.27
	Primary Production	0	191	833	6000	6000
	Sea Ice Concentration	1	-1	0	0.05	0.34