

Supplementary Tables

Supplementary Table S1. Globin genes of the sea lamprey.

Label	Accession number	Protein	Length (aa) /Exons	Genomic location
aHb1	ENSPMAG000000001587 not correctly annotated	P09967	150/3	GL478636: 78661-80200
aHb2a	AF248645, ENSPMAG000000007266	Q9I9I3	150/3	GL477137: 47523-49311
aHb2b	ENSPMAG000000007259 not correctly annotated	-	150/3	GL477137: 38017-40815
aHb2c	ENSPMAG000000007276	-	150/3	GL477137: 58445-59886
aHb3	ENSPMAG000000005328	P09968	150/3	GL477423: 86128-87616
aHb5a	ENSPMAG000000005354	P02208	150/3	GL477423: 91643-92884
aHb5c	not annotated		32/1	GL480013 (incomplete sequence)
aHb5d	ENSPMAG000000005317	-	150/3	GL477423: 74276-75516
aHb5d	ENSPMAG000000005354	-	150/3	GL477423: 100329-101615
aHb6	EG333697	-	160/3	GL479302: 428488-432549
aHb7	EE278870	-	159/3	GL487383 (incomplete sequence)
aHb8	ENSPMAG000000005367	-	160/3	GL477423: 113786-116619
aHb9	ENSPMAG000000008540	-	158/3	GL476782: 336771-345936
aHb10	FD718926	-	158/3	GL478504 (incomplete sequence)
aHb11	ENSPMAG000000001592	-	158/3	GL478636: 89680-93262
aHb12	ENSPMAG000000001587 not correctly annotated	-	153/3	GL478636: 74790-76680
aHb13	ENSPMAG000000001587 not correctly annotated	-	153/3	GL478636: 64058-65463
aHb14	ENSPMAG000000001587 not correctly annotated	-	153/3	GL478636: 70655-71833
aHb_ps1	not annotated	pseudogene	141/3	GL476413: 739046-740131
aHb_ps2	not annotated	pseudogene	141/3	GL480013: 24143-25251
aMb1	ENSPMAG000000006056	-	159/3	GL479302: 463339-464603
aMb2	EG021442,	-	160/3	GL481323 (incomplete

	ENSPMAG000000008310			sequence)
Cygb	ENSPMAG000000008260	-	165/3	GL478089 + GL477469
GbX1	ENSPMAG000000007241 not correctly annotated	-	222/5	GL476484: 69158-91992
GbX2	not annotated	-	107/3	GL477600 (incomplete sequence)

Supplementary Table S2. Globin genes of the Arctic lamprey.

Label	Accession number	Length (aa)/Exons	Genomic location
aHb1	AB294236	150/3	KE993782: 445415-446993 (incomplete sequence)
aHb2a		150/3	KE993857: 605702-606905
aHb2b		150/3	KE993857: 621222-621454
aHb2c	AB294235	150/3	KE993857: 614558-615759
aHb2d		150/3	APJL01123255
aHb6		160/3	KE993736: 1240304-1244535
aHb7	AB294237	159/3	KE993782: 1263324-1256951 (incomplete sequence)
aHb9		153/3	KE993782: 1379925-1377460
aHb10		158/3	KE994284: 13389-15769
aHb11		118/2	KE993782: 452740-453920
aHb12		153/3	KE993782: 440736-441724, APJL01129493
aHb13		153/3	KE993782: 429820-431012
aHb14a		153/3	KE993782: 424111-425256
aHb14b		153/3	KE993782: 436262-437408
aHb15		150/3	KE993857: 627462-629103
aHb16		42/1	APJL01106671
aHb17		68/1	KE993782: 1244627-1244829
aHb18		119/2	KE993782: 1244595-1245720
aMb1		159/3	KE993736: 1270853-1271922
aMb2		78/1	APJL01135086
Cygb		165/3	KE993827: 80981-106171
GbX1		183/5	KE993715: 897573-875415
GbX2		107/3	KE993935: 608940-

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Supplementary Table S3. List of globin sequences used for phylogenetic analyses (fig. 2 and Supplementary fig. 3). EMBL/GenBank/ENSEMBL accession numbers of nucleotides are given. Asterisks denote protein accession numbers.

Globin	Label	Species	Common name	Accession number
GbX	goldfish GbX	<i>Carassius auratus</i>	goldfish	AJ635195
GbX	zebrafish GbX	<i>Danio rerio</i>	zebrafish	AJ635194
GbX	catfish GbX	<i>Ictalurus punctatus</i>	channel catfish	CK416201
GbX	coelacanth GbX1	<i>Latimeria chalumnae</i>	coelacanth	ENSLACG000000010727
GbX	coelacanth GbX2	<i>Latimeria chalumnae</i>	coelacanth	ENSLACG000000003954
GbX	sea lamprey GbX1	<i>Petromyzon marinus</i>	sea lamprey	ENSPMAG000000007241
GbX	Arctic lamprey GbX1	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome
GbX	green spotted puffer GbX	<i>Tetraodon nigroviridis</i>	green spotted puffer	AJ635193
GbX	western clawed frog GbX	<i>Xenopus tropicalis</i>	western clawed frog	NM_001011196
Ngb	zebrafish Ngb	<i>Danio rerio</i>	zebrafish	BC059416
Ngb	chicken Ngb	<i>Gallus gallus</i>	chicken	NM_001031551
Ngb	human NGB	<i>Homo sapiens</i>	man	AB463927
Ngb	coelacanth Ngb	<i>Latimeria chalumnae</i>	coelacanth	genome
Ngb	mouse Ngb	<i>Mus musculus</i>	mouse	AJ245945
Ngb	platypus Ngb	<i>Ornithorhynchus anatinus</i>	platypus	XM_001508367
Ngb	medaka Ngb	<i>Oryzias latipes</i>	medaka	DK002855
Ngb	zebra finch Ngb	<i>Taeniopygia guttata</i>	zebra finch	ENSTGUG000000012286
Ngb	green spotted puffer Ngb	<i>Tetraodon nigroviridis</i>	green spotted puffer	AJ315609
Ngb	torafugu Ngb	<i>Takifugu rubripes</i>	torafugu	XM_003962460
Ngb	western clawed frog Ngb	<i>Xenopus tropicalis</i>	western clawed frog	NM_001030351
aHb	inshore hagfish aHb1	<i>Eptatretus burgeri</i>	inshore hagfish	Q7SID0*
aHb	river lamprey aHb	<i>Lampetra fluviatilis</i>	river lamprey	P02207*
aHb	Arctic lamprey aHb1	<i>Lethenteron camtschaticum</i>	Arctic lamprey	AB294236
aHb	Arctic lamprey aHb2a	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Arctic lamprey aHb6	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Arctic lamprey aHb7	<i>Lethenteron camtschaticum</i>	Arctic lamprey	AB294237
aHb	Arctic lamprey aHb9	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Arctic lamprey	<i>Lethenteron</i>	Arctic lamprey	genome data

	aHb10	<i>camtschaticum</i>		
aHb	Arctic lamprey aHb12	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Arctic lamprey aHb13	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Arctic lamprey aHb14a	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Arctic lamprey aHb15	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aHb	Po brook lamprey aHbA	<i>Lethenteron zanandreaei</i>	Po brook lamprey	Z24746
aHb	Po brook lamprey aHbB	<i>Lethenteron zanandreaei</i>	Po brook lamprey	Z24747
aHb	Po brook lamprey aHbC	<i>Lethenteron zanandreaei</i>	Po brook lamprey	Z24748
aHb	Australian lamprey aHb1	<i>Mordacia mordax</i>	Australian lamprey	P21197*
aHb	Australian lamprey aHb2	<i>Mordacia mordax</i>	Australian lamprey	P21198*
aHb	Australian lamprey aHb3	<i>Mordacia mordax</i>	Australian lamprey	P21199*
aHb	Atlantic hagfish aHb1	<i>Myxine glutinosa</i>	Atlantic hagfish	AF184239
aHb	Atlantic hagfish aHb2	<i>Myxine glutinosa</i>	Atlantic hagfish	AF157494
aHb	Atlantic hagfish aHb3	<i>Myxine glutinosa</i>	Atlantic hagfish	AF184047
aHb	Atlantic hagfish aHb4	<i>Myxine glutinosa</i>	Atlantic hagfish	AF156936
aHb	sea lamprey aHb1	<i>Petromyzon marinus</i>	sea lamprey	P09967*
aHb	sea lamprey aHb2a	<i>Petromyzon marinus</i>	sea lamprey	Q9I9I3*
aHb	sea lamprey aHb3	<i>Petromyzon marinus</i>	sea lamprey	P09968*
aHb	sea lamprey aHb5a	<i>Petromyzon marinus</i>	sea lamprey	P02208*
aHb	sea lamprey aHb5b	<i>Petromyzon marinus</i>	sea lamprey	ENSPMAG000000005354
aHb	sea lamprey aHb6	<i>Petromyzon marinus</i>	sea lamprey	EG333697
aHb	sea lamprey aHb7	<i>Petromyzon marinus</i>	sea lamprey	EE278870
aHb	sea lamprey aHb8	<i>Petromyzon marinus</i>	sea lamprey	ENSPMAG000000005367
aHb	sea lamprey aHb9	<i>Petromyzon marinus</i>	sea lamprey	ENSPMAG000000008540
aHb	sea lamprey aHb10	<i>Petromyzon marinus</i>	sea lamprey	FD718926

aHb	sea lamprey aHb11	<i>Petromyzon marinus</i>	sea lamprey	ENSPMAG000000001592
aHb	sea lamprey aHb12	<i>Petromyzon marinus</i>	sea lamprey	Scaffold GL477423
aHb	sea lamprey aHb13	<i>Petromyzon marinus</i>	sea lamprey	Scaffold GL477423
aHb	sea lamprey aHb14	<i>Petromyzon marinus</i>	sea lamprey	Scaffold GL477423
aHb	sea lamprey aHb1 ps	<i>Petromyzon marinus</i>	sea lamprey	Scaffold GL476413
aHb	sea lamprey aHb2 ps	<i>Petromyzon marinus</i>	sea lamprey	Scaffold GL480013
aMb	Arctic lamprey aMb1	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
aMb	sea lamprey aMb1	<i>Petromyzon marinus</i>	sea lamprey	ENSPMAG000000006056
aMb	sea lamprey aMb2	<i>Petromyzon marinus</i>	sea lamprey	EG021442
Cygb	zebrafish Cygb1	<i>Danio rerio</i>	zebrafish	BC165894
Cygb	zebrafish Cygb2	<i>Danio rerio</i>	zebrafish	AJ635229
Cygb	chicken Cygb	<i>Gallus gallus</i>	chicken	NM_001008789
Cygb	human CYGB	<i>Homo sapiens</i>	man	AJ315162
Cygb	European brook lamprey Cygb	<i>Lampetra planeri</i>	European brook lamprey	TBA
Cygb	coelacanth Cygb	<i>Latimeria chalumnae</i>	coelacanth	ENSLACG000000014904
Cygb	Arctic lamprey Cygb	<i>Lethenteron camtschaticum</i>	Arctic lamprey	genome data
Cygb	medaka Cygb1	<i>Oryzias latipes</i>	medaka	NM_001104767
Cygb	medaka Cygb2	<i>Oryzias latipes</i>	medaka	NM_001104768
Cygb	sea lamprey Cygb	<i>Petromyzon marinus</i>	sea lamprey	Scaffold GL478089+ GL477469
Cygb	rat Cygb	<i>Rattus norvegicus</i>	rat	NM_130744
Cygb	zebra finch Cygb	<i>Taeniopygia guttata</i>	zebra finch	XM_002195407
Cygb	green spotted puffer Cygb1	<i>Tetraodon nigroviridis</i>	green spotted puffer	AJ635230
Cygb	torafugu Cygb1	<i>Takifugu rubripes</i>	torafugu	ENSTRUG000000012110
Cygb	torafugu Cygb2	<i>Takifugu rubripes</i>	torafugu	ENSTRUG000000008030
Cygb	western clawed frog Cygb	<i>Xenopus tropicalis</i>	western clawed frog	NM_001006869
GbY	anole lizard GbY	<i>Anolis carolinensis</i>	anole lizard	ENSACAG000000027586
GbY	elephant shark GbY	<i>Callorhynchus milii</i>	elephant shark	JK861558
GbY	coelacanth GbY	<i>Latimeria chalumnae</i>	coelacanth	XM_005990799
GbY	platypus GbY	<i>Ornithorhynchus anatinus</i>	platypus	AC203513
GbY	African clawed frog GbY	<i>Xenopus laevis</i>	African clawed frog	NM_001095686

GbY	western clawed frog GbY	<i>Xenopus tropicalis</i>	western clawed frog	XM_002941194
GbE	mallard GbE	<i>Anas platyrhynchos</i>	mallard	genome data
GbE	chicken GbE	<i>Gallus gallus</i>	chicken	NM_001008786
GbE	coelacanth GbE	<i>Latimeria chalumnae</i>	coelacanth	ENSLACG000000001661
GbE	turkey GbE	<i>Meleagris gallopavo</i>	turkey	XM_003202331
GbE	zebra finch GbE	<i>Taeniopygia guttata</i>	zebra finch	XM_002196350
Mb	zebrafish Mb	<i>Danio rerio</i>	zebrafish	AY337025
Mb	tope shark Mb	<i>Galeorhinus galeus</i>	tope shark	P14397*
Mb	chicken Mb	<i>Gallus gallus</i>	chicken	XM_003202347
Mb	Port Jackson shark Mb	<i>Heterodontus portusjacksoni</i>	Port Jackson shark	P02206*
Mb	human MB	<i>Homo sapiens</i>	man	NM_203377
Mb	coelacanth Mb	<i>Latimeria chalumnae</i>	coelacanth	ENSLACG000000007526
Mb	gummy shark Mb	<i>Mustelus antarcticus</i>	gummy shark	P14399*
Mb	medaka Mb	<i>Oryzias latipes</i>	medaka	BJ883657
Mb	sperm whale Mb	<i>Physeter catodon</i>	sperm whale	AB271144
Mb	zebra finch Mb	<i>Taeniopygia guttata</i>	zebra finch	XM_002199380
Mb	cloudy catshark Mb	<i>Scyliorhinus torazame</i>	cloudy catshark	FY417124
HbA	zebrafish HbAa	<i>Danio rerio</i>	zebrafish	BC164447
HbA	zebrafish HbAe	<i>Danio rerio</i>	zebrafish	AY325264
HbA	zebrafish HbAx	<i>Danio rerio</i>	zebrafish	AL915033
HbA	chicken HbA	<i>Gallus gallus</i>	chicken	NM_001004376
HbA	chicken HbAD	<i>Gallus gallus</i>	chicken	XM_003643192
HbA	human HbA	<i>Homo sapiens</i>	man	AF105974
HbA	human HBZ	<i>Homo sapiens</i>	man	M24173
HbA	coelacanth HbA1	<i>Latimeria chalumnae</i>	coelacanth	ENSLACG000000006283
HbA	coelacanth HbA2	<i>Latimeria chalumnae</i>	coelacanth	P23740*
HbA	spotless smooth-hound HbA	<i>Mustelus griseus</i>	spotless smooth-hound	Q9YGW2*
HbA	medaka HbA	<i>Oryzias latipes</i>	medaka	BAC20295*
HbA	Port Jackson shark HbA	<i>Heterodontus portusjacksoni</i>	Port Jackson shark	P02021*
HbA	spiny dogfish HbA	<i>Squalus acanthias</i>	spiny dogfish	P07408*
HbA	cloudy catshark HbA	<i>Scyliorhinus torazame</i>	cloudy catshark	FY415186
HbA	zebra finch HbA	<i>Taeniopygia guttata</i>	zebra finch	DQ216719
HbA	zebra finch HbAD	<i>Taeniopygia guttata</i>	zebra finch	DQ213486
HbA	African clawed frog HbA1	<i>Xenopus laevis</i>	African clawed frog	X02796
HbA	African clawed frog HbAT5	<i>Xenopus laevis</i>	African clawed frog	X02798

HbA	western clawed frog HbA1	<i>Xenopus tropicalis</i>	western clawed frog	BC088005
HbB	zebrafish HbBa	<i>Danio rerio</i>	zebrafish	BC164283
HbB	zebrafish HbBe	<i>Danio rerio</i>	zebrafish	NM_198073
HbB	chicken HbG	<i>Gallus gallus</i>	chicken	M73995
HbB	human HBB	<i>Homo sapiens</i>	man	NM_000518
HbB	human HBD	<i>Homo sapiens</i>	man	NM_000519
HbB	human HBE	<i>Homo sapiens</i>	man	NM_005330
HbB	human HBG	<i>Homo sapiens</i>	man	BC130457
HbB	coelacanth HbB1	<i>Latimeria chalumnae</i>	coelacanth	P23741*
HbB	coelacanth HbB2	<i>Latimeria chalumnae</i>	coelacanth	XM_006011048
HbB	spotless smooth- hound HbB	<i>Mustelus griseus</i>	spotless smooth- hound	Q9YGW1*
HbB	platypus HbW	<i>Ornithorhynchus anatinus</i>	platypus	AC203513
HbB	medaka HbB	<i>Oryzias latipes</i>	medaka	AB080120
HbB	Port Jackson shark HbB	<i>Heterodontus portusjacksoni</i>	Port Jackson shark	P02143*
HbB	spiny dogfish HbB	<i>Squalus acanthias</i>	spiny dogfish	P07409*
HbB	cloudy catshark HbB	<i>Scyliorhinus torazame</i>	cloudy catshark	FY415474
HbB	zebra finch HbE	<i>Taeniopygia guttata</i>	zebra finch	NM_001245112
HbB	western clawed frog HbB1	<i>Xenopus tropicalis</i>	western clawed frog	NM_203528
HbB	western clawed frog HbB2	<i>Xenopus tropicalis</i>	western clawed frog	NM_001016495

Supplementary Table S4. Stage-specific expression pattern of sea lamprey globins. GenBank Biosample Identifiers are given.

Lamprey globin	Deveploment stage	Biosample Identifier
aHb1	Adult	LIBEST_018802
aHb2	Adult	LIBEST_018802
aHb3	Adult	LIBEST_018802
aHb5a	Adult	LIBEST_018802
aHb5b	Adult	LIBEST_018802
aHb6	Fertilized egg	LIBEST_019205
aHb7	Fertilized egg Larvae	LIBEST_019205 LIBEST_016049
aHb8	Fertilized egg	LIBEST_019205
aHb9	Embryo Larvae	LIBEST_022613 LIBEST_016049
aHb10	Embryo	LIBEST_022613
aHb11	Embryo Larvae	LIBEST_022613 LIBEST_016049
aHb12	Fertilized egg Larvae	LIBEST_019205 LIBEST_016049
aHb13	Embryo Larvae Adult	LIBEST_022613 LIBEST_016049 LIBEST_018804
aHb14	Embryo Larvae Adult	LIBEST_022613 LIBEST_016049 LIBEST_018804
aMb1	Fertilized egg Adult	LIBEST_019205 LIBEST_019151
aMb2	Adult, muscle tissue	LIBEST_018803
Cygb	Embryo	LIBEST_022613

Supplementary Table S5. Oligonucleotides used for RT-PCR and qPCR

Gene		5'3' sequence
Myoglobin1	aMb1_for	ATGAGCATTGCAGACAGC
	aMb1_rev	GAATGCAGATTTCAAGCCAATGC
	aMb1_qPCR_for	CCACGCAGAGGACCACGGAACC
	aMb1_qPCR_rev	CAGCGCCTGGAACTTGGGGAAG
Myoglobin2	aMb2_for	ATGAGTGCCATCGTGGAC
	aMb2_rev	GCCTAGAAAGCCGAGCG
	aMb2_qPCR_for	GCCAAGCTGCACTCGCTGAGC
	aMb2_qPCR_rev	GTCTCGCCCAGGATGTGAGC
Cytoglobin	Cygb_for	ATGGAGCAGGGCTGGCTGT
	Cygb_rev	CTAGGCCGCTGCTTGCTCC
	Cygb_qPCR_for	CGTCAAGTACTACCACATCTTGGGCGG
	Cygb_qPCR_rev	AGGGTGCCCAGCAGCTTCGTC
Globin 5	aHb5_for	ATGCCTATCGTTGACACTGGA
	aHb5_rev	TTAGTAGGCGGACCTGAGC
	aHb5_qPCR_for	CCGGTGTGGACATCCTGGTGAAGTTCT
	aHb5_qPCR_rev	ACGTCCGCGGATTTCTTGAGCTGA