

Oligocene basking sharks (Lamniformes, Cetorhinidae) of the Carpathian Basin with a
reconsideration of the role of gill rakers in species diagnostics

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TABLE S1. Catalogue of the studied cetorhinid remains (PL_rup)

Age	Ichthyofaunal zone	Locality	Acronym	Inv. ID	Collected by	Identified by	Previous identification
Oligocene, Chattian	IPM 5	Bachów III (A-1)	BH ₃	N/8118	A. Jerzmańska, 1986	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 4	Krępak I	KI	N/696	A. Jerzmańska, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 4	Krępak I	KI	N/997	A. Jerzmańska, 1979	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 4	Krępak I	KI	N/9374	A. Jerzmańska, 1986	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/7725	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/7730	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/7738	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/7745	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/7747	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/7749	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błazowa – Walant	BW	N/9375	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.

TABLE S1 (Continued)

Oligocene, Rupelian	IPM 1	Błażowa – Walant	BW	N/9378	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błażowa – Walant	BW	N/9379	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Błażowa – Walant	BW	N/9380	A. Jerzmańska, 1982	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Brzozówka near Jedlicz	BO	N/7717	A. Jerzmańska, 1969	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Brzuska	BR ₂₂	N/9382	A. Jerzmańska, 1972	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Futoma	F	N/9174	A. Jerzmańska, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Jamna Dolna (B-1)	J _B	W/986	J. Jerzmański, 1966	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Jamna Dolna (C-6)	J _C	N/130	J. Jerzmański, 1970	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Jamna Dolna (C-6)	J _C	N/131	J. Jerzmański, 1970	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Jamna Dolna (C-6)	J _C	N/9373	A. Jerzmańska, 1966	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Jazowa	JZ	N/7586	A. Jerzmańska, 1964	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Kotów X (level C)	KT _C	N/9369	A. Jerzmańska, 1966	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Kotów X (level C)	KT _C	N/9370	A. Jerzmańska, 1966	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Krosno	KR	N/9371	A. Jerzmańska, 1966	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Laskówka (0-I)	LA	N/8065	J. Świdnicki, 1987	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Łubno – Łazek	ŁŁ	N/8010	A. Jerzmańska, 1961	A. Jerzmańska	<i>Cetorhinus</i> sp.

TABLE S1 (Continued)

Oligocene, Rupelian	IPM 1	Obarzym	O	N/6428	A. Jerzmańska, 1988	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/6429	A. Jerzmańska, 1988	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/6430	A. Jerzmańska, 1988	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/6431	A. Jerzmańska, 1988	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/6432	A. Jerzmańska, 1988	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/6433	A. Jerzmańska, 1988	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/8955	J. Świdnicki, 1991	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/9007	J. Świdnicki, 1991	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Obarzym	O	N/9018	J. Świdnicki, 1991	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6860	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6861	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level III)	PT ₃	N/6862	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6863	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level III)	PT ₃	N/6864	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6865	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6866	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.

TABLE S1 (Continued)

Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6872	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6874	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6875	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6877	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/6879	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Piątkowa (level II)	PT ₂	N/9381	A. Jerzmańska, 1971	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Rudawka Rymanowska	RR	N/4076	A. Jerzmańska, 1969	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/6803	A. Jerzmańska, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8520	E. Świdnicka, 1977	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8524	A. Jerzmańska, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8538	E. Świdnicka, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8541	E. Świdnicka, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8542	E. Świdnicka, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8543	E. Świdnicka, 1978	A. Jerzmańska	<i>Cetorhinus</i> sp.
Oligocene, Rupelian	IPM 1	Straszydle	S _{1,1a,2}	N/8546	E. Świdnicka, 1977	A. Jerzmańska	<i>Cetorhinus</i> sp.

TABLE S2. Comparative material used in the study

Taxon	n	ID No.	Locality	Age	Reference
<i>Cetorhinus maximus</i> ^f	3	–	Celtic Sea	recent	Hovestadt and Hovestadt-Euler, 2012: figs. 9n, 9r, 9t
<i>Cetorhinus maximus</i> ^f	3	–	Gulf of Biscay	recent	Hovestadt and Hovestadt-Euler, 2012: fig. 9i-k
<i>Cetorhinus maximus</i> ^m	4	–	North Sea	recent	Hovestadt and Hovestadt-Euler, 2012: figs. 9a, 9d-f
<i>Cetorhinus maximus</i> ^m	4	LACM 35876-1	Morro Bay, California, U.S.A.	recent	Welton, 2013: fig. 12.1-4
† <i>Keasius rhenanus</i> **	7	–	Winterswijk-Miste, The Netherlands	Miocene, Burdigalian	Bor et al., 2012: pl. 14, figs. 4-10
† <i>Keasius septentrionalis</i> **	10	SMF P 10015	“Thomas Beton” sandpit, Germany	Oligocene, Chattian	Reinecke et al., 2015: fig. 11A-L
† <i>Keasius parvus</i>	1	V547	Coza Valley, Romania	Oligocene, Rupelian	Bordeianu et al., 2018: pl. I, fig. 1
† <i>Keasius parvus</i>	9	SMF P 10047	Eckelsheim, Wonsheim, Germany	Oligocene, Rupelian	Reinecke et al., 2015: fig. 16A-I
† <i>Keasius parvus</i>	2	Ge 29560	Litenčice, Czech Republic	Oligocene, Rupelian	Gregorová, 2011: fig. 2 Cappetta et al., 2016: fig. 8B

TABLE S2 (continued)

† <i>Keasius parvus</i> *	4	KBIN-P.902-904, KBIN-P.1412	Basel (Steendorp), Belgium	Oligocene, Rupelian	Leriche, 1910: figs. 91-94 Hovestadt and Hovestadt-Euler, 2012: fig. 10a-d
† <i>Caucasochasma zherikhini</i> **	3	PIN 5595/1	Belaya River near Abadzekhskaya, North Caucasus, Russia	Oligocene, Rupelian	Prokofiev and Sytchevskaya, 2018: fig. 3e
† <i>Keasius taylori</i> *	4	NWM 2100	NWM C500, Oregon, U.S.A.	Late Eocene	Welton, 2013: fig. 15
† <i>Keasius taylori</i> *	1	NWM 2101	NWM C501, Oregon, U.S.A.	Late Eocene	Welton, 2013: fig. 16.6

^f – female, ^m – male

*Type specimens

**Specimens associated with type series

TABLE S3. Loadings of landmark coordinates on the first three principal components

Landmark coordinates	PC1	PC2	PC3
x1	-0.171026	-0.182913	-0.085959
y1	0.212486	-0.269097	0.011470
x2	-0.035033	-0.201881	-0.100615
y2	0.141328	0.058665	-0.091528
x3	0.188023	-0.027846	0.013815
y3	0.032380	0.358095	-0.135700
x4	0.291827	0.092301	0.149882
y4	0.049663	0.073836	0.083254
x5	0.249707	0.075614	0.164195
y5	0.089107	-0.228777	0.286764
x6	0.311672	0.046188	0.183595
y6	-0.003452	0.077456	0.166693
x7	0.228266	-0.004407	0.021470
y7	-0.078211	0.349561	-0.019159
x8	0.116269	-0.200332	-0.222465
y8	-0.221908	0.138378	-0.189218
x9	-0.026438	0.052720	-0.353245
y9	-0.131635	-0.285621	-0.201276
x10	-0.236805	0.164403	0.276131
y10	-0.167082	-0.215741	0.113888
x11	-0.161554	0.194011	0.322345
y11	-0.251045	-0.173842	0.149507

TABLE S3 (continued)

x12	-0.177219	0.075982	0.123285
y12	-0.203038	-0.048032	0.310951
x13	-0.132218	0.033788	-0.142766
y13	0.095603	0.373876	-0.252357
x14	-0.172078	-0.053525	-0.185532
y14	0.184540	0.062518	-0.160612
x15	-0.273393	-0.064102	-0.164135
y15	0.251265	-0.271275	-0.072677
Eigenvalues	0.0179	0.0086	0.0028
% Variance	49.517	23.781	7.630

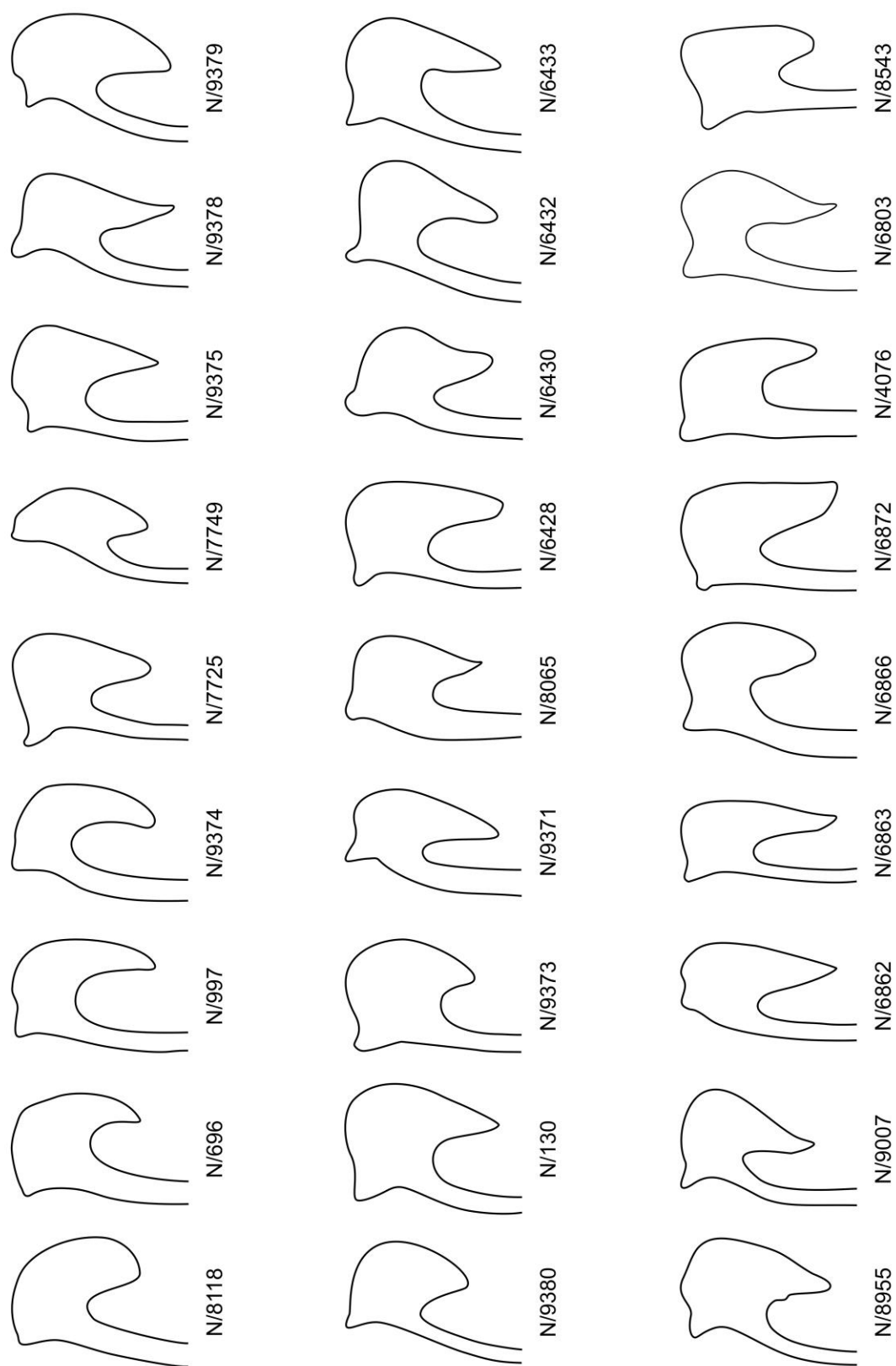


FIGURE S1. The shape of gill rakers of basking sharks from the Oligocene of Poland.

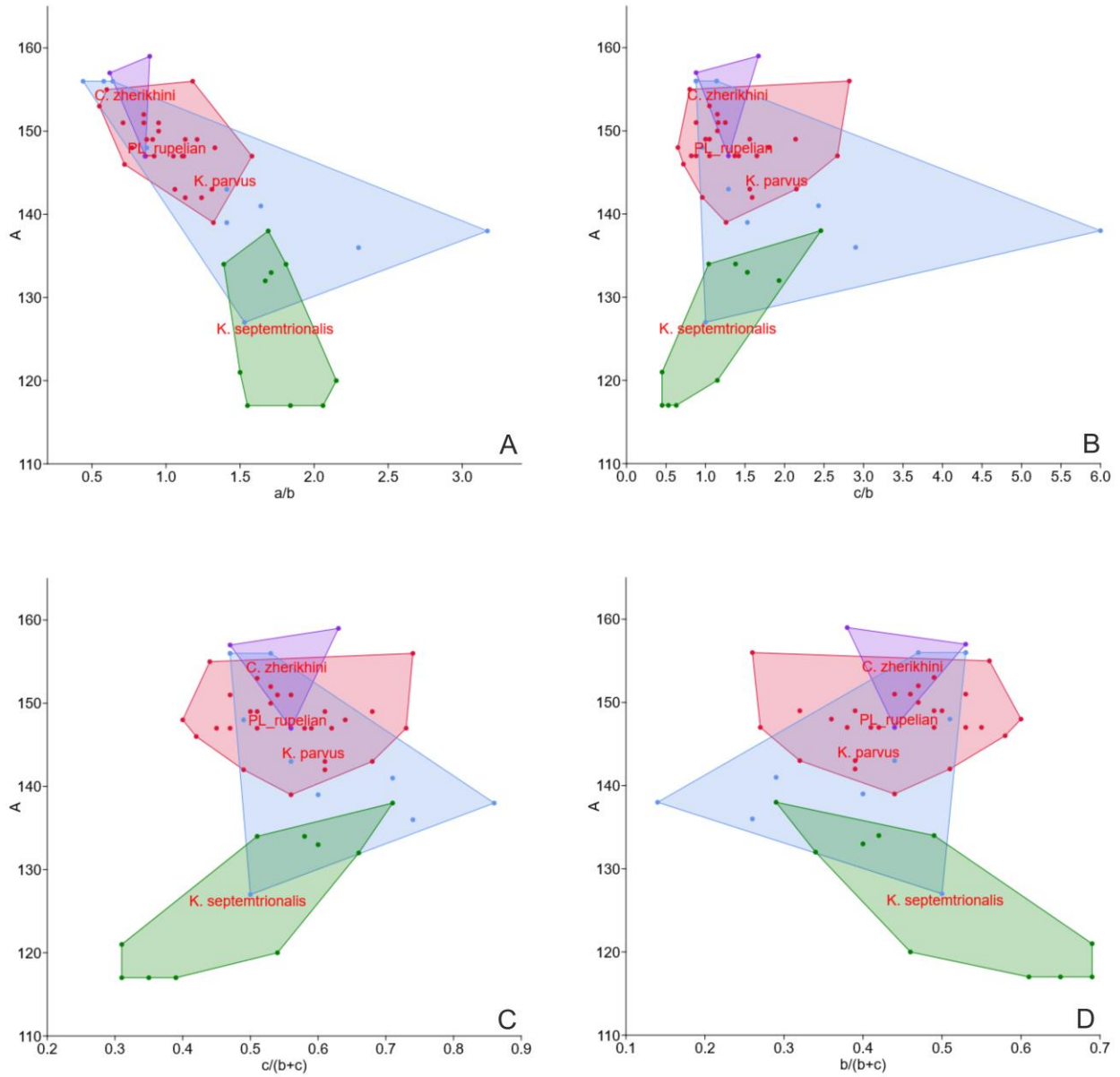


FIGURE S2. The distribution of gill rakers in the space of various morphological indices showing lesser discrimination of samples.

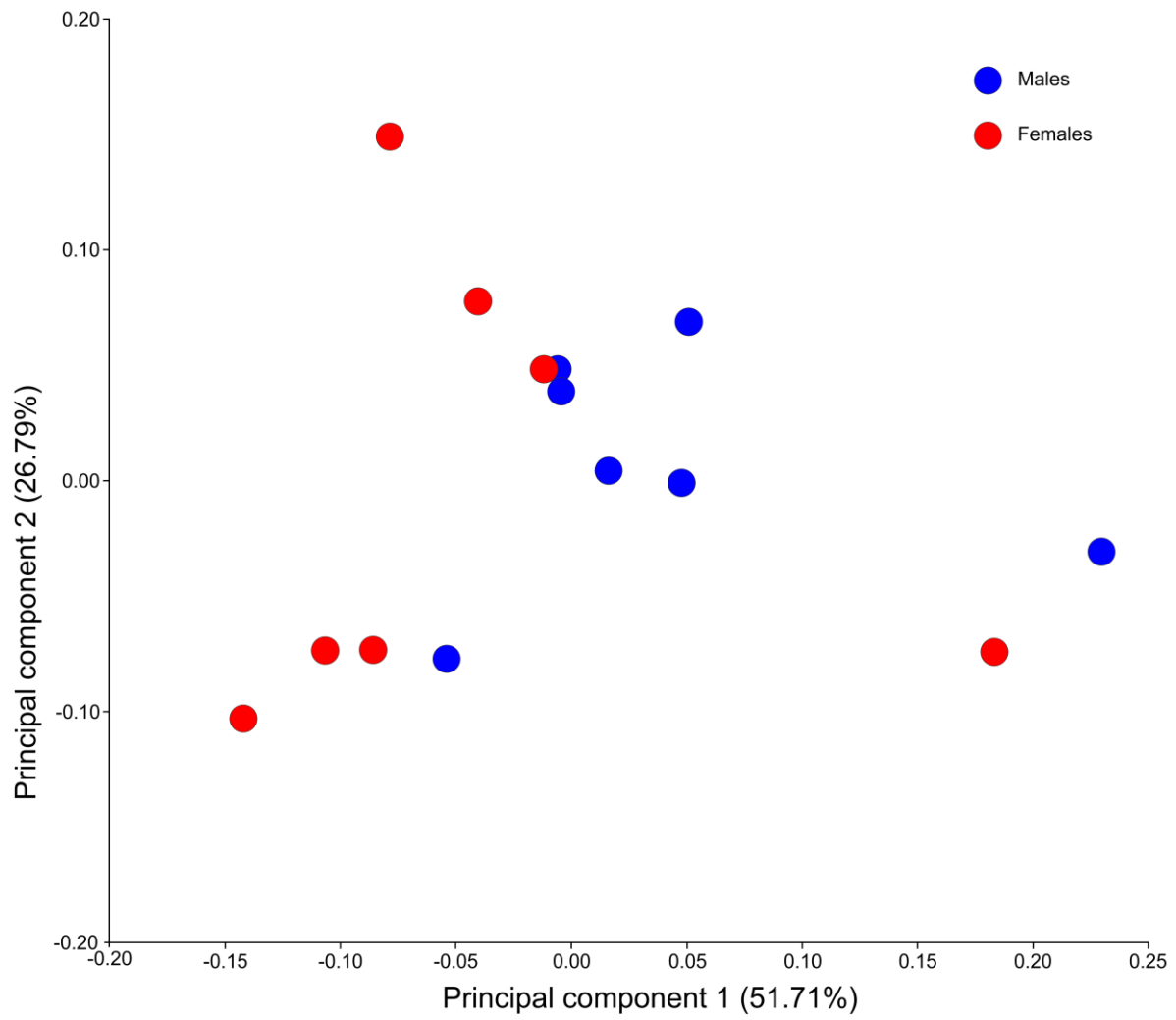


FIGURE S3. The distribution of gill rakers of extant *Cetorhinus maximus* in the space of the first two principal components.

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