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Osteological Study of a Hybrid between *Tursiops truncatus* and *Grampus griseus*

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Abstract A hybrid between a female *Tursiops truncatus* and a male *Grampus griseus* was born on 29 September 1978 and died on 1 May 1985 in Enoshima Aquarium, Japan. The living period was 2,407 days, which is the longest record among hybrids ever recorded in the world. The specimen was a female of 277 cm in body length and was sexually immature. The present hybrid specimen showed intermediate values in cranial characters between *T. truncatus* and *G. griseus*. Relationship of the hybrid specimen to Fraser's three anomalous specimens, *T. truncatus* and *G. griseus* was discussed using the principal component analysis of 16 cranial characters.

Five parent combinations of delphinid have produced hybrid in captivity, namely 1) between a female bottlenose dolphin, *Tursiops truncatus* (MONTAGU, 1821) and a male rough-toothed dolphin, *Steno bredanensis* (LESSON, 1828), 2) between a female *T. truncatus* and a male false killer whale, *Pseudorca crassidens* (OWEN, 1846), 3) between a female short-finned pilot whale, *Globicephala macrorhynchus* GRAY, 1846 and a male *T. truncatus*, 4) a female *T. truncatus* and a male Pacific white-sided dolphin, *Lagenorhynchus obliquidens* GILL, 1865, and 5) between a female *T. truncatus* and a male Risso's dolphin, *Grampus griseus* (G. CUVIER, 1812) (DOHL *et al.*, 1974; SHALLENBERGER & KING, 1977; ANTRIM & CORNELL, 1981; HIROSAKI *et al.*, 1981; NISHIWAKI & TOBAYAMA, 1982, HIROSAKI's personal communication). Single case is known for the first type. A newborn female lived in the Sea Life Park in Hawaii for 1,461 days (4 years). Four hybrids of the second type were recorded in Kamogawa Sea World, Japan. Among them, only one specimen lived for 277 days while other three were abortive

fetuses. A stillbirth of near-term calf was recorded for the third type in May 1981 at the Sea World of San Diego in California. A newborn female of 135.5 cm in body length for the fourth type was born on 15 June 1985 in Enoshima Aquarium, Japan and lived for only five hours after birth. Present hybrid specimen for the fifth type was obtained in Enoshima Aquarium, Japan. This specimen has been studied from aspects of external appearance, electrophoretic characters, blood components and enzymes (HIROSAKI *et al.*, 1981; SEZAKI *et al.*, 1981; SEZAKI *et al.*, 1984; SHIMURA *et al.*, 1986).

Concerning hybrids between *T. truncatus* and *G. griseus* in the wild, FRASER (1940) conducted a detailed study of external morphology and osteology of three anomalous dolphins from Blacksod Bay of Ireland, and concluded that they were probably hybrids between two species. He also stated that there existed no previous evidence of successful crossing between genera or even species of toothed whales. As mentioned above, the hybrid specimens between genera were obtained in the aquarium but not in wild after FRASER (1940).

Present study was undertaken to describe the osteology of a hybrid between a female *T. truncatus* and a male *G. griseus*, which obtained in Enoshima Aquarium, Japan and compare the specimen with three anomalous specimens of FRASER (1940), *T. truncatus*, and *G. griseus*.

Background

A hybrid female between a female *T. truncatus* and a male *G. griseus* was born on 29 September 1978 and was died on 1 May 1985 in Enoshima Aquarium, Japan. The animal was friendly called as Kuri-chan by trainers and public people. The living period was 2,407 days (6 years and 7 months) which was the longest record among hybrids ever recorded in the world. The present animal is the first birth of 13 hybrids between *T. truncatus* and *G. griseus* in Enoshima Aquarium (SYLVESTRE and TASAKA, 1985). During September and October in 1977 when the mother (Body length: 290 cm) of hybrid specimen probably became pregnant, there were four male dolphins, an adult male *T. truncatus* (310 cm), an immature male *T. truncatus*, an adult male *G. griseus* (300 cm) and an adult male *P. crassidens* (431 cm) together with her in the same pool (HIROSAKI *et al.*, 1981), and the father of the present hybrid was not recognized until the detailed biological and biochemical examinations. Thus, it was considered that the present hybrid specimen was born by crossing between a female *T. truncatus* of 290 cm in length (Body weight: 280 kg) and a male *G. griseus* of 300 cm in length (280 kg). Present hybrid female died of nocardiosis and was 277.0 cm in body length and 190.0 kg in body weight. Present animal had neither corpus luteum nor corpus albicans in both ovaries. Skeleton of the specimen was deposited in the Mammal Section of the National Science Museum, Japan (NSM, M. 26253).

Osteological analysis

Cranium

Skull of the present female specimen was compared with those of a female *T. truncatus* (NSM, M. 24907; BL: 275 cm) collected at Arari, Shizuoka Prefecture and a female *G. griseus* (NSM, M. 21400; 284 cm) collected at Yonashiro, Okinawa

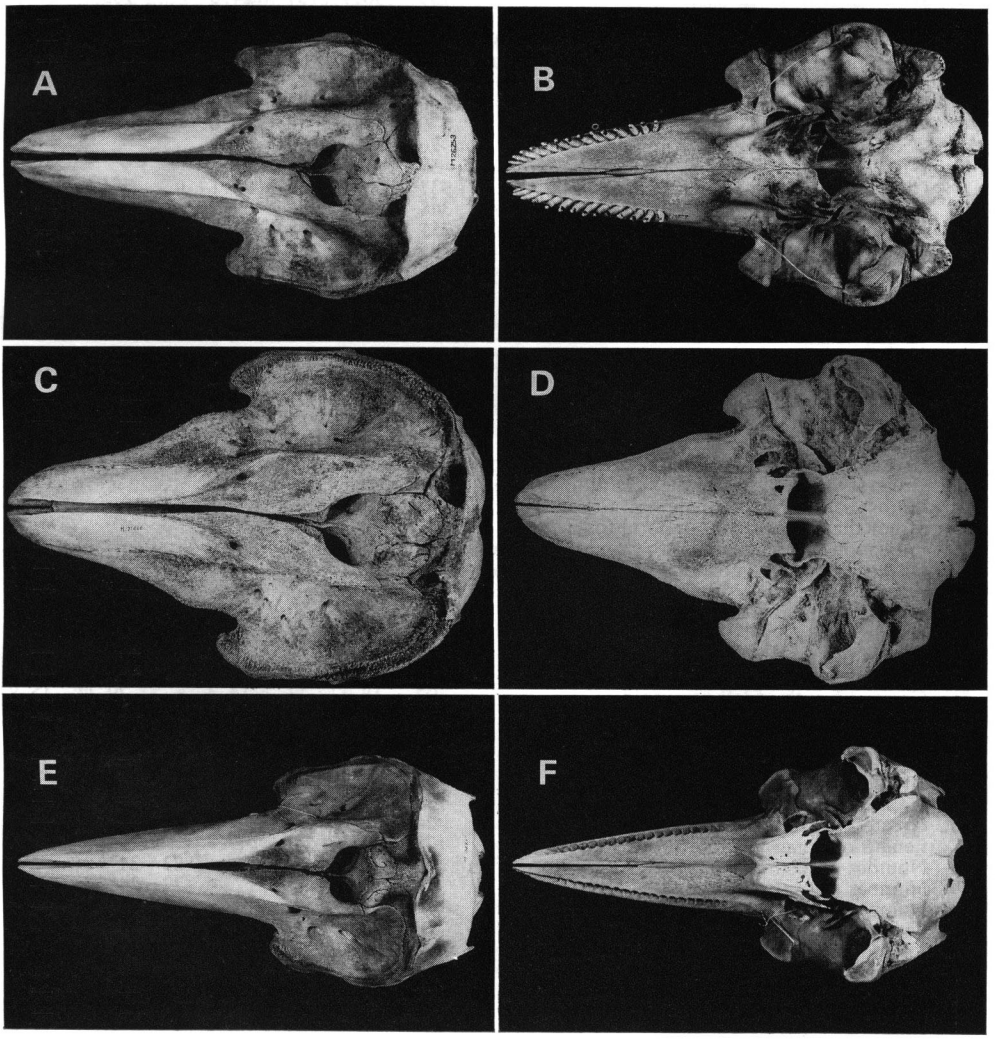


Fig. 1. Dorsal and ventral view of skulls. A: dorsal view of the present hybrid specimen (NSM M. 26253), B: ventral view of the present hybrid specimen (NSM M. 26253), C: dorsal view of *Grampus griseus* (NSM M. 21400), D: ventral view of *Grampus griseus* (NSM M. 21400), E: dorsal view of *Tursiops truncatus* (NSM M. 24907), F: ventral view of *Tursiops truncatus* (NSM M. 24907).

Table 1. Skull measurements of the present specimen, three hybrid

	Skull measurements	Present specimen M 26253		*Tursiops* N. Pacific M 24907		*Tursiops**	
		mm	%	mm	%	mm	%
1	Condylobasal length.	508	100.0	558	100.0	500	100 0
2	Length of rostrum.	270	53.1	322	57.7	281	56.2
3	Width of rostrum at base.	153	30.1	137	24.6	133	26.6
4	Width of premaxillaries at rostrum base.	86	16.9	79	14.2	—	—
5	Width of rostrum at 60 mm from rostrum base.	127	25.0	107	19.2	—	—
6	Width of premaxillaries at 60 mm from rostrum base.	77	15.2	64	11.5	—	—
7	Width of rostrum at midlength.	100	19.7	83	14.9	87	17.4
8	Width of premaxillaries at midlength.	70	13.8	48	8.6	46	9.2
9	Width of rostrum at 3/4 from posterior end.	76	15.0	55	9.9	—	—
10	Width of premaxillaries at 3/4 from posterior end.	58	11.4	40	7.2	—	—
11	Distance from tip of rostrum to external nares.	337	66.3	380	68.1	331	66.2
12	Distance from tip of rostrum to internal nares.	348	68.5	386	69.2	—	—
13	Greatest preorbital width.	255	50.2	238	42.7	—	—
14	Greatest postorbital width.	285	56.1	268	48.0	—	—
15	Least supraorbital width.	250	49.2	232	41.6	238	47.6
16	Greatest width of external nares.	60	11.8	60	10.8	—	—
17	Greatest width across zygomatic processes of squamosal.	284	55.9	274	49.1	267	53.4
18	Greatest width of premaxillaries.	109	21.5	100	17.9	98	19.6
19	Greatest parietal width.	218	42.9	221	39.6	156	31.2
20	Vertical external height of braincase from basisphenoid to summit of supraoccipital.	157	30.9	175	31.4	—	—
21	Internal length of braincase.	155	30.5	145	26.0	—	—
22	Greatest length of left posttemporal fossa.	114	22.4	121	21.7	112	22.4
23	Greatest width of left posttemporal fossa.	70	13.8	74	13.3	77	15.4
24	Major diameter of left temporal fossa.	63	12.4	62	11.1	—	—
25	Minor diameter of left temporal fossa.	52	10.2	58	10.4	—	—
26	Projection of premaxillaries beyond maxillaries.	15	3.0	24	4.3	—	—
27	Distance from foremost end of junction between nasals to hindmost point of margin of supraoccipital crest.	46	9.1	56	10.0	—	—
28	Length of left orbit.	82	16.1	70	12.5	—	—
29	Length of antorbital process of left lacrimal.	54	10.6	58	10.4	—	—
30	Greatest width of internal nares.	87	17.1	81	14.5	—	—
31	Greatest length of left pterygoid.	92	18.1	86	15.4	79	15.8
32	Greatest width of anterior overhang of supraoccipital crest.	209	41.1	220	39.4	—	—
33	Greatest length of left tympanic bulla.	39	7.7	35	6.3	—	—
34	Greatest width of left tympanic bulla.	22	4.3	21	3.8	—	—
35	Greatest length of left periotic.	36	7.1	36	6.5	—	—
36	Greatest width of left periotic.	24	4.7	23	4.1	—	—
37	Length of upper left tooth row.	179	35.2	276	49.5	242	48.4
38	Number of teeth-upper left.	14		24		22～24**	—
39	Number of teeth-upper right.	14		25		22～24**	—
40	Number of teeth-lower left.	16		24		22～24**	—
41	Number of teeth-lower right.	18		24		22～24**	—
42	Length of lower left tooth row.	198	39.0	266	47.7	221	44.2
43	Greatest length of left ramus.	423	83.3	466	83.5	392	78.4
44	Greatest height of left ramus.	98	19.3	99	17.7	—	—
45	Length of left mandibular fossa.	152	29.9	154	27.6	—	—
46	Length of symphysis.	55	10.8	75	13.4	59	11.8
47	Cranial breadth.	188	37.0	198	35.5	187	37.4
48	Cranial length.	170	33.5	168	30.1	164	32.8
49	Length from last tooth to maxillary notch.	94	18.5	53	9.5	51	10.2
50	Tip of rostrum to posterior end of pterygoids.	362	71.3	401	71.9	338	67.6
51	Center of glenoid cavity to tip of premaxilla.	426	83.9	471	84.4	424	84.8

* Measurements of these specimens are cited from Fraser (1940).
** The number of teeth is normally obtained on each side (Fraser, 1940).

dolphins of Fraser (1940), *Tursiops truncatus*, and *Grampus griseus*.

Hybrid						*Grampus*		*Grampus**	
No. 66*		No. 67*		No. 68*		N. Pacific M 21400			
mm	%	mm	%	mm	%	mm	%	mm	%
469	100 0	456	100.0	482	100 0	481	100 0	491	100.0
259	55.2	238	52.2	241	50.0	245	50.9	250	50.9
128	27.3	148	32.5	161	33.4	200	41.6	194	39.5
—	—	—	—	—	—	107	22.2	—	—
—	—	—	—	—	—	167	34.7	—	—
—	—	—	—	—	—	87	18.1	—	—
81	17.3	83	18.2	96	19 9	118	24.5	114	23.2
53	11.3	57	12.5	66	13.7	82	17.0	77	15.7
—	—	—	—	—	—	88	18.3	—	—
—	—	—	—	—	—	78	16.2	—	—
306	65.2	306	67.1	310	64.3	328	68.2	323	65.8
—	—	—	—	—	—	307	63.8	—	—
—	—	—	—	—	—	312	64.9	—	—
—	—	—	—	—	—	327	68.0	—	—
226	48.2	244	53.5	279	57.9	305	63.4	322	65.6
—	—	—	—	—	—	65	13.5	—	—
253	53.9	271	59.4	306	63.5	328	68.2	352	71.7
92	19.6	105	23.0	111	23 0	115	23.9	130	26.5
179	38.2	195	42.8	206	42.7	225	46.8	225	45.8
—	—	—	—	—	—	183	38.0	—	—
—	—	—	—	—	—	147	30.6	—	—
104	22.2	114	25.0	130	27.0	113	23.5	129	26.3
61	13.0	81	17.8	77	16.0	59	12.3	71	14.5
—	—	—	—	—	—	52	10.8	—	—
—	—	—	—	—	—	62	12.9	—	—
—	—	—	—	—	—	11	2.3	—	—
—	—	—	—	—	—	40	8.3	—	—
—	—	—	—	—	—	78	16.2	—	—
—	—	—	—	—	—	56	11.6	—	—
—	—	—	—	—	—	96	20.0	—	—
72	15.4	87	19.1	89	18.5	102	21.2	105	21.4
—	—	—	—	—	—	136	28.3	—	—
39	8.3	42	9.2	41	8.5	45	9.4	—	—
—	—	—	—	—	—	39	8.1	—	—
35	7.5	40	8.8	40	8.3	41	8.5	—	—
—	—	—	—	—	—	26	5.4	—	—
220	46.9	195	42.8	128	26.6	—	—	—	—
19		14		9		0		0	
19		14		8		0		0	
19		14		9		5		2～7**	
19		14		9		4		2～7**	
218	46.5	185	40.6	125	25.9	71	14.8	55	11.2
407	86.8	389	85.3	385	79 9	395	82.1	395	80.4
—	—	—	—	—	—	103	21.4	—	—
—	—	—	—	—	—	185	38.5	—	—
81	17.3	62	13.6	55	11.4	44	9.1	58	11.8
180	38.4	207	45.4	220	45.6	213	44.3	250	50.9
161	34.3	157	34.4	191	39.6	172	35.8	170	34.6
53	11.3	62	13.6	129	26.8	—	—	—	—
312	66.5	308	67.5	297	61.6	321	66.7	299	60.9
390	83.2	380	83.3	387	80.3	406	84.4	400	81.5

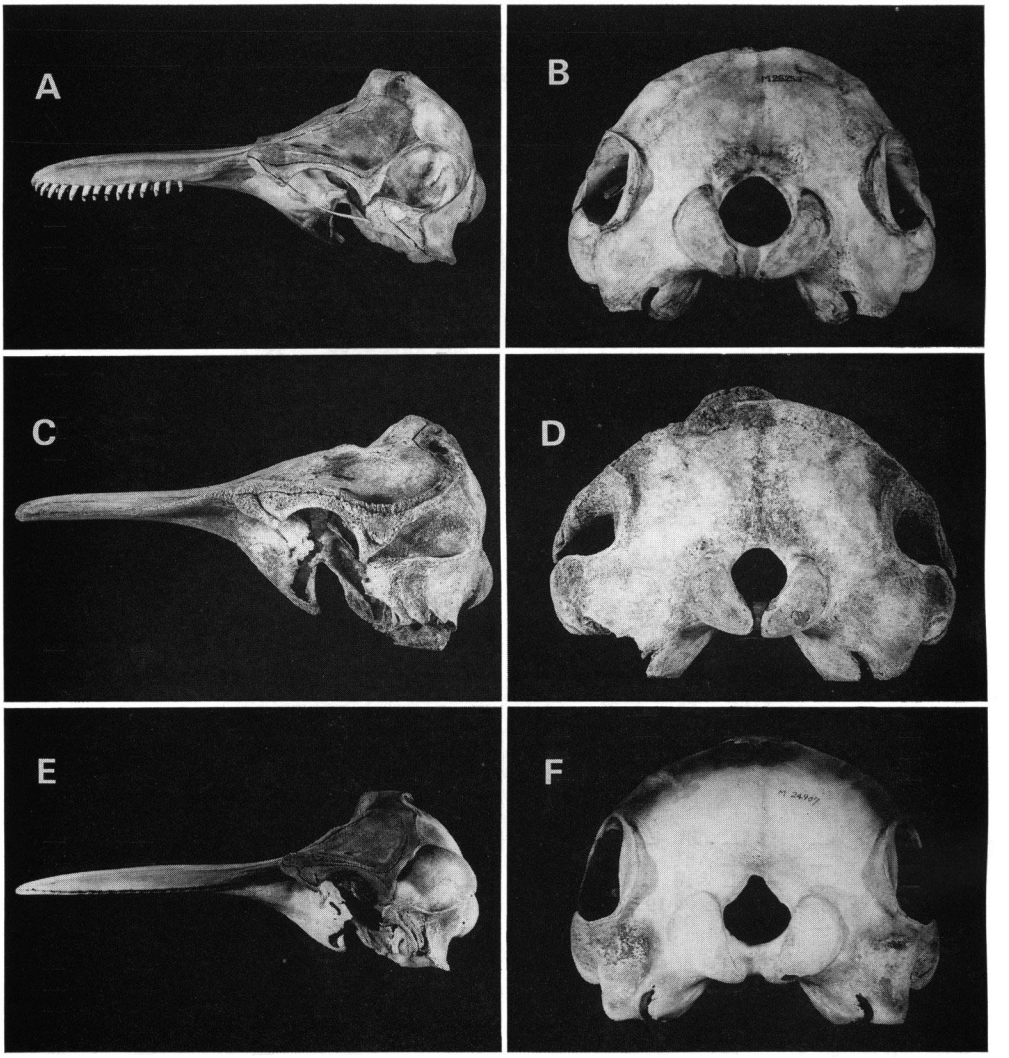
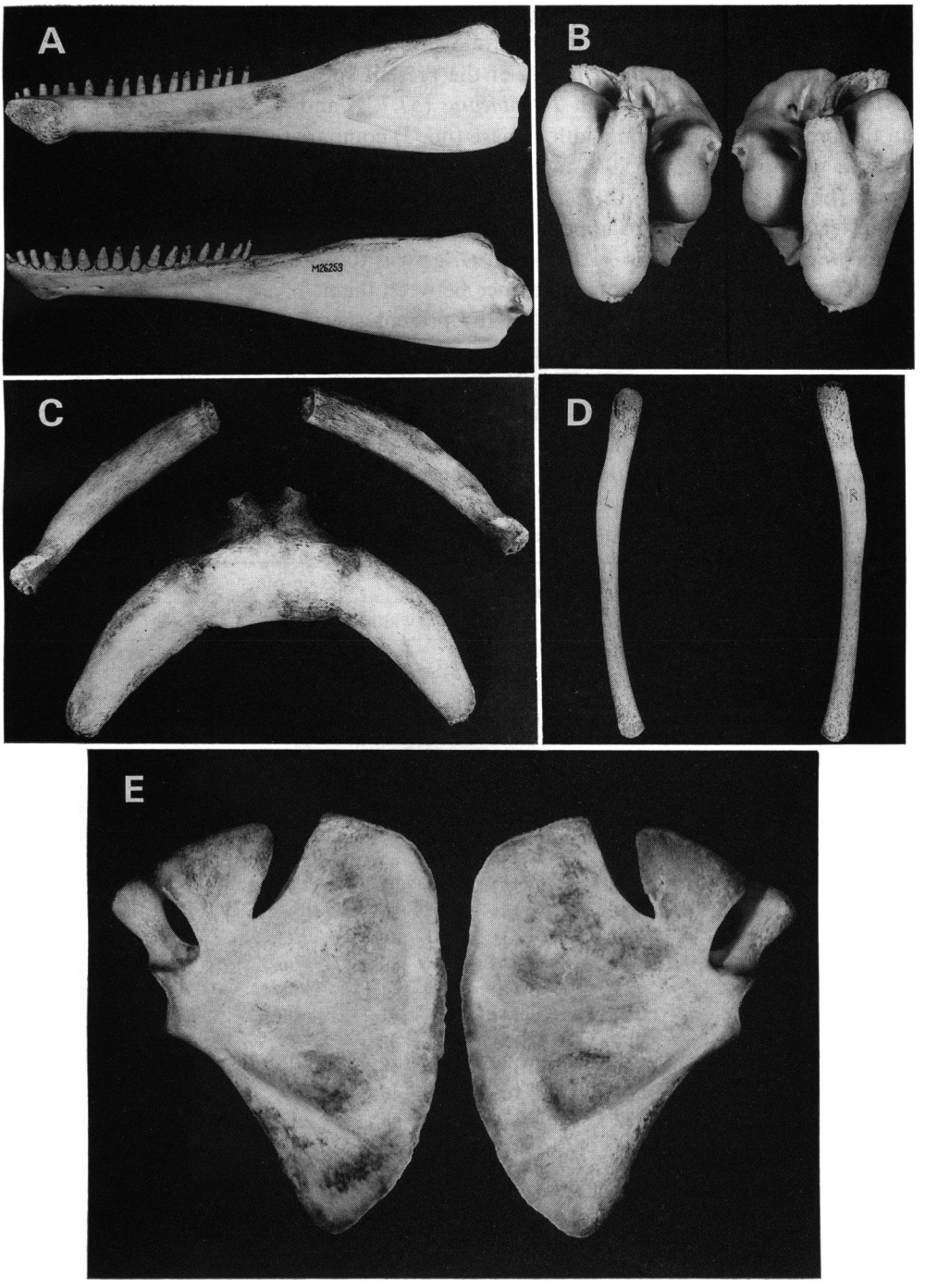


Fig. 2. Lateral and posterior view of skulls. A: lateral view of present hybrid specimen (NSM M. 26253), B: posterior view of the present hybrid specimen (NSM M. 26253), C: lateral view of *Grampus griseus* (NSM M. 21400), D: posterior view of *Grampus griseus* (NSM M. 21400), E: lateral view of *Tursiops truncatus* (NSM M. 24907), F: posterior view of *Tursiops truncatus* (NSM M. 24907).

Fig. 3. Mandibles, ear bones, hyoid bones, pelvic bones and scapulae of the present hybrid specimen (NSM M. 26253). A: mandibles, B: ear bones, C: hyoid bones, D: pelvic bones, E: scapulae.


A
M26253
B
C
D
E

Prefecture (Figs. 1 and 2). The present specimen showed intermediate values of *T. truncatus* and *G. griseus* in the following cranial characters (Table 1). The rostrum length (Measurement no. 2) of the present specimen was 53.1% of the condylobasal length compared with *T. truncatus* (57.7%) and *G. griseus* (50.9%), 30.1% in the proportional rostrum width at base (no. 3) compared with *T. truncatus* (24.6%) and *G. griseus* (41.6%), 55.9% in the proportional greatest width of zygomatic processes (no. 17) compared with *T. truncatus* (49.1%) and *G. griseus* (68.2%), and 14/16~18 in teeth formula (No. of upper teeth in each side/No. of lower teeth in each) compared with *T. truncatus* (24~25/24) and *G. griseus* (0/4~5). The dimension of temporal fossa showed no obvious difference between them.

The upper tooth row (no. 37) of the present specimen was 35.2% of the condylobasal length and it was shorter than that of *T. truncatus* (49.5%). *G. griseus* normally has no upper tooth. The proportional length of lower tooth row of the specimen is 39.0% and it was higher than that of *G. griseus* (14.8%) while it was lower than that of *T. truncatus* (47.7%). The concavity of the profile of the ventral edge of the mandible and the bluntly-rounded prominence at the antero-ventral of the mandible

Table 2. Measurements of vertebrae of present hybrid specimen (mm).

Serial no.	Vertebral no.	Greatest width	Greatest height	Centrum			Degree of fusion of epiphyses*
				width	height	length	
1	C1	186	125	—	—	—	A
2	2	129	107	46	46	—	A
3	3	67	77	46	41	4	C
4	4	61	80	45	44	5	C
5	5	51	82	43	44	4	C
6	6	54	86	46	43	5	C
7	7	68	81	50	41	9	C
8	T1	114	117	47	40	12	C
9	2	120	136	43	40	17	C
10	3	124	142	41	39	25	C
11	4	124	145	39	35	29	C
12	5	130	131	39	33	31	C
13	6	137	136	39	36	33	C
14	7	145	140	41	38	35	C
15	8	154	144	41	38	35	C
16	9	166	154	42	39	36	C
17	10	182	159	44	39	35	C
18	11	204	165	46	39	35	C
19	12	232	174	46	40	35	C
20	13	247	180	47	40	33	C
21	L1	245	186	48	40	33	C
22	2	245	192	49	41	31	C
23	3	240	195	50	42	30	C
24	4	243	193	50	42	31	C
25	5	237	195	51	43	30	C

Table 2. Continued

Serial no.	Vertebral no.	Greatest width	Greatest height	Centrum			Degree of fusion of epiphyses*
				width	height	length	
26	6	237	197	51	44	30	C
27	7	232	197	51	45	29	C
28	8	231	199	51	45	29	C
29	9	228	198	52	46	28	C
30	10	227	194	52	45	28	C
31	11	225	192	52	45	28	C
32	12	222	187	54	46	29	C
33	13	218	185	54	48	29	C
34	14	215	179	53	49	29	C
35	15	210	173	55	49	28	C
36	16	204	170	55	50	28	C
37	17	195	166	54	51	28	C
38	18	187	159	55	51	28	C
39	19	180	156	55	51	29	C
40	20	175	152	55	50	29	C
41	CA1	170	149	56	50	28	C
42	2	165	145	57	49	29	C
43	3	160	142	55	49	29	C
44	4	149	138	55	50	30	C
45	5	136	134	56	50	31	C
46	6	121	130	55	51	31	C
47	7	107	126	57	52	31	C
48	8	92	122	55	51	33	C
49	9	76	118	55	52	34	C
50	10	65	111	55	52	35	C
51	11	55	106	53	52	36	C
52	12	49	98	49	53	37	C
53	13	45	90	45	53	38	C
54	14	42	79	42	55	38	C
55	15	40	72	40	54	41	B
56	16	39	59	50	39	36	B
57	17	40	47	40	44	31	A
58	18	43	34	39	32	23	A
59	19	45	26	41	23	19	A
60	20	44	22	37	20	18	A
61	21	43	22	35	19	17	A
62	22	39	20	32	17	14	A
63	23	36	18	28	15	14	A
64	24	31	14	25	13	12	A
65	25	27	11	23	11	11	A
66	26	23	10	18	10	10	A
67	27	18	8	15	8	9	A
68	28	10	6	8	5	6	A

* A indicates epiphyses fused completely, B epiphyses fused with sutures, and C epiphyses not fused.

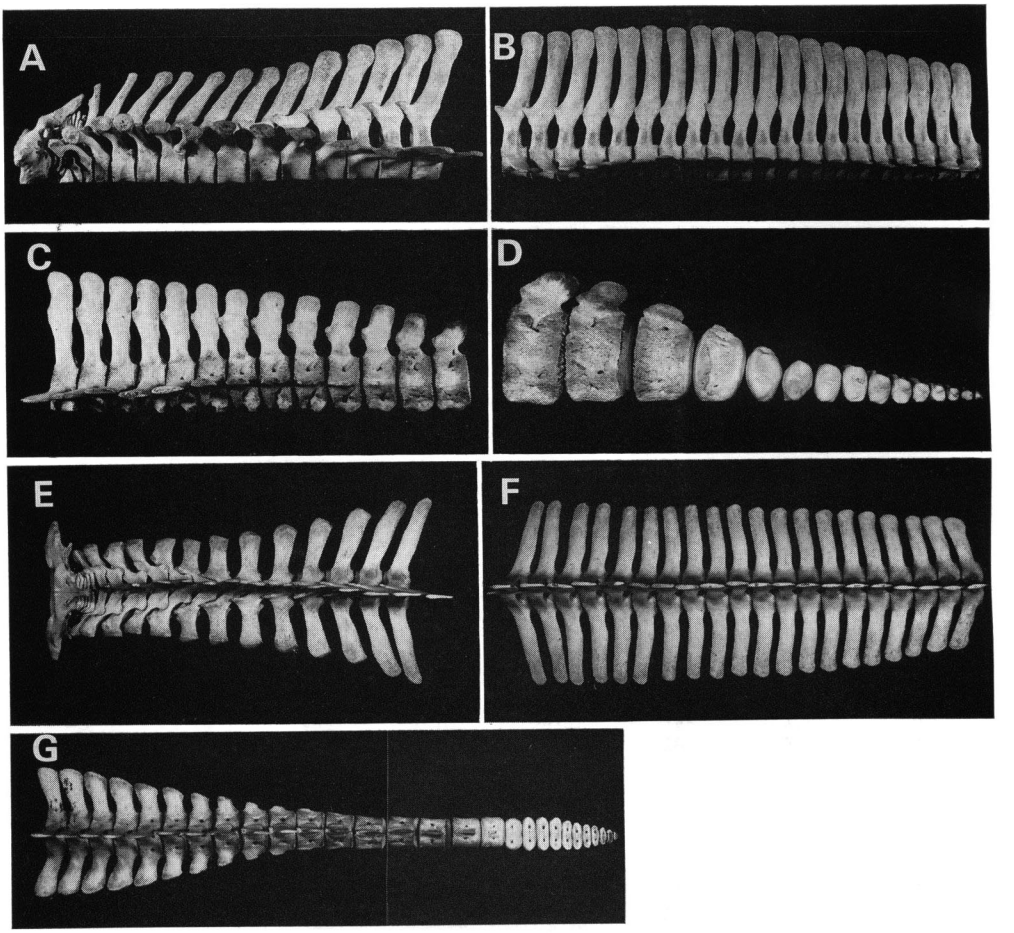


Fig. 4. Lateral and dorsal view of vertebrae of the present hybrid specimen (NSM M. 26253). A: lateral view of cervical and thoracic vertebrae, B: lateral lumbar vertebrae, C and D: lateral view of caudal vertebrae, E: dorsal view of cervical and thoracic vertebrae, F: dorsal view of lumbar vertebrae, G: dorsal view of caudal vertebrae.

were observed in the present specimen as well as *G. griseus* for which they are specific features (Fig. 3).

Postcranial skeleton

Vertebral formula of the present specimen was C7+T13+L20+Ca28=68 when the first caudal vertebra was considered to associate with the anterior part of the first chevron (Table 2 and Fig. 4). The first and second cervical bones were firmly fused in the centrum and neural arches as in *T. truncatus* (Fig. 5). The epiphyses were fused to the centrum on the 1st~2nd cervicals and the 15th~28th caudals, but not on other vertebra. This indicated that the present specimen was physically immature. Left

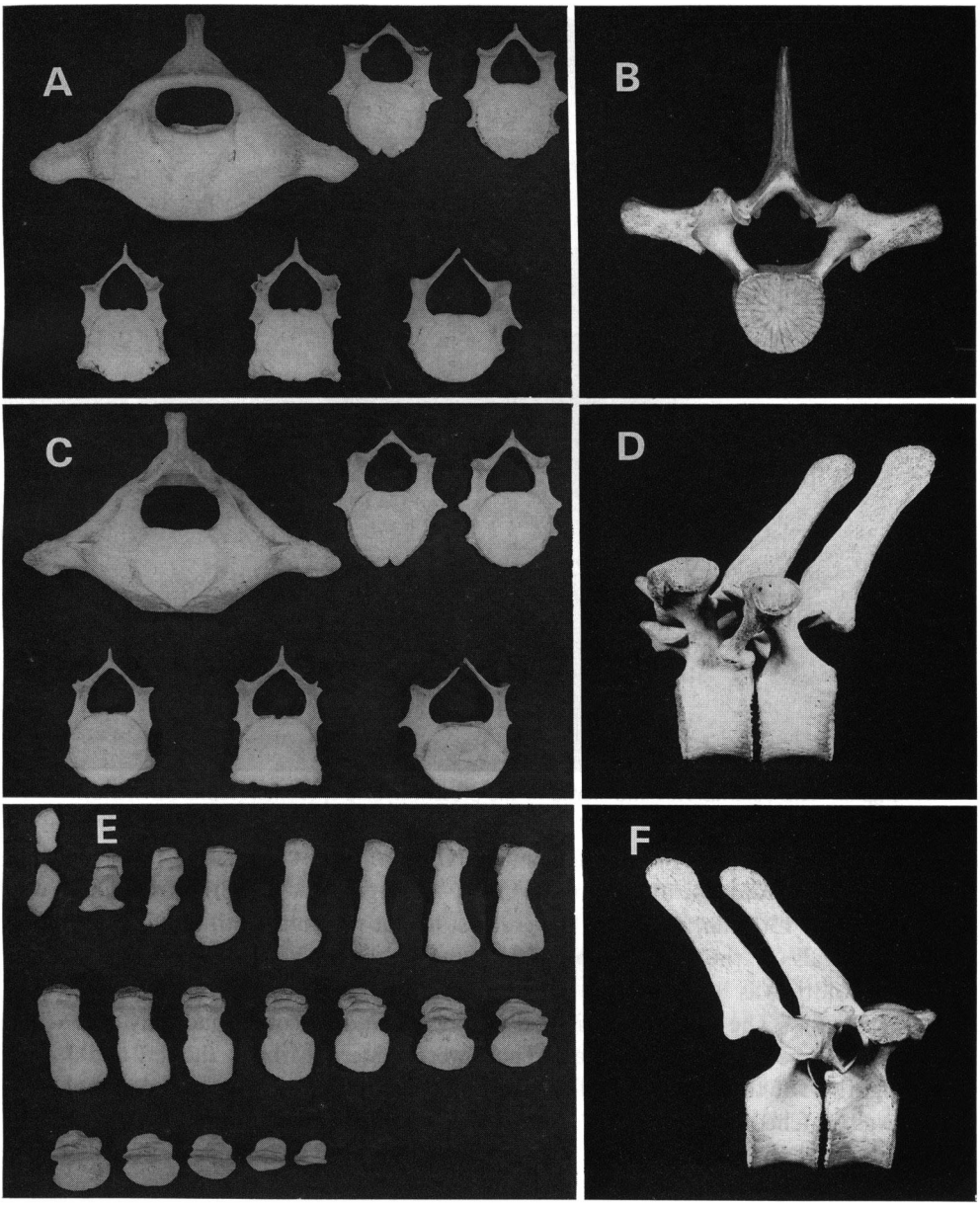


Fig. 5. Cervical vertebrae, the 5th and 6th thoracic vertebrae, and chevron bones of the present hybrid specimen (NSM M. 26253). A: anterior view of cervical vertebrae, top: 1st-2nd (fused into one), 3rd and 4th cervicals (left to right), bottom: 5th, 6th and 7th cervicals (left to right), B: anterior view of the 6th thoracic vertebra, C: posterior view of cervical vertebrae, top: 1st-2nd (fused into one), 3rd and 4th cervicals (left to right), bottom: 5th, 6th and 7th cervicals (left to right), D: left lateral view of 5th and 6th thoracic vertebrae (left to right), E: lateral view of chevron bones, top: 1st-8th chevron bones (left to right), middle: 9th-15th chevron bones (left to right), bottom: 16th-20th chevron bones (left to right). F: right lateral view of 6th and 5th thoracic vertebrae (left to right).

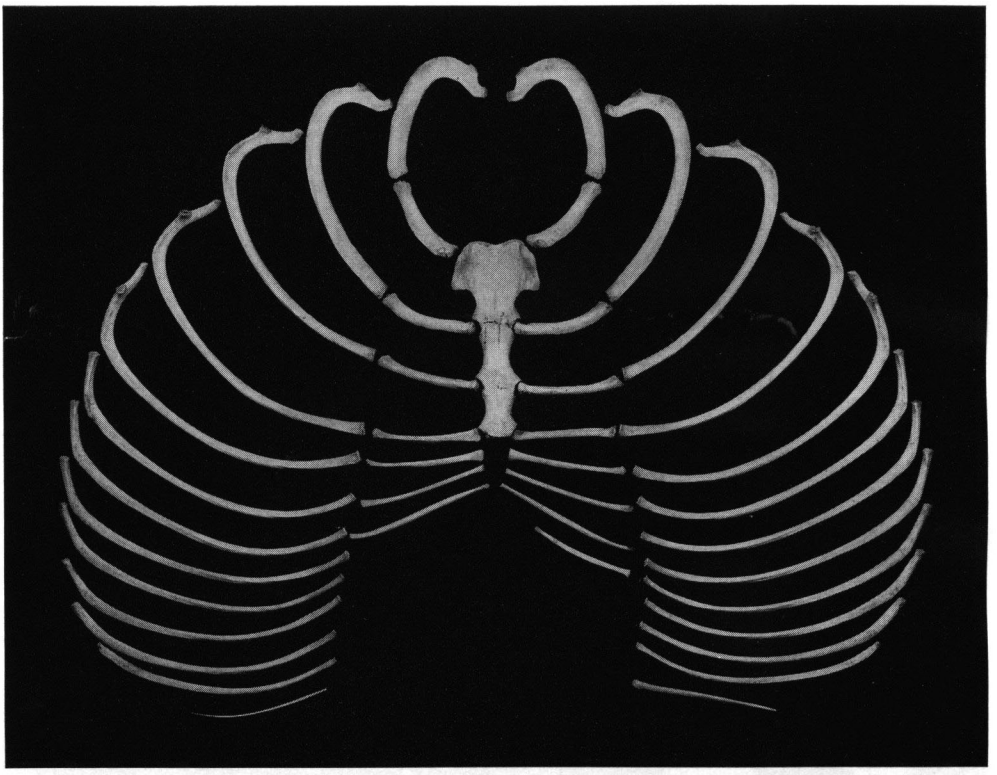


Fig. 6. Ribs, sternal ribs and sterna of the present hybrid specimen (NSM M. 26253).

diapophysis of the 6th thoracic attached to the posterior part of the 5th thoracic while right diapophysis did not attach to it (Fig. 5). The greatest breadth of vertebrae was observed in the 13th thoracic while the greatest height was in the 8th lumbar (Table 2).

Thyrohyals of the present specimen fused to basihyal (Fig. 3). The greatest thyrohyal width was 37.3% of the greatest length. The specimen had thirteen pairs of ribs (Fig. 6). The first five paris had two heads and the other had only one. The last pair was free from the vertebra. There were 8 sternal ribs in the left and 7 ones in the right. The three elements of the sternum were fused into one. The manubrium sterni was notched in front as in *T. truncatus*. No median foramen was observed. X-ray photograph of both flippers was shown in Fig. 7. The epiphyses of ulna and radius were completely fused in the proximal and distal end. The olectranon process projected at almost a right angle from the shaft of the ulna as in *T. truncatus*. The present specimen showed the following phalangeal formulae; I: 3, II: 10, III: 8, IV: 4 and V: 3 in both flippers. The epiphyses of these digits were almost fused but not completely.

Comparison of hybrid specimens in aquarium and in wild

Skull of the present hybrid specimen was compared with those of three Fraser's

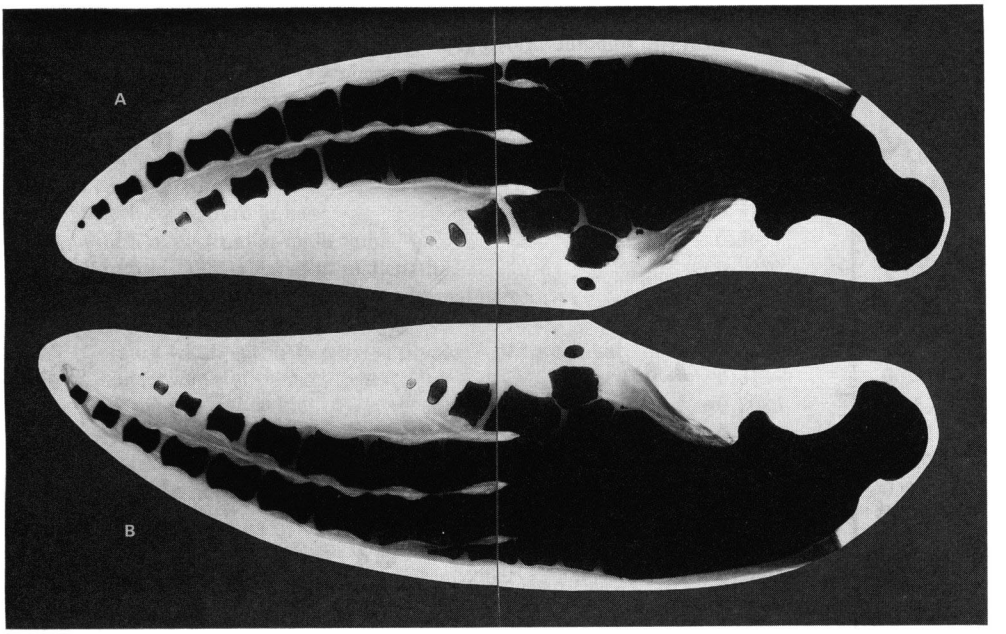


Fig. 7. X-ray photograph of flippers of the present hybrid specimen (NSM M. 26253). A: left flipper, B: right flipper.

specimens (Nos. 66, 67 and 68) from Blacksod Bay of Ireland, and those of *T. truncatus* and *G. griseus* from both North Atlantic and North Pacific. This comparison indicated that the cranial measurements of the present hybrid specimen and three Fraser's hybrid specimens showed intermediate values between *T. truncatus* and *G. griseus* (Table 1). Proportional rostrum length (Measurement no. 2) to condylobasal length (no. 1) increased in the order of 50.0% (Fraser's specimen no. 68), 50.9% (*G. griseus*), 52.2% (no. 67), 53.1% (present specimen), 55.2% (no. 66) and 56.2~57.7% (*T. truncatus*). Similar wide variety existed in the number of teeth of these specimens, *i.e.*, 0/4~5 (*G. griseus*), 8~9/9 (no. 68), 14/14 (no. 67), 14/16~18 (present specimen), 19/19 (no. 66) and 22~25/22~24 (*T. truncatus*). On the other hand, the relationship of proportional rostrum width at base (Measurement no. 3) to condylobasal length (no. 1) among above specimens showed the reverse tendency as it decreased in the order of 39.5~41.6% (*G. griseus*), 33.4% (no. 68), 32.5% (no. 67), 30.1% (present specimen), 27.3% (no. 66) and 24.6~26.6% (*T. truncatus*). Similar tendency was observed in the proportional greatest width across the zygomatic processes of squamosal (Measurement no. 17), the proportional least supraorbital width (no. 15), the proportional greatest parietal width (no. 19) and the proportional greatest premaxillaries width (no. 18).

In order to make clear the relationship among these specimens (present specimen, three Fraser's specimens, *T. truncatus*, and *G. griseus*), the principal component analy-

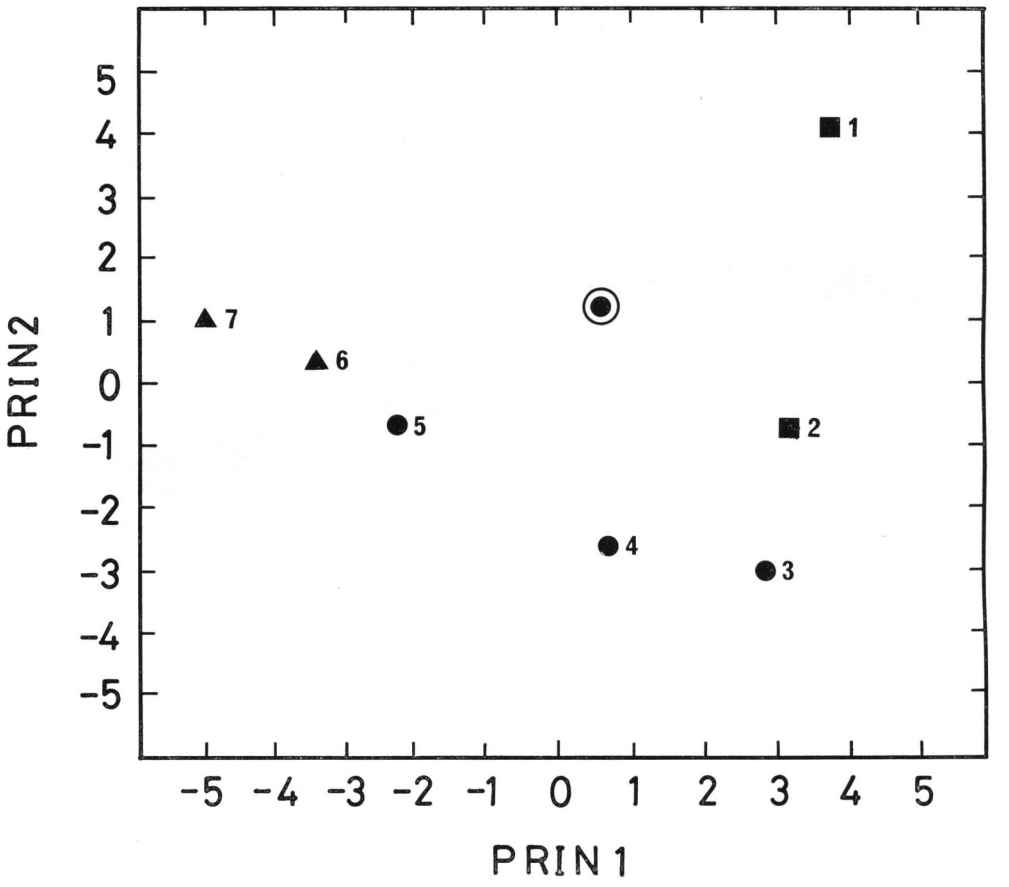


Fig. 8. Comparison of the present hybrid specimen (NSM M. 26253), three Fraser's hybrid dolphins, *Tursiops truncatus* and *Grampus girseus* based on the principal component analysis. Double circle indicates the present specimen, closed squares *T. truncatus* (No. 1: specimen of NSM M. 24907 from Japanese waters; No. 2: specimen cited from FRASER (1940)), closed circles three hybrid dolphins cited from FRASER (1940) (No. 3: specimen of No. 66, No. 4: specimen of No. 67 and No. 5: specimen of No. 68), and closed triangles *Grampus griseus* (No. 6: specimen of NSM M. 21400 from Japanese waters; No. 7: specimen cited from FRASER (1940)).

sis was carried out using the 16 cranial characters (Measurement nos, 1, 2, 3, 7, 8, 11, 15, 17, 18, 19, 22, 23, 47, 48, 50 and 51) (Fig. 8). Eigen vectors of these components were shown in Table 3. In the first principal component the following two groups of the characters were important factors to separate *T. truncatus* from *G. griseus*, *i.e.*, (1) rostrum width at base and midlength (nos. 3 and 7), and premaxillaries width at midlength (no. 8), (2) least width of supraorbital width (no. 15), greatest width zygomatic processes of squamosal (no. 17) and greatest parietal width (no. 19). Con-

Table 3. Eigenvectors and proportions for the first and second principal component of the present specimen, three hybrid dolphins of Fraser (1940), *Tursiops truncatus*, and *Grampus griseus*.

	Measurements	PRIN1	PRIN2
1	Condylobasal length.	0.1253	0.4368
2	Length of rostrum.	0.2336	0.3400
3	Width of rostrum at base.	−0.3287	0.0868
7	Width of rostrum at midlength.	−0.3077	0.1158
8	Width of premaxillaries at midlength.	−0.3187	0.0371
11	Distance from tip of rostrum to external nares.	0.1231	0.4371
15	Least supraoccipital width.	−0.3393	0.0705
17	Greatest width across zygomatic processes of squamosal.	−0.3292	0.1373
18	Greatest width of premaxillaries.	−0.3228	0.1211
19	Greatest parietal width.	−0.2088	0.2832
22	Greatest length of left posttemporal fossa.	−0.2011	0.2113
23	Greatest width of left posttemporal fossa.	0.0713	0.0082
47	Cranial breadth.	−0.3026	0.0841
48	Cranial length.	−0.1725	0.1240
50	Tip of rostrum to posterior end of pterygoid.	0.2128	0.3551
51	Center of glenoid cavity to tip of premaxillary.	0.1643	0.4102
	Proportion (%)	51.3	27.9
	Accumulated proportion (%)	51.3	79.2

Measurement numbers refer to Table 1.

dylobasal length (no. 1) and rostrum length (no. 2) were considered to be important factors for separation of the specimen in the second principal component (Tables 1 and 3). Figure 8 suggested that *T. truncatus* and *G. griseus* could be separated by the principal component analysis, and the hybrid specimens were intermediate between two speices and were continuously distributed between them.

Considering the electrophoretic pattern among present specimen, *T. truncatus* and *G. griseus*, the hybrid band in both isocitrate dehydrogenase and glucosephosphate isomerase was detected for the present hybrid specimen as well as the albumin hybrid band (SEZAKI *et al.*, 1982; SEZAKI *et al.*, 1984; SHIMURA *et al.*, 1986). These biochemical evidences strongly support that the present specimen is considered to be the hybrid between *T. truncatus* and *G. griseus* from the aspect of not only osteology but also genetic considerations.

Comparison of the present specimen and three Fraser's specimens suggested that there was a wide individual variation in the hybrid specimens between different species or different genera. In order to know the systematic relationship between species in cetaceans, it is important to accumulate the hybrid informations between species or genera in aquarium and in wild, to investigate the range of individual variation, and to estimate the hybrid-mechanism.

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