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Morphological Variation in *Chelonia mydas* (Linnaeus, 1758) from the Coastal Waters of Japan, with Special Reference to the Turtles Allied to *Chelonia mydas agassizii* Bocourt, 1868

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Abstract: Morphological variations were analyzed for green turtles, *Chelonia mydas*, on the basis of 127 individuals captured in the coastal waters of Japan. They were explicitly divided into two groups by plastral coloration—the yellow type and the black type. To statistically assess the morphometric differences between these color types, analysis of covariance was performed for each of 28 external measurements using the standard straight-line carapace length (SCL) as the covariate. Results indicated that the yellow and black types significantly differ in ratios to SCL of distances from the nuchal notch to the outermost point of boundry between the 11th and the preceding (10th) marginals, and also to the boundary of the 11th marginal, last (fifth) vertebral, and last (fourth) pleural on both sides. Such morphometric covariations with plastral coloration in *C. mydas* sensu lato, as well as sympatric occurrences of the two color types in the Japanese waters, collectively support the validity of the black type as a distinct species, *Chelonia agassizii*.

Key words: *Chelonia mydas*; *Chelonia agassizii*; Taxonomy; Morphological variation; Japan

Introduction

The Green turtle, *Chelonia mydas* (Linnaeus, 1758), is widely distributed in the tropical to temperate waters of the Atlantic, Indian, and Pacific Oceans (Iverson, 1992). In the Japanese coastal waters, this species can be found from an almost entire range, although its nesting beaches are confined to the Bonin Islands and the Ryukyu Archipelago in the warm temperate or subtropical region of the country (Kamezaki, 1989; Kanno, 1980; Suganuma, 1994; Yamaguchi et al., 2005).

Since the initial description of this species from Ascension Island in the south central Atlantic as *Testudo Mydas* by Linnaeus (1758) (see also Iverson [1992]), a total of 26 species have been described on the basis of specimens obtained from various localities across the Globe for the genus *Chelonia* Brongniart, 1800, a genus established for *Testudo Mydas*. Currently all of these nominal species are regarded as junior synonyms of *C. mydas* by most authors (e.g. Turtle

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Taxonomy Working Group, 2011), though several recent authors, such as Kamezaki and Matsui (1995), and Pritchard and Trebbau (1984), argued for the possible taxonomic diversity within *C. mydas* sensu lato by demonstrating its extensive morphological variations.

Chelonia mydas agassizii was first described by Bocourt (1868) as *Chelonia agassizii* on the basis of a specimen from the river mouse of Nagualate, Guatemala. Since then, this turtle has long been known as the black turtle or the eastern Pacific green turtle. Several authors noted that this turtle exhibits apparently unique morphological features including shell coloration, which is distinct from that of the typical *C. mydas*. Thus, Kamezaki and Matsui (1995) and Pritchard (1999) considered *agassizii* as a valid taxon at the subspecific or even the full-specific level. Based on the molecular phylogenetic analyses, however, Dutton et al. (1996) and Karl and Bowen (1999) regarded the black turtle as a mere local variant of *C. mydas*, not warranting taxonomic recognition, chiefly on the ground of its phylogenetic affinity with other *C. mydas* populations, because removal of the black turtle as a separate taxon would leave the remaining populations of *C. mydas* as a paraphyletic assemblage.

Recently Kuroyanagi and Kamezaki (1998) and Ishii (2008) reported some turtles with black to gray plastron (a feature of *C. m. agassizii*) from the Japanese waters. However, no further analyses have been attempted to assess their differences from the "ordinary" *C. mydas* statistically. We thus examined the correlation of such variation in plastral coloration with external morphometric variations in an assemblage of *C. mydas* sensu lato from the Japanese waters. The results revealed sympatric occurrences of two aggregations of *Chelonia mydas* within the Japanese waters that can be explicitly discriminated from each other in both plastral coloration and shell proportion. We consider these aggregations as two separate species.

Materials and Methods

A total of 127 green turtles (*Chelonia mydas* sensu lato) were examined, of which 120 had been caught by fisheries accidentally, one had landed for oviposition and one had stranded on beaches of southern Japan, three had been in captivity in local aquaria, and the remaining two had been maintained as stuffed specimens (see Appendices 1 and 2 for further details).

These turtles were first examined for plastral coloration, and were classified to those having white or pale yellow plastrons (henceforth referred to as the "yellow [or ordinary] type"), or to those having dark or light gray

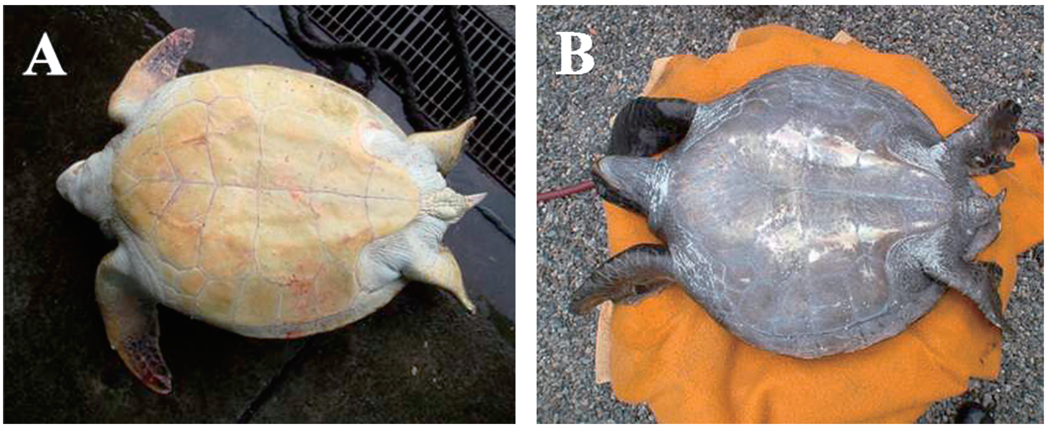

Fig. 1. Plastral coloration in two color types of *Chelonia mydas* sensu lato found in the Japanese waters. A, yellow type; B, black type.

plastrons ("black type": Fig. 1) (Carr, 1952; Pritchard and Trebbau, 1984).

Then, the turtles were examined for 29 external measurements as below to nearest 1 mm with calipers and a tape measure (Fig. 2). 1) Standard straight-line carapace length: Measured from nuchal notch to posterior tip of supra caudal (SCL)—this character is usually used as the standard body size for chelonians including sea turtles; 2) Curved carapace width: Measured at the widest portion along the curved line (CCW); 3)–14) 1st–12th marginal widths: Widths between outermost boundaries of 1st to 12th left and right marginals with preceding scutes, measured along the straight lines (M1–M12, respectively); 15) and 16) Nuchal notch to outermost points of boundries between 11th and the preceding (10th) marginals on left and right sides: Measured along the straight lines (NL11 and NR11, respectively); 17) and 18) Nuchal notch to boundaries of the 11th marginal, last (fifth) vertebral, and last (fourth) pleural on left and right sides: Measured along the straight lines (NL11in and NR11in, respectively); 19) 12th marginal length: Measured on joint of left and right 12th marginals (12thL); 20) 12th marginal width: Distance between boundaries of 11th and 12th marginals and 5th vertebral on left and right sides (12thW); 21) 5th vertebral length: Measured along the straight median line (5thL); 22) 5th vertebral width: Measured along the straight line (5thW); 23) Plastron length: Measured along the straight line (PL); 24) Head length (HL); 25) Head width (HW); 26) Inter orbital distance (IOW); 27) Nasal height (NH): Measured along the straight line from top to lowest margin of nasal; 28) Nasal width (NW); Measured along the straight line between outermost points of boundaries of nasal and prefrontals; and 29) Rostrum height: Measured medially along the straight line (RH).

Statistical significance of difference in SCL between the yellow and black types was tested by Mann-Whitney's U-test using software "Excel 2010". Measurements other than SCL

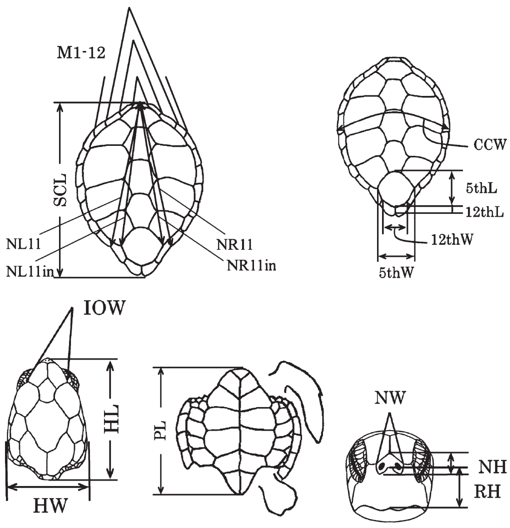

FIG. 2. External morphometric characters (measurements) used in the present analyses. Twenty-two characters were taken for the carapace, one for the plastron, and six for the head.

were $\log_{10}$ transformed. Then, each of these measurements was compared between the yellow and black types by the analysis of covariance (ANCOVA) using SCL as the covariate. For ANCOVA, software "R" (R Development Core Team, 2010) was used.

RESULTS

All individuals examined were explicitly assigned to one of the two color types, the yellow (or ordinary) type and the black type, as defined by Carr (1952) and Pritchard and Trebbau (1984). The number of individuals assigned to the yellow type was 109, whereas that of those to the black type was much smaller, 18 (appendices 1 and 2). The mean SCL of the yellow type was 594±170 mm (S.D.; range: 369–1007 mm), whereas that of the black type was 641±127 mm (S.D.; range: 438–923 mm). The SCLs between the yellow and the black type did not differ significantly (Mann-Whitney's U-test, U=750; $p>0.05$).

Results of ANCOVA for each of the 28 measurements between the two color types were given in Table 1. Four of the 28 measurements (NL11, NR11, NL11in, and NR11in) exhibited

TABLE 1. Comparisons in Slope and y-intercept of regression lines of 28 measurements to SCL (both $\log_{10}$ transformed) between the two color types of *Chelonia mydas* from the Japanese waters.

	Morphotype	slope	P value	y–intercept	P value	R^2 value	N
CCW/SCL	Yellow	0.983	Not significant	0.0345	P<0.001	0.982	98
	Black	0.961		0.114		0.973	12
M1/SCL	Yellow	0.898	Not significant	–0.798	P<0.05	0.793	107
	Black	0.631		–0.0980		0.274	18
M2/SCL	Yellow	0.916	Not significant	–0.320	P<0.01	0.939	107
	Black	0.895		–0.286		0.915	18
M3/SCL	Yellow	0.974	Not significant	–0.260	P<0.01	0.961	107
	Black	1.004		–0.361		0.941	18
M4/SCL	Yellow	0.974	Not significant	–0.133	Not significant	0.985	107
	Black	0.977		–0.147		0.949	18
M5/SCL	Yellow	0.938	Not significant	0.0274	Not significant	0.986	104
	Black	0.953		–0.0190		0.949	18
M6/SCL	Yellow	0.908	Not significant	0.153	Not significant	0.986	103
	Black	0.930		0.0852		0.963	18
M7/SCL	Yellow	0.923	Not significant	0.121	Not significant	0.989	106
	Black	0.967		–0.00720		0.968	18
M8/SCL	Yellow	0.956	Not significant	0.00140	Not significant	0.986	107
	Black	1.03		–0.205		0.961	18
M9/SCL	Yellow	0.985	Not significant	–0.138	Not significant	0.978	107
	Black	1.07		–0.377		0.973	18
M10/SCL	Yellow	1.01	Not significant	–0.301	Not significant	0.972	106
	Black	1.12		–0.605		0.956	18
M11/SCL	Yellow	0.999	Not significant	–0.431	P<0.05	0.944	104
	Black	1.12		–0.773		0.871	18
M12/SCL	Yellow	1.02	Not significant	–0.776	Not significant	0.933	105
	Black	1.13		–1.09		0.800	18
NL11/SCL	Yellow	0.998	P<0.05	–0.0359	P<0.001	0.998	102
	Black	0.961		0.0470		0.999	11
NR11/SCL	Yellow	1.00	P<0.05	–0.0495	P<0.001	0.998	100
	Black	0.968		0.0263		0.998	11
NL11in/SCL	Yellow	1.03	P<0.05	–0.131	P<0.001	0.997	92
	Black	0.985		–0.0371		0.999	9
NR11in/SCL	Yellow	1.03	P<0.01	–0.141	P<0.001	0.997	90
	Black	0.975		–0.0114		0.998	9
12thL/SCL	Yellow	0.758	Not significant	–0.497	P<0.001	0.729	82
	Black	0.953		–0.954		0.904	10
12thW/SCL	Yellow	1.04	Not significant	–0.955	Not significant	0.863	83
	Black	1.10		–1.14		0.892	10
5thL/SCL	Yellow	1.20	Not significant	–1.24	P<0.01	0.965	98
	Black	1.08		–0.892		0.970	7
5thW/SCL	Yellow	1.07	Not significant	–0.777	Not significant	0.935	99
	Black	1.20		–1.13		0.900	7
PL/SCL	Yellow	0.983	Not significant	–0.363	P<0.001	0.995	107
	Black	0.986		–0.0619		0.989	17
HL/SCL	Yellow	0.810	Not significant	–0.158	P<0.001	0.980	105
	Black	0.801		–0.117		0.916	17
HW/SCL	Yellow	0.827	Not significant	–0.323	P<0.01	0.974	106
	Black	0.840		–0.348		0.963	17
IOW/SCL	Yellow	0.721	Not significant	–0.353	Not significant	0.852	107
	Black	0.757		–0.444		0.600	17
NH/SCL	Yellow	0.692	Not significant	–0.724	Not significant	0.699	82
	Black	0.657		–0.634		0.550	9
NW/SCL	Yellow	0.732	Not significant	–0.810	P<0.001	0.819	84
	Black	1.00		–1.49		0.754	9
RH/SCL	Yellow	0.677	Not significant	–0.401	Not significant	0.904	82
	Black	0.686		–0.409		0.835	9

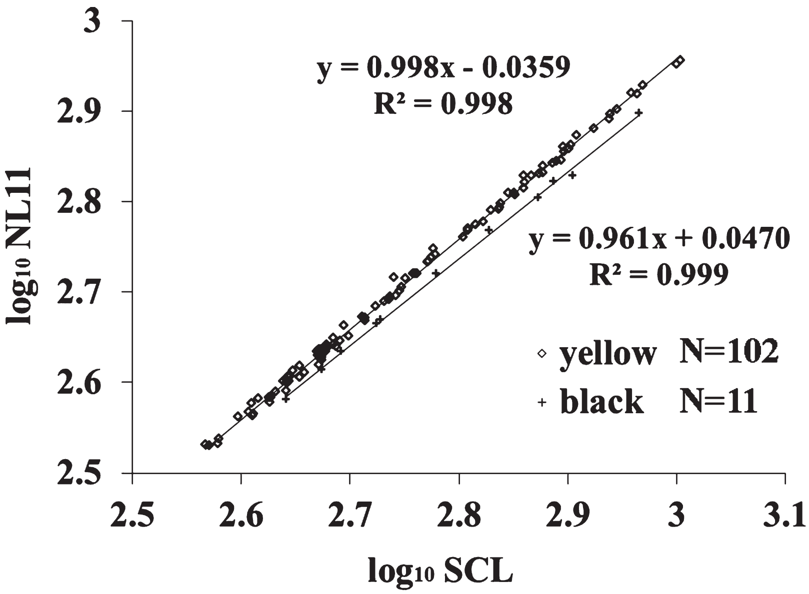

FIG. 3. Regression lines between SCL and NL11 (see Fig. 2; both $\log_{10}$ transformed) of the yellow and black types of *Chelonia mydas* sensu lato from the Japanese waters.

significantly greater slope in the yellow type than in the black type, whereas no significant differences were recognized in slope in the remaining measurements. With respect to the y-intercept, the yellow type exhibited significantly higher position in six measurements (M3, M11, 12thL, PL, HW, and NW), whereas the black type did so in six of the remaining measurements (M1, NL11, NR11, NL11in, NR11in, and HL: Fig. 3).

The results that the black type has smaller values of NL11, NR11, NL11in, and NR11in relative to SCL than the yellow type seemingly reflect prominent narrowing of the carapace at the position of 11th marginal in the former. Additionally the regression lines between each of these four measurements and SCL, smaller in slope in the black type, indicate that such characteristics of this type against the yellow type are consistent throughout growths.

DISCUSSION

Our results clearly indicate that *Chelonia mydas* sensu lato occurring in the coastal waters of Japan includes two extensive morphotypes that are consistently distinct from each other in both coloration and morphometric characters. In bisexual animals, occurres of two morphologically slightly but consistently different groups within an assemblage of apparently closely resembling individuals in the same geographic area could be interpreted in two ways—presence of: intraspecific dimorphisms that are usually attributable to sexual or age differences, or otherwise, of more than one reproductively isolated entities, namely biological species (Mayr, 1942). From the above results, it is obvious that the differences between the yellow and black types are not attributable to age differences, because their SCLs did not differ significantly with substantial range-overlap. Likewise, sexual dimorphisms are unlikely sources of differences, because both of the two types included both sexes (see Appendices 1 and 2). We, therefore, interpret the current result as indicative of the presence of two biological species in Japanese waters under the name, *Chelonia mydas*.

As mentioned above, only a single species, *C. mydas*, has long been recognized for the genus *Chelonia*. In recognition of distinct morphological differentiations within *C. mydas*, Parker et al. (2011) considered “the yellow type" to be typical of *C. mydas* sensu stricto. On the other hand, they suspected that their "black type" represents an undescribed species. However, judging from a few morphological features, such as plastral coloration and shell-shape, of our Japanese specimens and of specimens reported from other regions as *C. m. agassizii*, it is highly likely that the "black types" in both our study and Parker et al. (2011) correspond to *C. m. agassizii*, which has long been postulated to chiefly or exclusively occur in the East Pacific region. It yet requires further studies to see whether occurrences of the black types in the Japanese waters reflect the presence of its nesting site or sites there, or merely reflect their frequent long-distance dispersals from other regions. If the latter is the case, occurrences of both types in the Japanese waters might not necessarily offer a direct evidence to the validity of both *mydas* and *agassizii* as two full species. However, considering that both of the two color types nest on some islands of the Revillagigedo Archipelago simultaneously (Juarez-Ceron et al., 2003), their possession of spontaneous reproductive isolation mechanisms is highly likely.

Based on the analyses of variation in skull morphology using extensive geographic samples, Kamezaki and Matsui (1995) demonstrated that the population from the Galapagos (as the representative of *C. m. agassizii*) was most divergent among the *C. mydas* populations. However, since no single characters completely discriminated the Galapagos sample from the others, Kamezaki and Matsui (1995) retained the Galapagos population as a mere subspecies of *C. mydas* (see above). More recently, Karl and Bowen (1999) estimated the phylogenetic relationships among samples of *C. mydas* sensu lato from various localities by use of variation in mitochondrial and nuclear DNA sequences. The resultant phylogeny failed to confirm evolutionally distinctiveness between the samples from the Galapagos and other localities.

With respect to variations in postcranial external morphology, however, no statistical analyses have ever been applied to verification of differences between the yellow and black types. Thus, this study has revealed statistically significant morphological differences between *C. m. agassizii* and *C. mydas* sensu stricto for the first time, thus further supporting the full independent species status of *Chelonia agassizii*. Further progresses of molecular studies and revisions of relevant theoretical frameworks in species concept are definitely needed to assess our above conclusions taxonomically.

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APPENDIX 1. Sampling data for the black type *Chelonia mydas* found in the Japanese waters and used for this study. SCL=the standard straight-line carapace length.

ID	Date	Locality	Status	SCL (mm)	Sex	Note
1	1998/4/30	Hatomajima Is., Okinawa	Alive in captivity	802	Female	
2	1998/5/19	Iriomotejima Is., Okinawa	Captured alive	700	Female	Recapture/First captured on 10 Dec. 1997 at Iriomotejima Is.
3	1999/5/22	Iriomotejima Is., Okinawa	Captured alive	702	Female	Recapture/First captured on 10 Dec. 1997 at Iriomotejima Is.
4	1999/11/7	Iriomotejima Is., Okinawa	Captured alive	543	Unknown	
5	1999/12/14	Iriomotejima Is., Okinawa	Captured alive	680	Unknown	
6	2000/11/3	Ginoza, Okinawa	Captured alive	664	Unknown	
7	2000/12/25	Ginoza, Okinawa	Captured alive	596	Unknown	
8	2004/7/24	Owase, Mie	Captured alive	673	Female	
9	2005/11/14	Muroto Shiina, Kochi	Alive in captivity	923	Male	Recapture/First captured on 3 Nov. 2005 at Owase, Mie
10	2008/8/25	Shimakatsu, Mie	Found dead	771	Male	
11	2009/6/17	Muroto Shiina, Kochi	Captured alive	530	Unknown	
12	2009/9/7	Miyako, Iwate	Captured alive	534	Unknown	
13	2010/1/29	Tateyama, Chiba	Found dead	746	Female	
14	2010/6/28	Tahara, Aichi	Captured alive	601	Male	
15	2010/8/3	Rikuzentakata, Iwate	Captured alive	472	Unknown	
16	2010/9/1	Miyako, Iwate	Captured alive	438	Unknown	
17	Unknown	Yaeyama Is., Okinawa	Stuffed	662	Male	
18	Unknown	Tanegashima Is., Kagoshima	Stuffed	492	Unknown	

Appendix 2. Sampling data for the yellow *Chelonia mydas* found in the Japanese waters and used for this study.

ID	Date	Locality	Status	SCL (mm)	Sex
1	2008/4/27	Muroto Takaoka, Kochi	Captured alive	563	Unknown
2	2008/5/1	Muroto Shiina, Kochi	Found dead	413	Female
3	2008/5/3	Muroto Shiina, Kochi	Found dead	469	Female
4	2008/5/25	Muroto Mitsu, Kochi	Captured alive	487	Female
5	2008/6/16	Shimakatsu, Mie	Found dead	369	Female
6	2008/6/	Minamiawaji, Hyogo	Found dead	477	Unknown
7	2008/7/2	Muroto, Kochi	Found dead	372	Unknown
8	2008/7/28	Mitoyo, Kagawa	Found dead	776	Female
9	2008/8/25	Shimakatsu, Mie	Found dead	753	Female
10	2008/8/25	Shimakatsu, Mie	Found dead	688	Female
11	2008/9/4	Shimakatsu, Mie	Found dead	929	Female
12	2008/11/13	Shimakatsu, Mie	Found dead	478	Female
13	2008/11/13	Shimakatsu, Mie	Found dead	862	Male
14	2008/11/14	Shimakatsu, Mie	Found dead	954	Female
15	2008/11/	Minamiawaji, Hyogo	Found dead	471	Female
16	2009/6/1	Muroto Takaoka, Kochi	Captured alive	919	Male
17	2009/6/3	Muroto Mitsu, Kochi	Captured alive	1007	Female
18	2009/6/9	Muroto Shiina, Kochi	Captured alive	472	Unknown
19	2009/6/11	Muroto Shiina, Kochi	Captured alive	469	Unknown
20	2009/6/14	Muroto Takaoka, Kochi	Captured alive	550	Unknown
21	2009/6/17	Muroto Shiina, Kochi	Captured alive	379	Unknown
22	2009/6/19	Muroto Mitsu, Kochi	Captured alive	407	Unknown
23	2009/6/19	Muroto Shiina, Kochi	Captured alive	416	Unknown
24	2009/6/21	Shimakatsu, Mie	Found dead	491	Female
25	2009/6/21	Shimakatsu, Mie	Found dead	517	Male
26	2009/6/22	Muroto Shiina, Kochi	Captured alive	423	Unknown
27	2009/6/22	Muroto Shiina, Kochi	Captured alive	441	Unknown
28	2009/6/24	Shimakatsu, Mie	Captured alive	451	Unknown
29	2009/6/24	Shimakatsu, Mie	Found dead	424	Female
30	2009/6/24	Shimakatsu, Mie	Found dead	442	Female
31	2009/6/24	Shimakatsu, Mie	Found dead	455	Female
32	2009/6/24	Shimakatsu, Mie	Found dead	439	Female
33	2009/6/24	Shimakatsu, Mie	Found dead	422	Female
34	2009/6/24	Mihama, Mie	Captured alive	470	Unknown
35	2009/6/25	Mihama, Mie	Captured alive	440	Unknown
36	2009/7/2	Muroto Mitsu, Kochi	Captured alive	435	Unknown
37	2009/7/2	Muroto Mitsu, Kochi	Captured alive	451	Unknown
38	2009/7/2	Muroto Shiina, Kochi	Captured alive	654	Unknown
39	2009/7/2	Muroto Shiina, Kochi	Captured alive	475	Unknown
40	2009/7/3	Muroto Takaoka, Kochi	Captured alive	869	Female
41	2009/7/3	Muroto Takaoka, Kochi	Captured alive	723	Unknown
42	2009/7/3	Muroto Takaoka, Kochi	Captured alive	753	Unknown
43	2009/7/6	Shimakatsu, Mie	Found dead	470	Male
44	2009/7/6	Shimakatsu, Mie	Found dead	438	Female
45	2009/7/8	Shimakatsu, Mie	Found dead	467	Female
46	2009/7/10	Shimakatsu, Mie	Captured alive	484	Unknown

47	2009/7/12	Shimakatsu, Mie	Found dead	484	Female
48	2009/7/15	Shimakatsu, Mie	Captured alive	544	Unknown
49	2009/7/19	Muroto Mitsu, Kochi	Captured alive	769	Unknown
50	2009/7/23	Muroto Shiina, Kochi	Captured alive	552	Unknown
51	2009/8/5	Shimakatsu, Mie	Captured alive	643	Unknown
52	2009/8/17	Shimakatsu, Mie	Found dead	995	Female
53	2009/8/17	Shimakatsu, Mie	Found dead	666	Unknown
54	2009/8/19	Shimakatsu, Mie	Found dead	408	Female
55	2009/8/19	Shimakatsu, Mie	Found dead	784	Unknown
56	2009/9/14	Nomaike, Kagoshima	Captured alive	689	Unknown
57	2009/9/14	Nomaike, Kagoshima	Captured alive	799	Unknown
58	2009/9/14	Nomaike, Kagoshima	Captured alive	999	Female
59	2009/9/15	Nomaike, Kagoshima	Captured alive	747	Unknown
60	2009/10/10	Mihama, Mie	Captured alive	495	Unknown
61	2009/12/15	Shimakatsu, Mie	Found dead	476	Female
62	2010/1/19	Muroto Shiina, Kochi	Captured alive	409	Unknown
63	2010/1/27	Muroto Shiina, Kochi	Captured alive	788	Unknown
64	2010/3/12	Kuroshima Is.., Okinawa	Captured alive	598	Unknown
65	2010/4/12	Muroto Shiina, Kochi	Captured alive	724	Male
66	2010/5/5	Muroto Takaoka, Kochi	Captured alive	809	Male
67	2010/5/11	Yaeyama Is., Okinawa	Captured alive	600	Unknown
68	2010/5/11	Yaeyama Is., Okinawa	Captured alive	675	Unknown
69	2010/5/11	Yaeyama Is., Okinawa	Captured alive	592	Unknown
70	2010/5/11	Yaeyama Is., Okinawa	Captured alive	468	Unknown
71	2010/5/11	Yaeyama Is., Okinawa	Captured alive	529	Unknown
72	2010/5/11	Yaeyama Is., Okinawa	Captured alive	478	Unknown
73	2010/5/25	Muroto Takaoka, Kochi	Found dead	396	Male
74	2010/5/26	Kuroshima Is., Okinawa	Found dead	578	Unknown
75	2010/5/27	Kuroshima Is., Okinawa	Captured alive	709	Unknown
76	2010/5/28	Kuroshima Is., Okinawa	Captured alive	575	Unknown
77	2010/5/28	Kuroshima Is., Okinawa	Found dead	539	Unknown
78	2010/7/28	Ofunato, Iwate	Captured alive	517	Unknown
79	2010/8/19	Kuroshima Is., Okinawa	Captured alive	687	Unknown
80	2010/8/19	Kuroshima Is., Okinawa	Captured alive	475	Unknown
81	2010/8/20	Kuroshima Is., Okinawa	Captured alive	472	Unknown
82	2010/8/20	Kuroshima Is., Okinawa	Captured alive	557	Unknown
83	2010/8/20	Kuroshima Is., Okinawa	Captured alive	636	Unknown
84	2010/8/27	Muroto Mitsu, Kochi	Captured alive	868	Unknown
85	2010/9/2	Muroto Shiina, Kochi	Captured alive	796	Unknown
86	2010/9/5	Kuroshima Is., Okinawa	Captured alive	643	Unknown
87	2010/9/5	Kuroshima Is., Okinawa	Found dead	725	Unknown
88	2010/9/5	Kuroshima Is., Okinawa	Captured alive	559	Unknown
89	2010/9/5	Kuroshima Is., Okinawa	Captured alive	573	Unknown
90	2010/9/6	Kuroshima Is., Okinawa	Captured alive	711	Unknown
91	2010/9/8	Iriomotejima Is., Okinawa	Landing alive	931	Female
92	2010/9/22	Muroto Shiina, Kochi	Captured alive	840	Male
93	2010/9/28	Kami, Hyogo	Captured alive	700	Female
94	2010/9/28	Muroto Shiina, Kochi	Captured alive	736	Unknown
95	2010/9/29	Muroto Shiina, Kochi	Found dead	439	Female

96	2010/10/15	Muroto Shiina, Kochi	Found dead	405	Unknown
97	2010/12/20	Obama, Fukui	Found dead	595	Female
98	2011/2/8	Mugi, Tokushima	Found dead	428	Female
99	2011/2/23	Muroto Shiina, Kochi	Found dead	444	Female
100	2011/3/14	Muroto Shiina, Kochi	Captured alive	514	Male
101	2011/3/18	Mugi, Tokushima	Found dead	591	Male
102	2011/6/21	Muroto Takaoka, Kochi	Captured alive	881	Male
103	2011/6/24	Muroto Mitsu, Kochi	Captured alive	909	Male
104	2011/6/26	Muroto Takaoka, Kochi	Captured alive	786	Unknown
105	2011/6/27	Muroto Mitsu, Kochi	Captured alive	424	Unknown
106	2011/7/1	Muroto Mitsu, Kochi	Captured alive	380	Unknown
107	Unknown	Japan	Alive in captivity	500	Unknown
108	Unknown	Japan	Alive in captivity	665	Unknown
109	Unknown	Japan	Alive in captivity	545	Unknown

Accepted: 10 December 2013