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Complete List of Authors:	Noba, Kazuki; Yokohama National University, Graduate School of Environment and Information Sciences Yasumuro, Haruhiko; Kobe Animals-and-Plants Environmental College Ikeda, Yuzuru; University of the Ryukyus, Faculty of Science Wani, Ryoji; Yokohama National University, Faculty of Environment and Information Sciences
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Ontogenetic trajectories of septal spacing in modern cuttlefishes are phylogenetically dependent

KAZUKI NOBA, HARUHIKO YASUMURO, YUZURU IKEDA AND RYOJI WANI

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In this study, the ontogenetic trajectories of septal spacing between succeeding chambers of five modern cuttlefishes; *Sepia esculenta*; *S. lycidas*; *S. latimanus*; *S. pharaonic*; and *Sepiella japonica*, which were all wild-caught around Japan, were analysed. The ontogenetic trajectories of septal spacing of all examined cuttlefishes demonstrate a decrease in septal spacing followed by an increase during the earliest ontogenetic stage. This trend is assumed to be related to hatching. After the rapid decrease and increase in septal spacing, species-dependent trends occur irrespective of sex and locality. Based on cluster analyses of general trends recognised in each species, the five examined species can be categorised into two groups: (1) a group by *S. pharaonis*, *S. esculenta*, and

Sepiella japonica and (2) *S. latimanus* and *S. lycidas* as more distant branching groups within the five examined species. This classification is concordant with some phylogenetic clades determined from DNA analyses. Therefore, we hypothesised that the ontogenetic trajectories of septal spacing among modern cuttlefishes are phylogenetically dependent. If this hypothesis holds in fossil cuttlefishes, the examination of ontogenetic trajectories of septal spacing would give new insight into the recognition not only of the life history but also of the phylogeny of fossil cuttlefishes. □

septal spacing, *ontogenetic trajectory*, *Sepiidae*, Sepia, Sepiella.

*Kazuki Noba, Graduate School of Environment and Information Sciences, Yokohama National University, Yokohama 240-8501, Japan; Haruhiko Yasumuro, Kobe Animals-and-Plants Environmental College, Kobe 658-0032, Japan; Yuzuru Ikeda, Faculty of Science, University of the Ryukyus, Okinawa 903-0213, Japan; Ryoji Wani [wani@ynu.ac.jp], Faculty of Environment and Information Sciences, Yokohama National University, 79-7, Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan; manuscript received on **/**/****; manuscript accepted on **/**/****.*

Modern cuttlefishes have septate internal shells that serve as buoyancy devices (Denton & Gilpin-Brown 1964, 1971; Denton *et al.* 1967). These internal shells have septa, which divide the shells into phragmocones used to regulate buoyancy. As coleoids grow, new septa are formed within their internal shells, generating a record of growth progress. Little attention to date has been devoted to the study of modern cuttlebones and their ontogenetic analysis (Hewitt & Stait 1988; Yamaguchi *et al.* 2015). The ontogenetic trajectories of septal spacing have been demonstrated in only a couple of species: *Sepia officinalis* in the study by Hewitt & Stait (1988) and *Sepiella japonica* in the study by Yamaguchi *et al.* (2015). Therefore, it is as yet unknown whether there are common features among modern cuttlefishes related to the ontogenetic trajectories of septal spacing.

To reconstruct ontogenetic shell growth of cephalopods, numerous studies have been dedicated to ontogenetic analysis of the septate external shell morphology of modern nautiloids (Landman *et al.* 1983; Collins & Ward 1987; Tanabe & Tsukahara 1987; Landman 1988; Klug 2004; Chirat *et al.* 2008; Klug *et al.* 2008; Tajika *et al.* 2015, 2018; Lemanies *et al.* 2016), fossil nautiloids (i.e. the order Nautilida; Ruzhencev & Shimansky 1954; Davis & Mohorter 1973; Landman *et al.* 1983; Landman 1988; Chirat & Rioult 1998; Chirat 2001; Wani & Ayyasami 2009; Wani & Mapes 2010) and ammonoids (Kulicki 1974; Doguzhaeva 1982; Checa 1987; Landman 1987; Dommergues 1988; Bucher *et al.* 1996; Okamoto & Shibata 1997; Korn & Titus 2006; Ebbighausen & Korn 2007; Kraft *et al.* 2008; Arai & Wani 2012; Tajika *et al.* 2014, 2015; Naglik *et al.* 2015; Lemanies *et al.* 2015, 2016; Iwasaki *et al.* 2020). In Late Cretaceous ammonoids from Hokkaido, Japan, for example, Arai & Wani (2012) found various patterns of ontogenetic trajectories of septal spacing and suggested that these patterns tend to conform to higher taxonomy and are generally uniform within each superfamily (see Iwasaki *et al.* 2020 for the exception). In modern and fossil nautiloids (the order Nautilida), Wani & Mapes (2010) suggested that the ontogenetic trajectories of septal spacing are conservatively uniform, irrespective of taxonomy and age. Although such similarities have been recognised in cephalopods with external shells (ammonoids and nautiloids), no information is as yet available for cephalopods with internal shells.

To recognize the similarity or dissimilarity of ontogenetic trajectories of septal spacing of modern sepioid cuttlefishes, this study examined five species. The ontogenetic trajectories of septal spacing were compared among these species to examine their implications for the life history and phylogeny of cuttlefishes.

Material

Cuttlebones of *Sepia esculenta* Hoyle, 1885 (10 specimens); *S. lycidas* Gray, 1849 (five specimens); *S. latimanus* Quoy and Gaimard, 1832 (two specimens); *S. pharaonis* Ehrenberg, 1831 (nine specimens); *Sepiella japonica* Sasaki, 1929 (11 specimens), were used in this study for the analyses of septal spacing (Table S1).

All specimens were wild caught (Fig. 1; Table S1). Specimens of *S. esculenta* were caught off the Nagasaki Prefecture (five specimens) and in the Sea of Harima (five specimens) in

Japan. Specimens of *S. lycidas* were caught in the Sea of Harima. Specimens of *S. latimanus* were caught off Okinawa-jima Island, Japan. Specimens of *S. pharaonis* were caught off Okinawa-jima Island. Specimens of *Sepiella japonica* were caught in the Sea of Harima. Detailed environmental information (e.g. seawater temperature and depth) of the areas where these animals lived is currently unknown.

An attempt was made in this study to recognise sex and sexual maturity of the specimens by examination of sex organs (the presence of testis or ovary). It was found that 14 specimens were not sexed, and the sexual maturity of 13 specimens was not examined because of poor specimen condition (Table S1).

The life cycles of *S. esculenta*, *S. lycidas* and *Sepiella japonica* are known to be one year, whereas those of *S. pharaonis* and *S. latimanus* are one or two years (Okutani 1979b; Aoyama & Nguyen 1989; Nabhitabhata & Nilaphat 1999; Dan *et al.* 2012). The maximum cuttlebone length and the septal number of examined *S. pharaonis* is 217 mm and 203, respectively, and the maximum mantle length and the septal number of examined *S. latimanus* are 276 mm and 224, respectively (Table S1). The known maximum mantle lengths of *S. pharaonis* and *S. latimanus* around Japan are 360 and 500 mm, respectively (Okutani 1979a, b), and species of this size probably have two-year life cycles. The maximum number of septa of mature *S. latimanus* having a two-year life cycle is more than 400 (Dan *et al.* 2012). Considering the observed mantle length and total septal number of each examined specimen of *S. pharaonis* and *S. latimanus* (Table S1), these facts suggest that the life cycles of all examined specimens of *S. pharaonis* and *S. latimanus* are not two years but one year. Therefore, this study examined and compared the ontogenetical trajectories of septal spacing among five species of modern cuttlefishes around Japan whose life cycles were all one year.

All specimens are housed in the collections of the Mikasa City Museum, Hokkaido, Japan.

Note on phylogeny of the five examined species

The phylogenetic affinity of modern sepiids (including the five examined species) has been estimated based on DNA analyses (Bonnaud *et al.* 2006; Yoshida *et al.* 2006, 2010; Anderson *et al.* 2011; Dai *et al.* 2012; Lindgren *et al.* 2012; Sanchez *et al.* 2016; Lü *et al.* 2019). However, the phylogeny of the five examined species has been still controversial and therefore a consensus of the phylogeny of the five examined species is not obtained (Fig. 2). For example, some studies have suggested *S. latimanus* and *S. lycidas* as paraphyletic (Bonnaud *et al.* 2006; Anderson *et al.* 2011), although the other have suggested that they are monophyletic with other three species (Yoshida *et al.* 2006, 2010; Dai *et al.* 2012). Such discrepancy of the supposed phylogeny seems to be possibly derived from the analysing methods (e.g. analysing regions, such as 12S, 16S, and COI).

Methods

Septal distance

The cuttlebones of the examined species were first embedded in transparent epoxy resin to avoid damage to the thin septa. Then, the cuttlebones were cut along the median line. Cuttlebone longitudinal sections were examined under a digital microscope (Keyence VHX-900, with a magnification of ×25–×175), and distances between succeeding septa were measured from the median point of the septa, perpendicular to the previous septum (Fig. 3A). The measured septal spacing is shown in comparison to the septal number. These graphs define the ontogenetic trajectories of septal spacing for the examined cuttlefishes.

Cluster analysis

To categorize the ontogenetic trajectories of septal spacing among the five examined, cluster analyses of septal spacing data versus the septal number were performed to calculate the Euclidean distance. First, cluster analyses were performed with the averages of septal spacing in each species with Ward's method, which is a popular method of cluster analyses. Then, cluster analyses were performed with the septal spacing of all the examined specimens only with Ward's method.

Shell morphology

To investigate the factors most closely related to the ontogenetic trajectories of septal spacing, cuttlebone shapes of the five examined species were compared in this study (Fig. 3B; Table S1).

This study defined and used five basic parameters representing the shape of the cuttlebone.

Results

Septal distance

The septal spacing results for the five examined species are shown in Figs. 4–6 and Table S1.

Sepia esculenta. – In this study, specimens from two areas (five specimens caught off the Nagasaki Prefecture and five specimens caught in the Sea of Harima) were examined (Figs. 4, 5A, B).

For the specimens caught off the Nagasaki Prefecture, the septal spacing for *S. esculenta* showed that the distances between septa follow a general decrease from the 1st septum (mean±standard deviation [SD]; 0.15±0.027 mm) to the 8th septum (0.09±0.015 mm), a subsequent gradual increase from the 9th septum (0.11±0.014 mm) to the 100th septum (0.41±0.035 mm), and then a slight decrease from the 101st septum (with a larger standard deviation; Fig. 4). The standard deviations of measurements between septa decreased from the 1st septum to the 11th septum and then increased gradually.

For the specimens caught in the Sea of Harima, the septal spacing for *S. esculenta* showed that the distances between septa follow a general decrease from the 1st septum (mean±standard deviation; 0.16±0.026 mm) to the 8th septum (0.10±0.012 mm), a subsequent gradual increase from the 9th septum (0.10±0.007 mm) to the 100th septum (0.40±0.046 mm), and then a decrease from the 101st septum (with a larger standard deviation; Fig. 4). The standard deviations of measurements between septa decreased from the 1st septum to the 10th septum and then increased gradually.

The ontogenetic trajectories of septal spacing in the specimens from both localities were basically comparable and overlapped throughout almost the entire ontogeny (Fig. 4), although some specimens showed irregular septal spacing at some ontogenetic stages.

Sepia lycidas. – The septal spacing for *S. lycidas* showed that the distances between septa follow a general decrease from the 1st septum (mean±standard deviation; 0.20±0.002 mm) to the 9th septum (0.15±0.035 mm), a subsequent increase from the 10th septum (0.19±0.017 mm) to the 102nd septum (0.54±0.017 mm), and then a decrease from the 103rd septum (with a larger standard deviation; Figs. 5C, D). The standard deviations of measurements between septa decreased from the 1st septum to the 10th septum and then increase gradually.

Sepia latimanus. – The septal spacing for *S. latimanus* showed that the distances between septa followed a general decrease from the 1st septum (mean±standard deviation; 0.19±0.005 mm) to the 17th septum (0.08±0.028 mm), a subsequent increase from the 18th septum (0.10±0.004 mm) to the 99th septum (0.48±0.007 mm), and then a decrease from the 100th septum to the 166th septum (Figs. 5E, F).The septal spacing in addition showed another cycle of increasing to decreasing spacing: an increase from the 167th septum to the 187th septum (0.36±0.069 mm); and a decrease thereafter (Figs. 5E, F).

Sepia pharaonis. – The septal spacing for wild specimens of *S. pharaonis* showed that the distances between septa followed a general decrease from the 1st septum (mean±standard deviation; 0.13±0.030 mm) to the 10th septum (0.10±0.022 mm) and a subsequent linear increase from the 11th septum (0.11±0.018 mm) to the 58th septum (0.40±0.041 mm). The measurements between septa from the 59th septum to the 164th septum were maintained between 0.34 mm and 0.42 mm, followed by a linear decline from the 165th septum (Figs. 6A, B). The standard deviations of measurements between septa decreased from the 1st septum to the 11th septum and then increased gradually.

Sepiella japonica. – The septal spacing for *Sepiella japonica* showed that the distances between septa followed a general decrease from the 1st septum (mean±standard deviation; 0.20±0.056 mm) to the 8th septum (0.09±0.030 mm) and a subsequent linear increase from the 9th septum (0.12±0.046 mm) to the 47th septum (0.33±0.037 mm). The measurements between septa from the 48th septum to the 135th septum were maintained between 0.31 mm and 0.39 mm, followed by a linear decline from the 136th septum (Figs. 6C, D). The standard deviations of measurements between septa decreased from the 1st septum to the 8th septum and then increased gradually.

Cluster analysis

The results of the cluster analyses with the average septal trajectories of the five examined species can be classified into two groups: one group is composed by *S. pharaonis*, *S. esculenta*, and *Sepiella japonica*, and the other group is composed by *S. latimanus* and *S. lycidas* (Fig. 7A).

The results of the cluster analyses with the septal spacing of all the examined specimens (Fig. 7B) can be classified into three groups (Fig. 7C). The first group is composed by the mixture of *S. pharaonis*, *S. esculenta*, and *Sepiella japonica*, the second is composed by the mixture of *S. pharaonis*, *S. esculenta*, and *S. latimanus*, and the third is composed by mainly *S. lycidas* with one specimen of *S. pharaonis*.

Shell morphology

The scatter diagrams of the five examined parameters of shell morphology indicate that cuttlebone shape tends to be species-dependent (Fig. 8).

Discussion

Common characteristics in ontogenetic trajectories of septal spacing among modern cuttlefishes

The results of this study, based on measurements of septal spacing of more than 5,600 septa in total from five species of modern cuttlefish, revealed the characteristics of the ontogenetic trajectories of septal spacing (Figs. 2–4). These results suggest species-dependent general trends. For *Sepia esculenta*, this study compared specimens from two localities (Nagasaki vs. Sea of Harima; Fig. 2). The ontogenetic trajectories of septal spacing between the two localities demonstrated a similar tendency, overlapping each other for most ontogenetic stages (Fig. 2). All environmental conditions (seawater temperature; habitat depth, or the equivalent condition of hydrostatic pressure; and conditions of food) between the two localities could not be assumed to be totally equivalent. Although it is unknown how the environmental conditions differ, they seem to have little importance in controlling the ontogenetic trajectories of septal spacing, at least in the examined specimens of *S. esculenta*. In contrast, Hewitt & Stait (1988) found a correlation of septal spacing with ambient water temperature, which argues for an environmental control of septal spacing. Such relationship between cuttlebone growth, including septal spacing, and water temperature is possibly exaggerated under a limited food condition (Martínez *et al.* 2000). Considering these literatures, the food conditions of the examined specimens of *S. esculenta* were postulated to be not scarce, which therefore possibly minimized the environmental control of septal spacing. In the other four species (*S. lycidas*, *S. latimanus*, *S. pharaonis*, and *Sepiella japonica*), the environmental control of septal spacing cannot be determined, because detailed environmental information (e.g. seawater temperature and depth) of the areas where these animals lived is currently unknown. However, we also hypothesised little importance in controlling the ontogenetic trajectories of septal spacing in the other four species. This is because no irregular shell shape and shell growth found in the examined specimens implies that they lived in enough food conditions and because some specimens were caught in the area same with those of *S. esculenta* (i.e. the Sea of Harima; Table S1), possibly resulting in the minimized environmental control of septal spacing.

In addition to the comparison of locality, this study examined the influence of sex (male vs. female). Both male and female cuttlefishes were examined in the *S. esculenta*, *S. lycidas*, *S. latimanus*, and *S. pharaonis* groups (Table S1). The ontogenetic trajectories of septal spacing of both sexes in each species are similar (Figs. 2–4), which implies that these trajectories in each species of cuttlefishes develop irrespective of sex. However, the examined numbers of specimens are limited, so that it should be confirmed with abundant specimens in future studies whether the trajectories of septal spacing in each species are irrespective of sex.

A common feature among the five examined species can be discerned, which is the presence of a decrease in septal spacing followed by an increase during the earliest ontogenetic stage (8th–17th septum, depending on the species; Figs. 2–4). Based on the reared specimens, modern cuttlefishes are known to hatch with several chambers, demonstrating that *S. esculenta*, *S. lycidas*, *S. pharaonis*, and *Sepiella japonica* hatch with 6–8, 7–11, 5–6, and 7–9 chambers, respectively (Choe 1962; Chung & Wang 2013). Among *S. latimanus*, the mantle length of hatchlings is 11–15 mm (Okutani 1978), which would approximately correspond to 15–20 septa at hatching based on the relationship between mantle length and numbers of septa recorded through the measurements of this study. Therefore, the decrease in septal spacing followed by an increase during the earliest ontogenetic stage, is thought to be related to the hatchings in each species of cuttlefishes.

Categories of ontogenetic trajectories of septal spacing among modern cuttlefishes

Species-dependent general trends of ontogenetic trajectories of septal spacing among the examined cuttlefishes enable us to categorise cuttlefish species based on similarity or dissimilarity to these general trends. The results of cluster analyses can be categorized into two cluster patterns (Fig. 7A, B). The first pattern is seen in the results of the cluster analyses with the average septal trajectories of the five examined species with Ward's method (Fig. 7A), in which there are two groups: one group by *S. pharaonis*, *S. esculenta*, and *Sepiella japonica*, and the other group by *S. latimanus* and *S. lycidas*. The second pattern is seen in the results of the cluster analyses with the septal spacing of all the examined specimens (Fig. 7B, C). In this cluster pattern, there is a group by *S. pharaonis*, *S. esculenta*, and *Sepiella japonica* with *S. latimanus* and *S. lycidas* as more distant branching groups within the five examined species. Some specimens of *S. pharaonis* and *S. esculenta* represent similar pattern with *S. latimanus* and *S. lycidas* due to their intraspecific variations of septal spacing (Fig. 7B, C). In any case, these two patterns commonly suggest that *S. latimanus* and *S. lycidas* represent more distant branching groups than *S. pharaonis*, *S. esculenta*, and *Sepiella japonica*.

These two cluster patterns of septal spacing are recognised irrespective of taxonomic assignment at the genus level, because *Sepiella japonica* is categorised is the group together with two species of the genus *Sepia* (*S. pharaonis* and *S. esculenta*; Fig. 7). The phylogenetic affinity of cephalopods (including modern cuttlefishes) has been estimated based on DNA analyses (Bonnaud *et al.* 2006; Yoshida *et al.* 2006, 2010; Anderson *et al.* 2011; Dai *et al.* 2012; Lindgren *et al.* 2012; Sanchez *et al.* 2016), indicating that a consensus of the phylogeny of the five examined species is not obtained (Fig. 2). Some studies have suggested *S. latimanus* and *S. lycidas* as paraphyletic (Bonnaud *et al.* 2006; Anderson *et al.* 2011; Fig. 2A, D), which are concordant with the two cluster patterns recognised in this study based on the general trends of ontogenetic trajectories of septal spacing. Based on this concordance in plural phylogenetic trees among eight literatures (Bonnaud *et al.* 2006; Yoshida *et al.* 2006, 2010; Anderson *et al.* 2011; Dai *et al.* 2012; Lindgren *et al.* 2012; Sanchez *et al.* 2016; Lü *et al.* 2019), therefore, we hypothesised that the ontogenetic trajectories of septal spacing among modern cuttlefishes are phylogenetically dependent. However, several phylogenetic trees are not all concordant with the two cluster patterns based on the general trends of ontogenetic trajectories of septal spacing (Fig. 2B–C, E–G, H). Lindgren *et al.* (2012) used the relatively complete dataset in terms of the relevant factors (the number of species and number of analysed sequences). The phylogenetic tree of Lindgren *et al.* (2012), however, does not reflect the two cluster patterns of this study (Figs. 2E, 7). A recent study of sepiid phylogeny based on whole mitochondrial genomes (Lü *et al.* 2019) showed a phylogenetic pattern, which is also not concordant with the two cluster patterns of this study (Figs. 2H, 7). The reason of these discrepancies is possibly unexpected confusion about genus *Sepia* and *Sepiella*, which comes from the unsolved classification in sepiid species (Yoshida *et al.* 2006; Lü *et al.* 2019). Further investigations of DNA classification of modern sepiids, which result in a consensus of the sepiid phylogeny, and of ontogenetic trajectories of septal spacing with more abundant species would be able to solve such discrepancy and to examine the validity of our hypothesis.

Finally, to investigate the factors most closely related to the recognised cluster patterns, cuttlebone shapes of the five examined species were compared in this study (Fig. 5; Table S1). The scatter diagrams of cuttlebone shapes of the five examined species indicate that cuttlebone shape cannot be categorised into two groups similar to the recognised cluster patterns (*S. pharaonis*, *S. esculenta*, and *Sepiella japonica*, and *S. latimanus* and *S. lycidas*; Fig. 7). These facts suggest that the two clusters of septal spacing are recognised irrespective of cuttlebone shape. Bonnaud *et al.* (2006) suggested the shell shape of sepiids is not phylogenetically informative, due to their plasticity, which is concordant to the speculation of this study. Therefore, the adult shape only is not as informative as the ontogenetic patterns of septal spacing to reconstruct the phylogeny.

Implications for fossil cephalopods

A decrease in septal spacing followed by an increase during the earliest ontogenetic stage can be observed among all examined modern cuttlefishes (8th–17th septum, depending on the species; Figs. 2–4). This common feature is assumed to be related to hatching in each species of cuttlefishes.

Similar relationships between hatching and decreased septal spacing followed by increased septal spacing during the earliest ontogenetic stage have been recognised in other cephalopods (modern spirula and modern and fossil nautiloids (the order Nautilida); Landman *et al.* 1983; Tanabe & Tsukahara 1987; Arnold *et al.* 1987; Chirat & Rioult 1998; Wani & Ayyasami 2009; Wani & Mapes 2010; Yamaguchi *et al.* 2015). These facts suggest that such a relationship is one common characteristic among cephalopods, except for ammonoids and belemnites (both are assumed to hatch with a protoconch and no chamber; Landman *et al.* 1996; Arai & Wani 2012; De Baets *et al.* 2015; Wani *et al.* 2018).

This relationship between hatching and decreased septal spacing followed by increased septal spacing during the earliest ontogenetic stage would possibly enable us to recognise the hatching timing for fossil cuttlefishes. If preservation permitted analysis of the ontogenetic trajectories of septal spacing of fossil cuttlefishes, it is highly likely that the examined cuttlefishes hatched with septal spacing which decreased and followed by increased septal spacing during the earliest ontogenetic stage. The hatching timing of fossil cuttlefishes has rarely been discussed until now. The examination of ontogenetic trajectories of septal spacing would give new insight into recognition of the life history of fossil cuttlefishes.

This study also hypothesized that the species-dependent general trends of ontogenetic trajectories of septal spacing in modern cuttlefishes reflect phylogenetic affinity, making them more reliable indicators than cuttlebone shape. This is concordant with the suggestion in Bonnaud *et al.*

(2006) that shell characters of modern sepiids are not phylogenetically informative. If this hypothesis holds in fossil cuttlefishes, the examination of ontogenetic trajectories of septal spacing would enable us to recognise the phylogenetic resemblance of fossil cuttlefishes. DNA examination of fossil cuttlefishes would be difficult in most cases. Thus, examination of ontogenetic trajectories of septal spacing would give insight into the recognition of the phylogeny of fossil cuttlefishes, if preservation permitted.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Measurement data for septal spacing and shell morphology.

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Figure captions (figure widths; single column, Fig. 1; full page width, Figs. 2–8)

Fig. 1. Map of the examined specimens in the studied locations.

Fig. 2. Supposed phylogeny of the five examined species based on DNA molecular analyses. A, Bonnaud *et al.* (2006); B, Yoshida *et al.* (2006); C, Yoshida *et al.* (2010); D, Anderson *et al.* (2011); E, Lindgren *et al.* (2012); F, Dai *et al.* (2012); G, Sanchez *et al.* (2016). All phylogenetic trees are simplified from the originals, showing the relationship among only the five examined species.

Fig. 3. Measurements of septal spacing and shell morphology. A, schematic diagram of the cross section of cuttlebone. Modified from Yamaguchi *et al.* (2015). B, five parameters representing the shape of the cuttlebone. Wo, shell width; Wi, shell width without outer cone; Lo, shell length; Li, shell length without outer cone; T, shell thickness.

Fig. 4. Graphs of septal spacing through ontogeny of *Sepia esculenta* from two localities. A, all specimens; B, average ontogenetic trajectories of septal spacing with error bars (standard deviations [SD]).

Fig. 5. Graphs of septal spacing through ontogeny for the examined modern cuttlefishes. A, B, *Sepia esculenta*; C, D, *Sepia lycidas*; E, F, *Sepia latimanus*. A, C, E, all specimens; B, D, F, average ontogenetic trajectories of septal spacing with error bars (standard deviations).

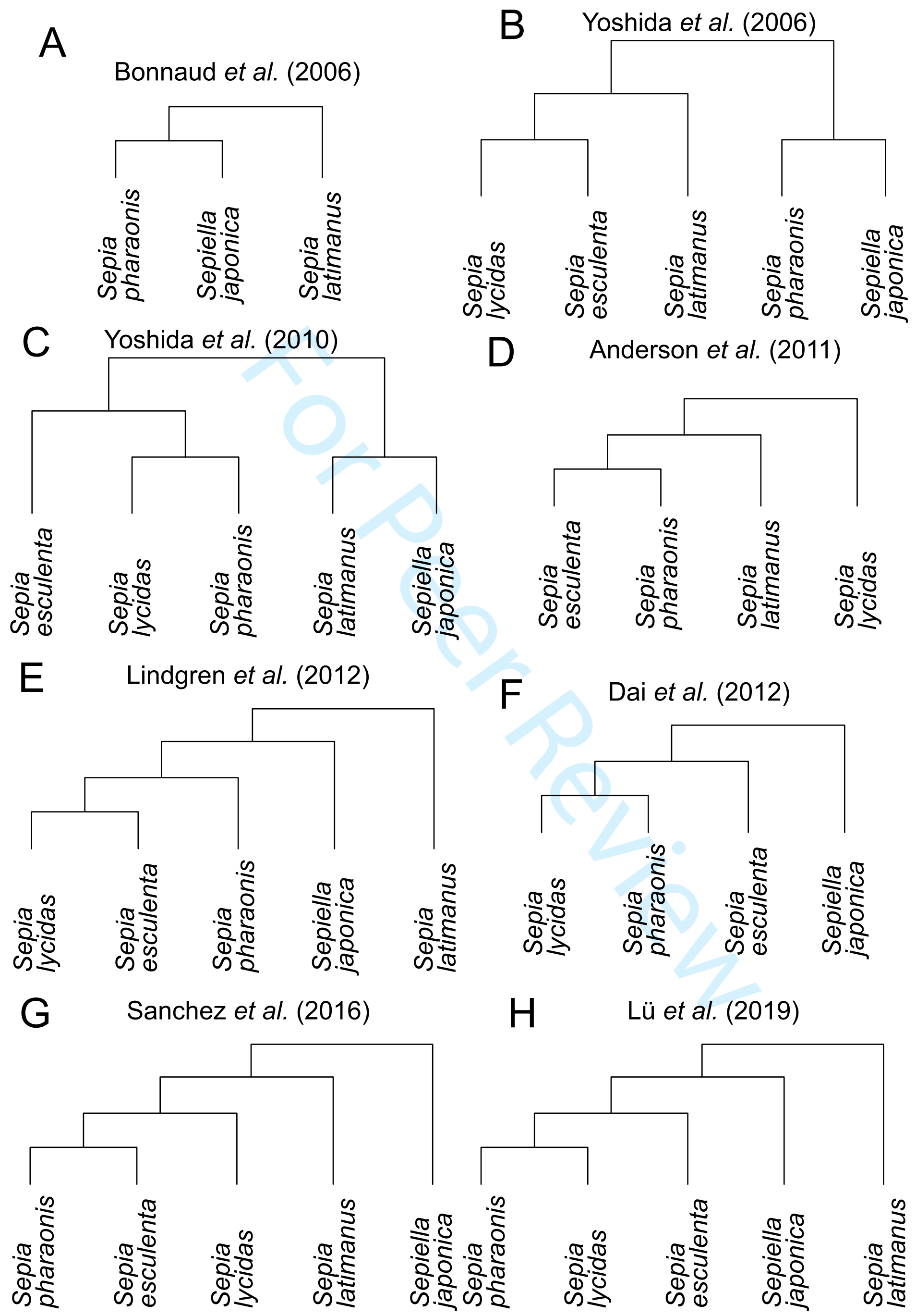
Fig. 6. Graphs of septal spacing through ontogeny for the examined modern cuttlefishes. A, B,

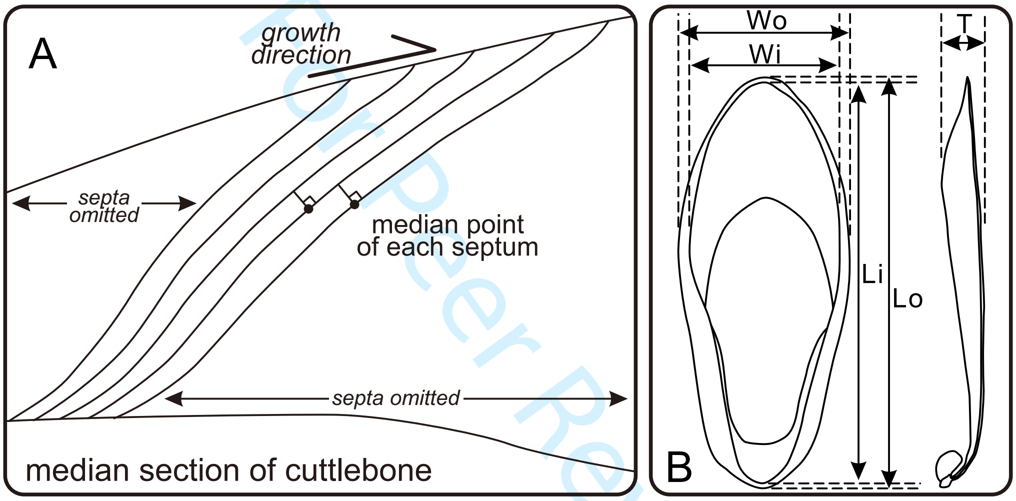
Sepia pharaonis; C, D, *Sepiella japonica*. A, C, all specimens; B, D, average ontogenetic trajectories of septal spacing with error bars (standard deviations).

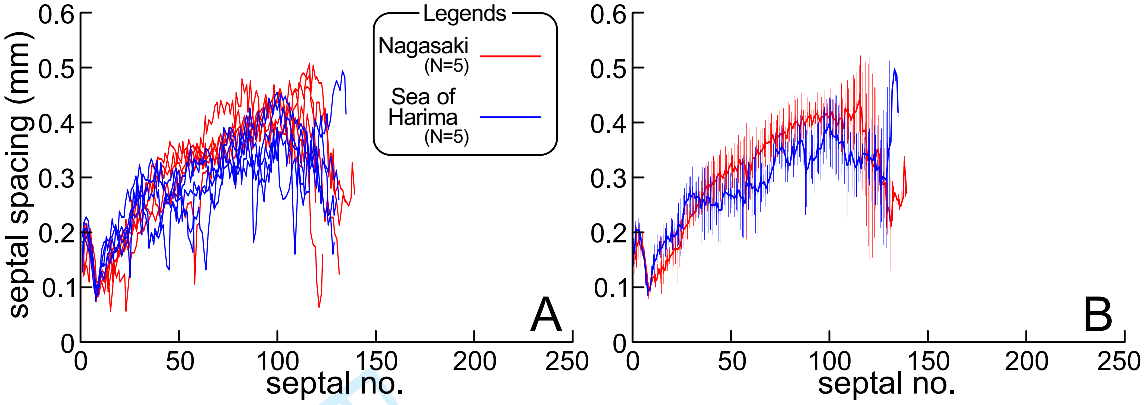
Fig. 7. Results of cluster analyses. A, cluster analysis with the average septal trajectories of the five examined species by Ward's method. B, cluster analysis with the septal spacing of all the examined specimens by Ward's method. C, simplified result of B.

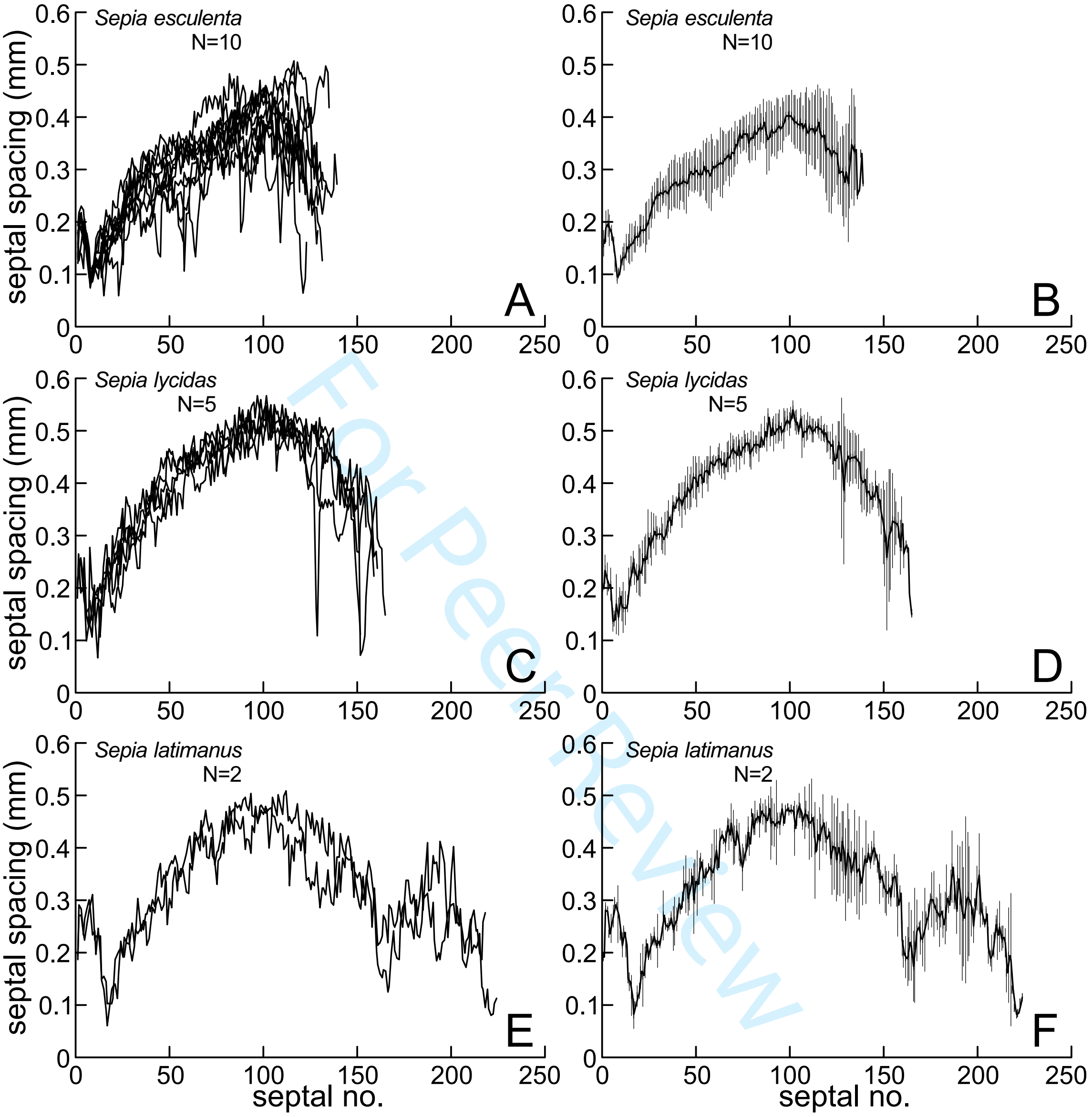
Fig. 8. Comparison of cuttlebone shape among the five examined species. A, shell thickness (T) vs. shell length (Lo); B, shell thickness (T) vs. shell length without outer cone (Li); C, shell width (Wo) vs. shell length (Lo); D, shell width without outer cone (Wi) vs. shell length without outer cone (Li); E, shell length (Lo) vs. shell length without outer cone (Li).

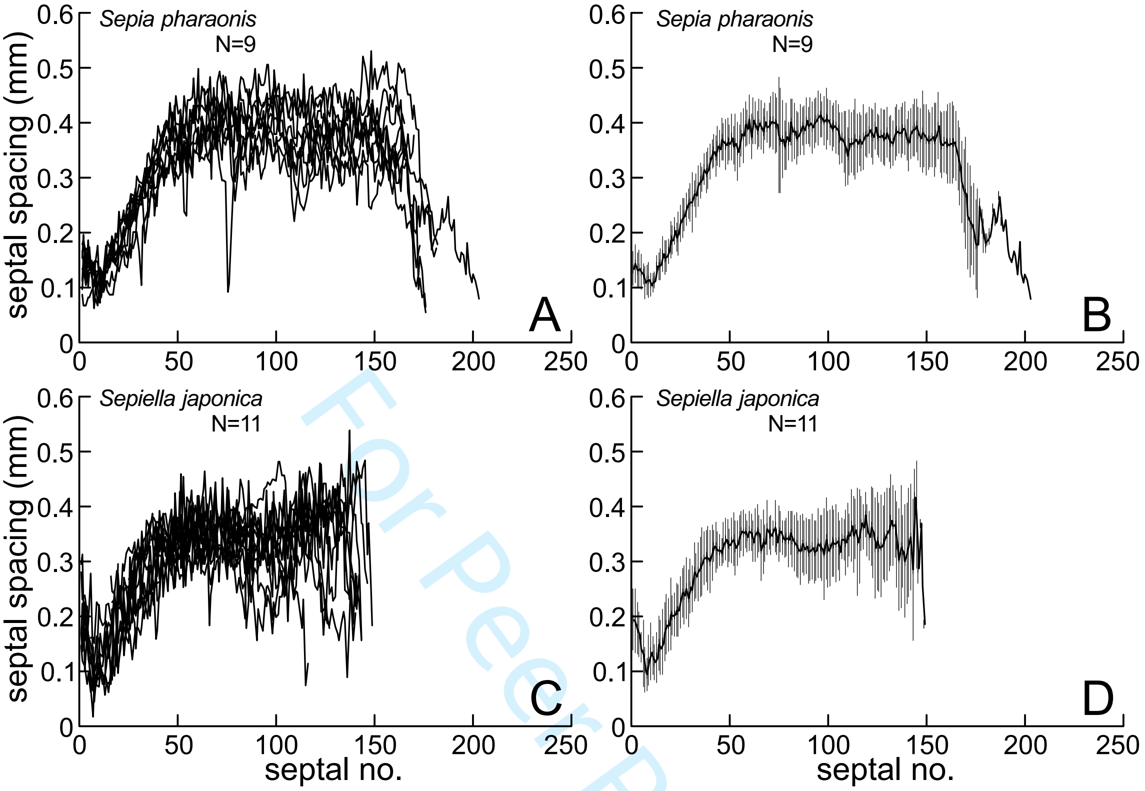

Sea of
Harima
Nagasaki
Japan
Okinawa
400 km

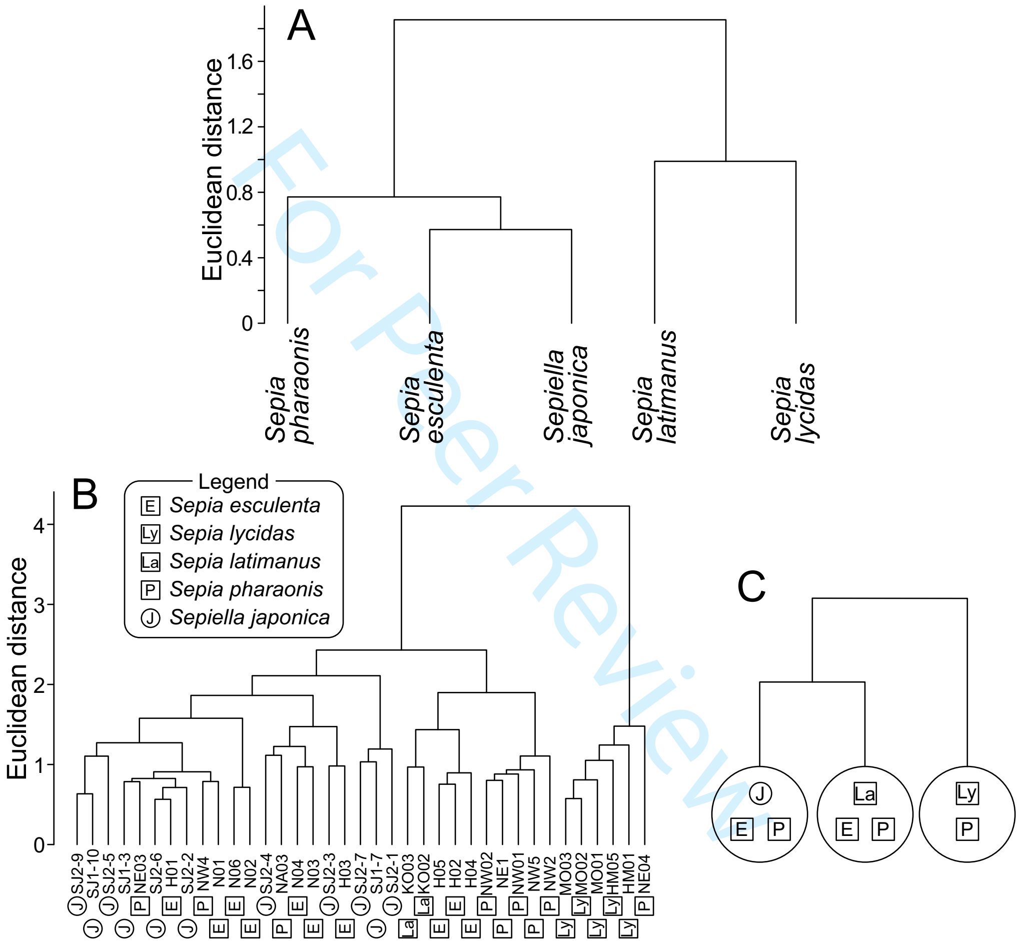

A
Bonnaud *et al.* (2006)
Sepia pharaonis
Sepiella japonica
Sepia latimanus
B
Yoshida *et al.* (2006)
Sepia lycidas
Sepia esculenta
Sepia latimanus
Sepia pharaonis
Sepiella japonica
C
Yoshida *et al.* (2010)
Sepia esculenta
Sepia lycidas
Sepia pharaonis
Sepia latimanus
Sepiella japonica
D
Anderson *et al.* (2011)
Sepia esculenta
Sepia pharaonis
Sepia latimanus
Sepia lycidas
E
Lindgren *et al.* (2012)
Sepia lycidas
Sepia esculenta
Sepia pharaonis
Sepiella japonica
Sepia latimanus
F
Dai *et al.* (2012)
Sepia lycidas
Sepia pharaonis
Sepia esculenta
Sepiella japonica
G
Sanchez *et al.* (2016)
Sepia pharaonis
Sepia esculenta
Sepia lycidas
Sepia latimanus
Sepiella japonica
H
Lü *et al.* (2019)
Sepia pharaonis
Sepia lycidas
Sepia esculenta
Sepiella japonica
Sepia latimanus

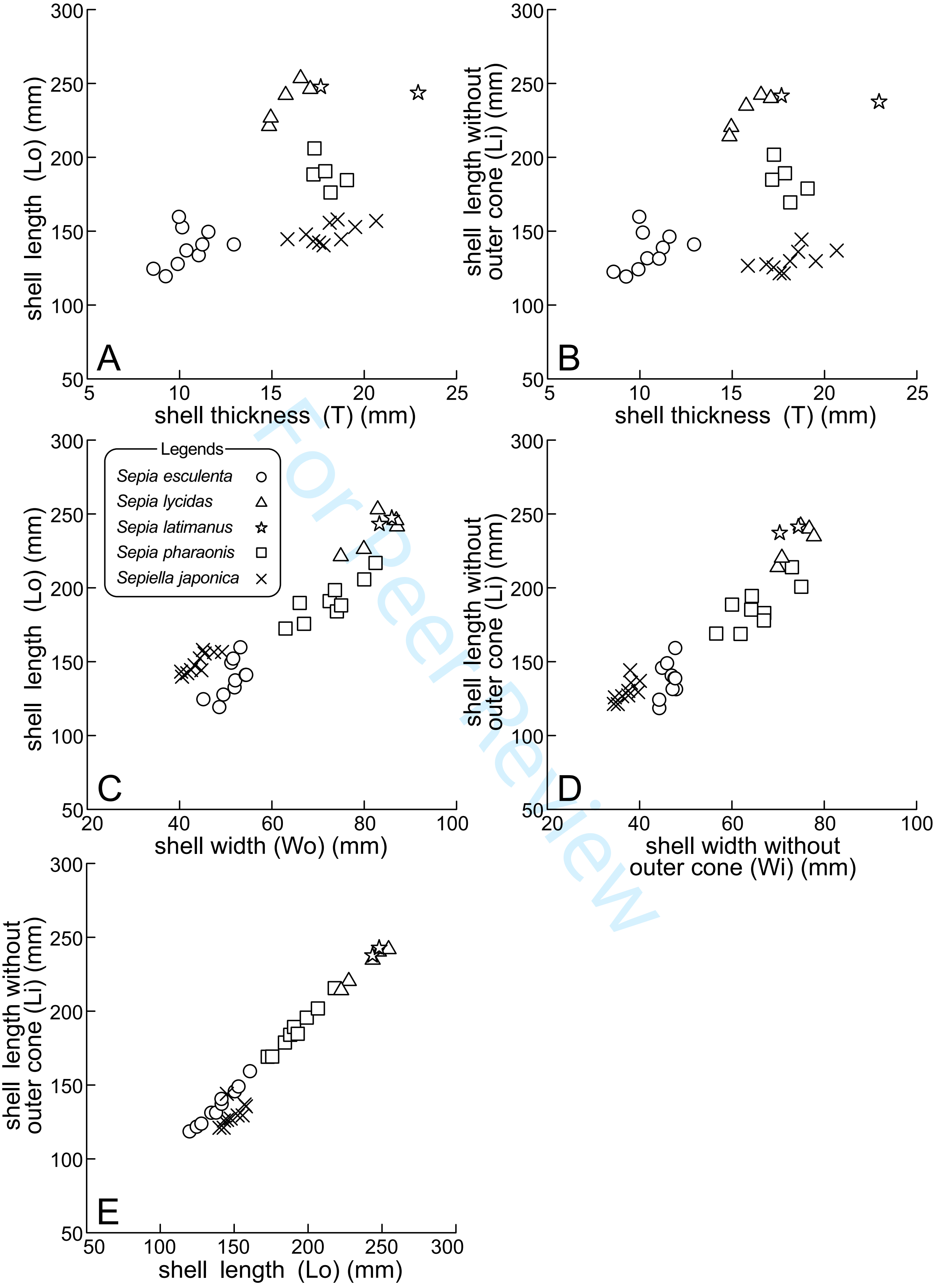

A
growth direction
septa omitted
median point of each septum
septa omitted
median section of cuttlebone
B
Wo
Wi
T
Li
Lo


septal spacing (mm)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
septal no.
Legends
Nagasaki (N=5)
Sea of Harima (N=5)
A
B


Sepia esculenta
N=10
Sepia esculenta
N=10
Sepia lycidas
N=5
Sepia lycidas
N=5
Sepia latimanus
N=2
Sepia latimanus
N=2
septal spacing (mm)
0
0.1
0.2
0.3
0.4
0.5
0.6
0
50
100
150
200
250
septal no.
A
B
C
D
E
F


Sepia pharaonis
N=9
septal spacing (mm)
0
0.1
0.2
0.3
0.4
0.5
0.6
0
50
100
150
200
250
A
Sepia pharaonis
N=9
B
Sepiella japonica
N=11
C
septal no.
Sepiella japonica
N=11
D
septal no.


A
Euclidean distance
0
0.4
0.8
1.2
1.6
Sepia pharaonis
Sepia esculenta
Sepiella japonica
Sepia latimanus
Sepia lycidas
B
Legend
E Sepia esculenta
Ly Sepia lycidas
La Sepia latimanus
P Sepia pharaonis
J Sepiella japonica
Euclidean distance
0
1
2
3
4
J SJ2-9
J SJ1-10
J SJ2-5
J SJ1-3
P NE03
J SJ2-6
E H01
J SJ2-2
P NW4
E N01
E N06
E N02
J SJ2-4
P NA03
E N04
E N03
J SJ2-3
E H03
J SJ2-7
J SJ1-7
J SJ2-1
La KO03
La KO02
E H05
E H02
E H04
P NW02
P NE1
P NW01
P NW5
P NW2
Ly MO03
Ly MO02
Ly MO01
Ly HM05
Ly HM01
P NE04
C
J
E P
La
E P
Ly
P


A
shell length (Lo) (mm)
shell thickness (T) (mm)
B
shell length without outer cone (Li) (mm)
shell thickness (T) (mm)
C
shell length (Lo) (mm)
shell width (Wo) (mm)
Legends
Sepia esculenta ○
Sepia lycidas △
Sepia latimanus ☆
Sepia pharaonis □
Sepiella japonica ×
D
shell length without outer cone (Li) (mm)
shell width without outer cone (Wi) (mm)
E
shell length without outer cone (Li) (mm)
shell length (Lo) (mm)
50
100
150
200
250
300
5
10
15
20
25
40
60
80

species	locality	sample no.	repository no.	sex	maturity
Sepia esculenta	Nagasaki	N01	MCM.W.1519	female	mature
		N02	MCM.W.1520	female	mature
		N03	MCM.W.1521	female	mature
		N04	MCM.W.1522	female	mature
		N06	MCM.W.1523	female	mature
	Sea of Harima	H01	MCM.W.1524	female	mature
		H02	MCM.W.1525	male	mature
		H03	MCM.W.1526	male	mature
		H04	MCM.W.1527	male	mature
		H05	MCM.W.1528	–	mature
Sepia lycidas	Sea of Harima	MO01	MCM.W.1529	male	mature
		MO02	MCM.W.1530	male	mature
		MO03	MCM.W.1531	male	mature
		HM01	MCM.W.1532	male	mature
		HM05	MCM.W.1533	female	mature
Sepia latimanus	Okinawa	KO02	MCM.W.1534	male	mature
		KO03	MCM.W.1535	female	mature
Sepia pharaonis	Okinawa	NE1	MCM.W.1536	–	–
		NW01	MCM.W.1537	–	–
		NW2	MCM.W.1538	–	–
		NW5	MCM.W.1539	–	–
		NW4	MCM.W.1540	–	–
		NA03	MCM.W.1541	male	mature
		NE03	MCM.W.1542	–	–
		NE04	MCM.W.1543	–	–
		NW02	MCM.W.1544	female	mature
Sepiella japonica	Sea of Harima	SJ1-3	MCM.A.1741	–	–
		SJ1-7	MCM.A.1742	–	–
		SJ1-10	MCM.A.1743	–	–
		SJ2-1	MCM.A.1744	–	–
		SJ2-2	MCM.A.1745	–	–
		SJ2-3	MCM.A.1746	–	–
		SJ2-4	MCM.A.1747	female	mature
		SJ2-5	MCM.A.1748	female	mature
		SJ2-6	MCM.A.1749	female	mature
		SJ2-7	MCM.A.1750	female	mature
		SJ2-9	MCM.A.1751	female	mature

mantle length (mm)	numbers of septa	shell length (Lo) (mm)	shell length without outer cone (Li) (mm)
–	131	134.5	133.0
130	130	120.1	120.1
150	145	138.0	132.8
138	120	128.2	125.6
130	129	125.2	123.4
144	139	141.8	139.7
145	140	142.0	142.0
170	123	160.7	160.0
159	131	150.6	147.3
155	134	152.9	150.5
241	159	228.0	222.0
255	155	248.0	242.2
278	161	255.0	244.0
234	152	223.0	216.2
246	165	244.0	236.3
256	224	244.2	237.7
257	218	248.0	241.7
–	165	176.0	170.2
–	176	188.0	184.4
–	176	206.0	201.3
–	170	190.0	188.8
–	182	184.0	179.3
207	203	191.6	186.5
–	166	172.6	169.4
–	181	217.3	215.4
205	173	198.4	195.4
–	137	140.5	122.0
–	147	157.5	138.0
–	136	147.6	128.7
–	137	156.0	130.5
–	140	157.4	137.5
–	143	152.7	130.4
–	116	145.3	127.0
–	143	158.0	136.7
–	141	145.1	144.5
–	149	143.8	126.2
–	142	143.1	122.2

shell width (Wo) (mm)	shell width without outer cone (Wi) (mm)	shell thickness (T) (mm)
52.0	48.0	11.1
48.6	44.4	9.2
52.0	47.2	10.4
49.5	44.3	9.9
45.2	41.6	8.6
54.6	47.7	11.2
54.0	47.0	13.0
53.1	47.9	10.0
51.2	45.1	11.6
51.7	46.1	10.1
80.0	71.0	15.0
87.0	77.0	17.1
83.0	75.0	16.6
75.0	70.0	14.8
87.2	77.9	15.7
83.3	70.4	22.9
85.8	74.4	17.7
67.0	62.0	18.2
75.0	67.0	17.3
80.0	75.0	17.3
66.0	60.0	17.9
74.0	67.0	19.1
72.5	64.3	–
63.0	56.6	–
82.4	72.9	–
73.7	64.2	–
40.6	34.6	17.8
49.3	41.8	–
43.3	37.8	16.8
45.4	39.9	18.1
47.4	40.3	20.6
44.4	37.8	19.5
42.5	36.4	15.8
45.2	38.2	18.5
44.8	38.1	18.7
40.3	34.8	17.2
41.7	35.4	17.6

septal spacing (mm)

Septal no.	H01	H02	H03	H04	H05
	Nagasaki	Nagasaki	Nagasaki	Nagasaki	Nagasaki
1	0.18	0.14	0.14	0.12	0.18
2	0.13	0.18	0.21	0.15	0.20
3	0.16	0.22	0.20	0.14	0.21
4	0.20	0.16	0.17	0.11	0.20
5	0.19	0.15	0.21	0.17	0.18
6	0.15	0.15	0.16	0.14	0.18
7	0.13	0.10	0.13	0.11	0.15
8	0.09	0.08	0.10	0.08	0.11
9	0.12	0.11	0.09	0.09	0.11
10	0.11	0.13	0.13	0.11	0.13
11	0.11	0.13	0.12	0.12	0.12
12	0.09	0.13	0.12	0.11	0.12
13	0.13	0.14	0.12	0.14	0.13
14	0.14	0.13	0.10	0.12	0.15
15	0.19	0.06	0.12	0.16	0.15
16	0.11	0.11	0.15	0.13	0.17
17	0.15	0.15	0.15	0.13	0.18
18	0.15	0.12	0.15	0.15	0.17
19	0.16	0.13	0.17	0.17	0.16
20	0.16	0.11	0.17	0.17	0.20
21	0.17	0.12	0.21	0.17	0.19
22	0.17	0.13	0.17	0.19	0.20
23	0.18	0.06	0.20	0.18	0.23
24	0.17	0.11	0.21	0.21	0.20
25	0.19	0.15	0.22	0.20	0.22
26	0.20	0.17	0.26	0.20	0.21
27	0.22	0.17	0.24	0.22	0.23
28	0.21	0.18	0.26	0.21	0.24
29	0.25	0.20	0.25	0.22	0.22
30	0.22	0.20	0.28	0.23	0.23
31	0.22	0.22	0.28	0.25	0.22
32	0.26	0.21	0.26	0.25	0.25
33	0.24	0.22	0.29	0.25	0.25
34	0.27	0.22	0.28	0.26	0.24
35	0.26	0.23	0.29	0.30	0.24
36	0.28	0.24	0.33	0.28	0.24
37	0.31	0.23	0.32	0.29	0.27
38	0.31	0.22	0.33	0.28	0.26
39	0.30	0.24	0.34	0.30	0.25
40	0.30	0.24	0.34	0.31	0.23
41	0.33	0.24	0.34	0.32	0.25
42	0.32	0.25	0.33	0.30	0.28
43	0.31	0.26	0.35	0.32	0.28
44	0.34	0.26	0.34	0.31	0.29
45	0.32	0.26	0.37	0.32	0.26
46	0.31	0.25	0.36	0.30	0.27

47	0.35	0.28	0.36	0.32	0.26
48	0.32	0.28	0.35	0.33	0.27
49	0.35	0.31	0.33	0.33	0.27
50	0.34	0.32	0.36	0.33	0.29
51	0.33	0.29	0.35	0.31	0.27
52	0.37	0.31	0.35	0.32	0.26
53	0.34	0.31	0.36	0.32	0.23
54	0.35	0.34	0.36	0.36	0.26
55	0.34	0.32	0.37	0.33	0.26
56	0.35	0.34	0.36	0.35	0.26
57	0.35	0.33	0.36	0.34	0.23
58	0.33	0.32	0.35	0.36	0.11
59	0.36	0.35	0.37	0.35	0.22
60	0.36	0.32	0.34	0.33	0.22
61	0.35	0.33	0.37	0.35	0.27
62	0.35	0.34	0.36	0.32	0.31
63	0.34	0.32	0.41	0.37	0.31
64	0.35	0.34	0.38	0.33	0.32
65	0.35	0.34	0.41	0.33	0.31
66	0.36	0.35	0.40	0.35	0.30
67	0.35	0.37	0.40	0.35	0.35
68	0.33	0.35	0.43	0.36	0.33
69	0.36	0.35	0.44	0.35	0.34
70	0.34	0.37	0.41	0.37	0.32
71	0.36	0.36	0.44	0.38	0.34
72	0.33	0.35	0.43	0.36	0.35
73	0.37	0.39	0.42	0.37	0.36
74	0.37	0.36	0.44	0.37	0.34
75	0.38	0.38	0.44	0.39	0.33
76	0.38	0.36	0.42	0.37	0.36
77	0.38	0.36	0.44	0.40	0.34
78	0.37	0.38	0.40	0.38	0.34
79	0.41	0.35	0.46	0.39	0.35
80	0.43	0.35	0.43	0.39	0.39
81	0.39	0.37	0.43	0.40	0.36
82	0.38	0.40	0.48	0.38	0.35
83	0.37	0.42	0.46	0.41	0.37
84	0.35	0.40	0.47	0.39	0.37
85	0.37	0.38	0.42	0.42	0.37
86	0.39	0.42	0.48	0.40	0.38
87	0.35	0.39	0.42	0.42	0.40
88	0.40	0.40	0.44	0.40	0.38
89	0.37	0.39	0.46	0.42	0.41
90	0.40	0.41	0.45	0.42	0.39
91	0.38	0.41	0.37	0.42	0.41
92	0.40	0.40	0.40	0.43	0.42
93	0.40	0.43	0.39	0.42	0.44
94	0.39	0.43	0.36	0.44	0.45
95	0.39	0.41	0.38	0.41	0.43
96	0.40	0.43	0.36	0.44	0.43
97	0.41	0.39	0.39	0.42	0.44
98	0.38	0.40	0.38	0.47	0.45

99	0.41	0.39	0.41	0.43	0.44
100	0.40	0.39	0.37	0.45	0.44
101	0.42	0.38	0.39	0.46	0.46
102	0.39	0.38	0.38	0.46	0.43
103	0.38	0.39	0.38	0.44	0.43
104	0.38	0.42	0.38	0.41	0.39
105	0.37	0.43	0.39	0.44	0.41
106	0.36	0.44	0.33	0.48	0.43
107	0.36	0.32	0.39	0.46	0.43
108	0.38	0.42	0.42	0.45	0.46
109	0.41	0.43	0.33	0.47	0.46
110	0.39	0.44	0.35	0.46	0.44
111	0.37	0.39	0.32	0.47	0.48
112	0.37	0.43	0.32	0.49	0.47
113	0.33	0.41	0.41	0.49	0.45
114	0.37	0.46	0.35	0.49	0.47
115	0.42	0.47	0.35	0.48	0.50
116	0.39	0.46	0.27	0.49	0.51
117	0.38	0.45	0.20	0.45	0.44
118	0.39	0.51	0.18	0.44	0.42
119	0.26	0.48	0.18	0.34	0.40
120		0.49	0.11	0.33	0.44
121		0.48	0.07	0.35	0.44
122		0.48	0.09	0.31	0.40
123		0.46	0.16	0.27	0.41
124		0.40		0.22	0.43
125		0.39		0.26	0.38
126		0.35		0.25	0.31
127		0.28		0.23	0.35
128		0.35		0.23	0.29
129		0.28		0.20	0.27
130		0.25		0.19	0.28
131		0.22		0.13	0.30
132		0.23			0.28
133		0.27			0.28
134		0.26			0.26
135		0.26			
136		0.25			
137		0.26			
138		0.33			
139		0.27			
140					
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Sepia esculenta

N01	N02	N03	N04	N06	average (Nagasaki)	standard deviation (Nagasaki)
Sea of Harima	Sea of Harima	Sea of Harima	Sea of Harima	Sea of Harima		
0.15	0.19	0.13	0.20	0.16	0.15	0.027
0.20	0.19	0.22	0.22	0.20	0.17	0.036
0.21	0.19	0.22	0.23	0.19	0.19	0.034
0.20	0.20	0.20	0.22	0.17	0.17	0.035
0.17	0.17	0.18	0.19	0.17	0.18	0.020
0.13	0.16	0.15	0.18	0.16	0.15	0.016
0.10	0.12	0.12	0.12	0.13	0.12	0.021
0.09	0.11	0.08	0.10	0.10	0.09	0.015
0.09	0.09	0.10	0.10	0.10	0.10	0.014
0.13	0.12	0.13	0.13	0.14	0.12	0.010
0.17	0.13	0.14	0.15	0.14	0.12	0.009
0.18	0.12	0.17	0.15	0.14	0.11	0.013
0.19	0.14	0.18	0.20	0.14	0.13	0.007
0.17	0.16	0.18	0.19	0.16	0.12	0.019
0.19	0.17	0.18	0.19	0.14	0.14	0.051
0.19	0.19	0.16	0.23	0.16	0.13	0.028
0.20	0.18	0.15	0.21	0.17	0.15	0.018
0.22	0.17	0.21	0.21	0.17	0.15	0.020
0.19	0.18	0.19	0.20	0.17	0.16	0.015
0.20	0.19	0.20	0.24	0.19	0.16	0.031
0.21	0.19	0.18	0.23	0.16	0.17	0.032
0.20	0.20	0.19	0.23	0.17	0.17	0.028
0.19	0.21	0.20	0.26	0.18	0.17	0.064
0.20	0.21	0.21	0.28	0.19	0.18	0.042
0.21	0.24	0.12	0.26	0.22	0.20	0.027
0.24	0.24	0.19	0.28	0.23	0.21	0.035
0.24	0.24	0.28	0.29	0.23	0.21	0.027
0.26	0.27	0.25	0.30	0.23	0.22	0.030
0.26	0.30	0.29	0.29	0.24	0.23	0.021
0.27	0.27	0.23	0.32	0.24	0.23	0.027
0.29	0.27	0.31	0.30	0.20	0.24	0.027
0.24	0.27	0.27	0.31	0.24	0.24	0.022
0.28	0.25	0.27	0.30	0.23	0.25	0.026
0.28	0.24	0.29	0.30	0.21	0.25	0.021
0.26	0.18	0.30	0.32	0.17	0.26	0.030
0.27	0.20	0.29	0.34	0.20	0.27	0.036
0.27	0.19	0.30	0.32	0.18	0.29	0.035
0.30	0.21	0.31	0.32	0.20	0.28	0.041
0.33	0.20	0.33	0.27	0.20	0.29	0.040
0.30	0.19	0.29	0.28	0.21	0.28	0.044
0.29	0.20	0.33	0.21	0.23	0.29	0.045
0.28	0.24	0.28	0.22	0.24	0.30	0.033
0.29	0.27	0.29	0.18	0.25	0.30	0.035
0.25	0.26	0.29	0.14	0.27	0.31	0.033
0.25	0.26	0.30	0.13	0.26	0.30	0.048
0.27	0.28	0.30	0.23	0.25	0.30	0.042

0.29	0.26	0.32	0.26	0.25	0.31	0.042
0.31	0.29	0.27	0.25	0.24	0.31	0.033
0.32	0.31	0.26	0.22	0.25	0.32	0.030
0.27	0.32	0.26	0.29	0.22	0.33	0.026
0.30	0.28	0.27	0.27	0.23	0.31	0.030
0.31	0.26	0.22	0.29	0.24	0.32	0.041
0.30	0.24	0.28	0.29	0.24	0.31	0.049
0.32	0.24	0.27	0.33	0.24	0.33	0.044
0.33	0.21	0.27	0.33	0.20	0.32	0.043
0.29	0.20	0.28	0.36	0.18	0.33	0.041
0.33	0.21	0.27	0.31	0.17	0.32	0.052
0.34	0.27	0.30	0.34	0.23	0.29	0.105
0.33	0.27	0.28	0.32	0.23	0.33	0.062
0.33	0.29	0.29	0.31	0.25	0.31	0.054
0.33	0.26	0.27	0.34	0.21	0.34	0.038
0.33	0.28	0.28	0.33	0.20	0.34	0.019
0.33	0.29	0.27	0.35	0.15	0.35	0.041
0.33	0.28	0.28	0.36	0.14	0.34	0.025
0.31	0.28	0.32	0.35	0.20	0.35	0.037
0.31	0.30	0.26	0.34	0.25	0.35	0.037
0.34	0.29	0.26	0.32	0.27	0.36	0.025
0.30	0.30	0.25	0.32	0.24	0.36	0.043
0.31	0.30	0.31	0.31	0.25	0.37	0.041
0.31	0.31	0.31	0.32	0.26	0.36	0.035
0.32	0.30	0.36	0.33	0.28	0.38	0.039
0.36	0.32	0.37	0.29	0.30	0.36	0.038
0.36	0.36	0.39	0.34	0.32	0.38	0.024
0.36	0.33	0.38	0.34	0.32	0.38	0.038
0.39	0.36	0.37	0.33	0.33	0.38	0.038
0.39	0.36	0.40	0.34	0.30	0.38	0.022
0.36	0.37	0.39	0.32	0.32	0.38	0.040
0.29	0.36	0.38	0.33	0.29	0.37	0.020
0.32	0.35	0.38	0.28	0.31	0.39	0.046
0.32	0.33	0.32	0.34	0.31	0.40	0.034
0.34	0.37	0.39	0.37	0.32	0.39	0.029
0.29	0.34	0.37	0.37	0.31	0.40	0.052
0.34	0.38	0.38	0.34	0.32	0.40	0.037
0.34	0.38	0.41	0.39	0.31	0.40	0.047
0.37	0.37	0.41	0.35	0.33	0.39	0.027
0.34	0.39	0.37	0.43	0.32	0.41	0.040
0.32	0.33	0.38	0.39	0.35	0.40	0.026
0.18	0.33	0.36	0.40	0.30	0.40	0.022
0.20	0.30	0.37	0.37	0.34	0.41	0.034
0.29	0.31	0.32	0.42	0.34	0.41	0.022
0.33	0.29	0.36	0.41	0.33	0.40	0.024
0.35	0.30	0.29	0.40	0.33	0.41	0.013
0.37	0.29	0.26	0.43	0.34	0.42	0.020
0.38	0.34	0.29	0.40	0.36	0.41	0.042
0.38	0.31	0.31	0.42	0.34	0.40	0.019
0.37	0.33	0.29	0.45	0.34	0.41	0.035
0.40	0.31	0.35	0.43	0.37	0.41	0.021
0.43	0.39	0.37	0.42	0.33	0.42	0.041

0.44	0.34	0.35	0.45	0.37	0.42	0.020
0.42	0.39	0.39	0.46	0.33	0.41	0.035
0.44	0.29	0.37	0.43	0.38	0.42	0.038
0.45	0.28	0.38	0.40	0.38	0.41	0.033
0.44	0.26	0.39	0.43	0.36	0.41	0.027
0.45	0.26	0.40	0.41	0.37	0.40	0.018
0.44	0.27	0.41	0.37	0.32	0.41	0.027
0.44	0.28	0.41	0.36	0.36	0.41	0.061
0.41	0.31	0.39	0.34	0.39	0.39	0.052
0.42	0.33	0.38	0.26	0.36	0.43	0.033
0.40	0.34	0.37	0.16	0.35	0.42	0.058
0.41	0.28	0.35	0.27	0.36	0.41	0.048
0.39	0.33	0.32	0.37	0.36	0.40	0.065
0.40	0.29	0.28	0.33	0.39	0.42	0.069
0.39	0.29	0.25	0.31	0.37	0.42	0.059
0.40	0.33	0.27	0.26	0.36	0.43	0.065
0.37	0.39	0.28	0.32	0.33	0.44	0.060
0.31	0.34	0.28	0.34	0.33	0.42	0.097
0.35	0.35	0.37	0.34	0.32	0.38	0.108
0.35	0.32	0.33	0.39	0.33	0.39	0.123
0.41	0.31	0.29	0.34	0.36	0.33	0.119
0.40	0.36	0.28	0.34	0.33	0.34	0.167
0.39	0.31	0.37		0.28	0.33	0.185
0.38	0.25	0.42		0.29	0.32	0.166
0.38	0.34	0.38		0.28	0.33	0.136
0.33	0.32	0.38		0.23	0.35	0.111
0.32	0.31	0.42		0.25	0.34	0.069
0.31	0.23	0.39		0.21	0.30	0.051
0.34	0.24	0.41		0.23	0.29	0.059
0.32	0.27	0.46		0.16	0.29	0.063
0.30	0.23	0.47		0.18	0.25	0.043
0.32	0.26	0.48			0.24	0.047
0.26		0.47			0.21	0.085
		0.46			0.26	0.037
		0.50			0.27	0.006
		0.49			0.26	0.002
		0.42			0.26	
					0.25	
					0.26	
					0.33	
					0.27	

average (Harima)	standard deviation (Harima)	average (all)	standard deviation (all)	MO01 Sea of Harima	MO02 Sea of Harima
0.16	0.026	0.16	0.025	0.20	0.21
0.21	0.013	0.19	0.029	0.24	0.23
0.21	0.019	0.20	0.027	0.20	0.26
0.20	0.020	0.18	0.029	0.20	0.22
0.18	0.011	0.18	0.015	0.20	0.19
0.16	0.016	0.15	0.014	0.10	0.15
0.12	0.013	0.12	0.016	0.13	0.13
0.10	0.012	0.09	0.012	0.13	0.28
0.10	0.007	0.10	0.011	0.11	0.20
0.13	0.008	0.13	0.010	0.19	0.19
0.15	0.015	0.13	0.017	0.13	0.19
0.15	0.026	0.13	0.027	0.17	0.19
0.17	0.026	0.15	0.025	0.16	0.21
0.17	0.012	0.15	0.028	0.18	0.19
0.17	0.020	0.16	0.039	0.17	0.23
0.19	0.026	0.16	0.036	0.22	0.23
0.18	0.025	0.17	0.026	0.22	0.23
0.19	0.024	0.17	0.030	0.23	0.26
0.19	0.012	0.17	0.019	0.22	0.23
0.20	0.023	0.18	0.032	0.24	0.30
0.20	0.026	0.18	0.029	0.27	0.25
0.20	0.020	0.18	0.026	0.27	0.27
0.21	0.030	0.19	0.048	0.25	0.29
0.22	0.037	0.20	0.041	0.29	0.23
0.21	0.054	0.20	0.039	0.30	0.29
0.24	0.031	0.22	0.033	0.29	0.27
0.26	0.023	0.24	0.031	0.32	0.25
0.26	0.028	0.24	0.034	0.32	0.32
0.27	0.026	0.25	0.031	0.30	0.26
0.27	0.036	0.25	0.033	0.32	0.30
0.27	0.045	0.26	0.038	0.31	0.32
0.26	0.028	0.25	0.025	0.31	0.29
0.27	0.026	0.26	0.024	0.30	0.31
0.26	0.038	0.26	0.028	0.30	0.33
0.25	0.069	0.25	0.048	0.31	0.35
0.26	0.059	0.27	0.044	0.31	0.35
0.25	0.064	0.27	0.049	0.31	0.33
0.27	0.057	0.27	0.045	0.37	0.34
0.26	0.066	0.28	0.050	0.36	0.35
0.25	0.048	0.27	0.044	0.35	0.35
0.25	0.056	0.27	0.050	0.33	0.41
0.25	0.029	0.27	0.035	0.33	0.36
0.26	0.044	0.28	0.042	0.28	0.36
0.24	0.058	0.28	0.053	0.34	0.39
0.24	0.063	0.27	0.058	0.33	0.35
0.27	0.025	0.28	0.036	0.33	0.39

0.28	0.026	0.30	0.036	0.35	0.39
0.27	0.031	0.29	0.034	0.33	0.40
0.27	0.040	0.29	0.040	0.36	0.46
0.27	0.036	0.30	0.040	0.38	0.45
0.27	0.023	0.29	0.032	0.34	0.43
0.26	0.034	0.29	0.045	0.38	0.45
0.27	0.030	0.29	0.042	0.41	0.45
0.28	0.043	0.31	0.047	0.41	0.42
0.27	0.063	0.29	0.056	0.43	0.45
0.26	0.071	0.30	0.062	0.43	0.45
0.26	0.067	0.29	0.063	0.42	0.45
0.29	0.046	0.29	0.072	0.43	0.46
0.29	0.043	0.31	0.052	0.42	0.44
0.29	0.030	0.30	0.041	0.42	0.45
0.28	0.053	0.31	0.049	0.44	0.45
0.28	0.052	0.31	0.044	0.42	0.43
0.28	0.077	0.31	0.066	0.41	0.47
0.28	0.086	0.31	0.066	0.39	0.44
0.29	0.056	0.32	0.051	0.40	0.44
0.29	0.036	0.32	0.045	0.39	0.45
0.30	0.030	0.33	0.042	0.40	0.45
0.28	0.033	0.32	0.053	0.40	0.47
0.30	0.025	0.33	0.046	0.41	0.48
0.30	0.026	0.33	0.041	0.43	0.46
0.32	0.029	0.35	0.043	0.43	0.46
0.33	0.034	0.35	0.037	0.40	0.44
0.35	0.028	0.37	0.027	0.44	0.48
0.35	0.025	0.36	0.032	0.40	0.47
0.35	0.027	0.37	0.033	0.46	0.45
0.36	0.039	0.37	0.031	0.41	0.48
0.35	0.033	0.37	0.036	0.45	0.46
0.33	0.037	0.35	0.034	0.48	0.47
0.33	0.036	0.36	0.048	0.43	0.47
0.32	0.013	0.36	0.044	0.42	0.47
0.36	0.028	0.37	0.030	0.45	0.47
0.34	0.036	0.37	0.051	0.46	0.46
0.35	0.028	0.38	0.039	0.45	0.48
0.37	0.044	0.38	0.043	0.45	0.51
0.37	0.028	0.38	0.027	0.47	0.48
0.37	0.042	0.39	0.042	0.47	0.47
0.35	0.030	0.37	0.034	0.46	0.51
0.32	0.083	0.36	0.070	0.45	0.51
0.32	0.069	0.36	0.068	0.50	0.54
0.34	0.050	0.38	0.052	0.45	0.51
0.34	0.043	0.37	0.042	0.48	0.51
0.33	0.042	0.37	0.048	0.46	0.52
0.34	0.066	0.38	0.059	0.47	0.54
0.35	0.044	0.38	0.049	0.47	0.55
0.35	0.047	0.38	0.041	0.48	0.56
0.35	0.059	0.38	0.052	0.47	0.53
0.37	0.047	0.39	0.038	0.45	0.57
0.39	0.041	0.40	0.039	0.50	0.54

0.39	0.054	0.40	0.039	0.51	0.52
0.40	0.046	0.40	0.037	0.47	0.54
0.38	0.062	0.40	0.050	0.51	0.55
0.38	0.063	0.39	0.047	0.52	0.57
0.38	0.072	0.39	0.051	0.54	0.53
0.38	0.070	0.39	0.046	0.50	0.55
0.36	0.068	0.39	0.051	0.50	0.51
0.37	0.059	0.39	0.057	0.51	0.55
0.37	0.041	0.38	0.043	0.52	0.53
0.35	0.061	0.39	0.058	0.52	0.54
0.32	0.093	0.37	0.084	0.53	0.51
0.33	0.059	0.37	0.063	0.49	0.55
0.35	0.030	0.38	0.052	0.52	0.53
0.34	0.057	0.38	0.069	0.50	0.50
0.32	0.057	0.37	0.071	0.49	0.50
0.32	0.056	0.37	0.075	0.52	0.51
0.34	0.044	0.39	0.070	0.52	0.52
0.32	0.026	0.37	0.083	0.48	0.52
0.34	0.018	0.36	0.072	0.47	0.54
0.34	0.029	0.37	0.083	0.49	0.52
0.34	0.044	0.34	0.081	0.48	0.53
0.34	0.042	0.34	0.100	0.44	0.52
0.34	0.052	0.34	0.118	0.46	0.51
0.33	0.075	0.33	0.112	0.47	0.45
0.34	0.050	0.34	0.090	0.42	0.49
0.32	0.063	0.33	0.074	0.39	0.47
0.32	0.072	0.33	0.061	0.40	0.50
0.29	0.080	0.29	0.060	0.43	0.50
0.30	0.085	0.30	0.065	0.45	0.51
0.30	0.122	0.30	0.087	0.47	0.50
0.30	0.122	0.28	0.086	0.38	0.50
0.35	0.113	0.30	0.090	0.36	0.47
0.37	0.146	0.27	0.113	0.43	0.47
0.46		0.32	0.098	0.46	0.43
0.50		0.35	0.106	0.44	0.48
0.49		0.34	0.106	0.49	0.47
0.42		0.34	0.080	0.49	0.45
		0.25		0.50	0.46
		0.26		0.51	0.48
		0.33		0.46	0.45
		0.27		0.44	0.45
				0.43	0.44
				0.36	0.40
				0.41	0.41
				0.39	0.40
				0.36	0.41
				0.35	0.39
				0.36	0.39
				0.38	0.39
				0.37	0.39
				0.33	0.35
				0.27	0.36

0.27	0.40
0.32	0.43
0.36	0.38
0.38	0.38
0.40	0.32
0.33	
0.31	
0.30	
0.23	

Sepia lycidas					
MO03	HM01	HM05			KO02
Sea of Harima	Sea of Harima	Sea of Harima	average	standard deviation	Okinawa
0.18	0.20	0.20	0.20	0.002	0.19
0.27	0.24	0.19	0.23	0.027	0.27
0.19	0.25	0.19	0.22	0.031	0.27
0.20	0.20	0.19	0.20	0.011	0.24
0.18	0.26		0.21	0.031	0.23
0.16	0.15		0.14	0.022	0.25
0.16	0.15		0.14	0.014	0.28
0.13	0.13	0.18	0.17	0.057	0.29
0.11	0.17	0.14	0.15	0.035	0.31
0.19	0.21	0.15	0.18	0.017	0.23
0.19	0.13	0.18	0.16	0.028	0.23
0.20	0.07	0.18	0.16	0.047	0.23
0.11	0.16	0.18	0.16	0.033	0.23
0.14	0.17	0.17	0.17	0.016	0.15
0.24	0.21	0.22	0.21	0.026	0.13
0.28	0.20	0.22	0.23	0.028	0.09
0.28	0.25	0.26	0.25	0.021	0.06
0.20	0.21	0.26	0.23	0.025	0.10
0.25	0.17	0.23	0.22	0.028	0.13
0.19	0.17	0.27	0.23	0.048	0.14
0.20	0.16	0.28	0.23	0.046	0.14
0.25	0.20	0.30	0.26	0.033	0.11
0.21	0.21	0.32	0.25	0.044	0.16
0.26	0.18	0.32	0.26	0.048	0.22
0.34	0.21	0.35	0.30	0.052	0.19
0.31	0.25	0.29	0.28	0.023	0.23
0.29	0.23	0.38	0.29	0.050	0.22
0.29	0.26	0.36	0.31	0.033	0.22
0.32	0.27	0.36	0.30	0.037	0.22
0.30	0.28	0.32	0.30	0.013	0.26
0.30	0.29	0.30	0.30	0.011	0.22
0.36	0.28	0.28	0.30	0.030	0.24
0.33	0.30	0.24	0.29	0.029	0.30
0.36	0.29	0.24	0.30	0.041	0.26
0.35	0.29	0.29	0.32	0.026	0.24
0.39	0.31	0.33	0.34	0.031	0.26
0.35	0.30	0.32	0.32	0.018	0.26
0.39	0.35	0.35	0.36	0.019	0.21
0.37	0.36	0.34	0.35	0.009	0.23
0.38	0.37	0.36	0.36	0.010	0.25
0.38	0.38	0.37	0.37	0.025	0.29
0.39	0.35	0.41	0.37	0.031	0.28
0.40	0.40	0.35	0.36	0.043	0.29
0.41	0.39	0.36	0.38	0.026	0.31
0.43	0.41	0.36	0.38	0.037	0.29
0.45	0.41	0.38	0.39	0.040	0.28

0.43	0.41	0.34	0.38	0.033	0.29
0.45	0.41	0.37	0.39	0.038	0.36
0.45	0.40	0.39	0.41	0.039	0.35
0.47	0.39	0.36	0.41	0.041	0.37
0.46	0.39	0.37	0.40	0.042	0.38
0.46	0.41	0.38	0.42	0.035	0.37
0.44	0.41	0.39	0.42	0.020	0.39
0.43	0.41	0.34	0.40	0.032	0.37
0.43	0.42	0.38	0.42	0.021	0.34
0.45	0.42	0.38	0.43	0.026	0.36
0.44	0.42	0.35	0.42	0.034	0.36
0.46	0.47	0.39	0.44	0.029	0.34
0.46	0.43	0.43	0.44	0.015	0.32
0.41	0.46	0.44	0.44	0.017	0.31
0.44	0.45	0.44	0.44	0.006	0.37
0.44	0.47	0.47	0.45	0.021	0.36
0.44	0.42	0.49	0.45	0.030	0.39
0.43	0.45	0.47	0.43	0.026	0.42
0.46	0.45	0.45	0.44	0.020	0.41
0.43	0.44	0.46	0.43	0.026	0.40
0.47	0.49	0.44	0.45	0.028	0.43
0.46	0.48	0.44	0.45	0.029	0.45
0.50	0.48	0.45	0.46	0.032	0.47
0.48	0.50	0.47	0.47	0.022	0.46
0.47	0.50	0.44	0.46	0.023	0.43
0.49	0.48	0.46	0.45	0.033	0.45
0.50	0.48	0.45	0.47	0.020	0.44
0.49	0.45	0.47	0.45	0.028	0.37
0.48	0.50	0.46	0.47	0.019	0.39
0.52	0.46	0.47	0.47	0.032	0.40
0.50	0.49	0.48	0.48	0.018	0.42
0.50	0.49	0.45	0.48	0.018	0.45
0.47	0.49	0.42	0.46	0.026	0.42
0.52	0.48	0.43	0.46	0.038	0.46
0.51	0.49	0.44	0.47	0.023	0.43
0.51	0.48	0.46	0.47	0.016	0.48
0.47	0.51	0.47	0.47	0.018	0.45
0.44	0.50	0.45	0.47	0.028	0.43
0.49	0.53	0.48	0.49	0.022	0.49
0.47	0.48	0.48	0.48	0.006	0.48
0.50	0.55	0.48	0.50	0.029	0.48
0.50	0.52	0.47	0.49	0.027	0.47
0.51	0.54	0.53	0.53	0.017	0.49
0.50	0.50	0.51	0.49	0.022	0.50
0.51	0.51	0.53	0.51	0.016	0.48
0.45	0.54	0.50	0.49	0.033	0.47
0.54	0.49	0.49	0.50	0.028	0.50
0.49	0.52	0.49	0.50	0.028	0.46
0.52	0.52	0.48	0.51	0.029	0.46
0.51	0.50	0.49	0.50	0.018	0.48
0.50	0.50	0.50	0.50	0.038	0.45
0.51	0.54	0.49	0.52	0.021	0.48

0.50	0.56	0.52	0.52	0.022	0.48
0.52	0.52	0.51	0.51	0.021	0.47
0.55	0.52	0.50	0.53	0.020	0.47
0.54	0.55	0.53	0.54	0.017	0.47
0.52	0.52	0.49	0.52	0.018	0.40
0.48	0.54	0.51	0.52	0.025	0.45
0.49	0.49	0.50	0.50	0.008	0.50
0.50	0.54	0.51	0.52	0.019	0.48
0.50	0.42	0.47	0.49	0.039	0.46
0.51	0.45	0.48	0.50	0.031	0.50
0.49	0.50	0.47	0.50	0.020	0.48
0.51	0.52	0.48	0.51	0.026	0.46
0.52	0.50	0.48	0.51	0.017	0.50
0.49	0.48	0.54	0.50	0.023	0.51
0.53	0.46	0.52	0.50	0.022	0.45
0.51	0.49	0.50	0.51	0.011	0.46
0.50	0.51	0.49	0.51	0.014	0.45
0.48	0.52	0.52	0.50	0.019	0.46
0.51	0.51	0.49	0.50	0.024	0.46
0.48	0.48	0.51	0.49	0.015	0.49
0.48	0.50	0.49	0.50	0.017	0.43
0.48	0.48	0.50	0.48	0.026	0.44
0.48	0.46	0.49	0.48	0.020	0.43
0.49	0.44	0.51	0.47	0.026	0.39
0.52	0.44	0.50	0.47	0.038	0.47
0.49	0.41	0.46	0.44	0.037	0.46
0.49	0.40	0.45	0.45	0.042	0.44
0.51	0.40	0.51	0.47	0.045	0.47
0.51	0.39	0.50	0.47	0.046	0.43
0.49	0.16	0.52	0.43	0.133	0.45
0.47	0.11	0.48	0.39	0.144	0.45
0.48	0.35	0.53	0.44	0.071	0.41
0.51	0.37	0.49	0.45	0.051	0.46
0.50	0.35	0.49	0.45	0.053	0.43
0.51	0.37	0.45	0.45	0.047	0.40
0.50	0.36	0.44	0.45	0.051	0.39
0.49	0.37	0.46	0.45	0.043	0.45
0.45	0.36	0.46	0.44	0.046	0.41
0.45	0.37	0.40	0.44	0.052	0.43
0.45	0.33	0.38	0.41	0.051	0.35
0.45	0.30	0.37	0.40	0.059	0.31
0.44	0.29	0.44	0.41	0.058	0.37
0.44	0.30	0.40	0.38	0.046	0.32
0.39	0.30	0.42	0.39	0.043	0.38
0.36	0.32	0.39	0.37	0.028	0.36
0.39	0.33	0.38	0.38	0.026	0.41
0.37	0.36	0.41	0.37	0.020	0.42
0.39	0.39	0.45	0.40	0.028	0.40
0.38	0.33	0.39	0.37	0.021	0.36
0.34	0.33	0.41	0.37	0.031	0.37
0.36	0.28	0.41	0.35	0.043	0.34
0.35	0.21	0.44	0.32	0.079	0.31

0.39	0.15	0.27	0.30	0.091	0.29
0.36	0.11	0.07	0.26	0.141	0.28
0.38		0.08	0.30	0.126	0.35
0.38		0.11	0.31	0.116	0.29
0.42		0.19	0.33	0.091	0.34
0.40		0.25	0.33	0.063	0.38
0.38		0.28	0.32	0.040	0.36
0.35		0.31	0.32	0.025	0.34
0.26		0.35	0.28	0.052	0.30
0.27		0.37	0.32	0.052	0.20
0.24		0.30	0.27	0.029	0.18
		0.28	0.28		0.16
		0.28	0.28		0.15
		0.19	0.19		0.17
		0.15	0.15		0.17
					0.13
					0.14
					0.20
					0.24
					0.20
					0.19
					0.19
					0.26
					0.29
					0.30
					0.26
					0.25
					0.27
					0.25
					0.23
					0.30
					0.27
					0.30
					0.35
					0.28
					0.35
					0.41
					0.32
					0.32
					0.39
					0.37
					0.37
					0.33
					0.41
					0.39
					0.37
					0.32
					0.23
					0.30
					0.35
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0.11

Sepia latimanus

KO03 Okinawa	average	standard deviation	NE1 Okinawa	NW01 Okinawa	NW2 Okinawa
0.19	0.19	0.005	0.11	0.16	0.09
0.29	0.28	0.014	0.14	0.20	0.07
0.28	0.28	0.008	0.16	0.12	0.07
0.24	0.24	0.001	0.10	0.19	0.08
0.27	0.25	0.028	0.13	0.14	0.08
0.28	0.27	0.021	0.13	0.15	0.10
0.30	0.29	0.014	0.06	0.13	0.11
0.28	0.29	0.005	0.10	0.11	0.13
0.23	0.27	0.054	0.13	0.08	0.13
0.24	0.23	0.012	0.13	0.09	0.14
0.20	0.21	0.023	0.13	0.08	0.13
0.25	0.24	0.011	0.13	0.12	0.11
0.20	0.21	0.023	0.15	0.14	0.13
0.15	0.15	0.002	0.16	0.14	0.13
0.16	0.14	0.018	0.15	0.17	0.15
0.14	0.12	0.038	0.19	0.18	0.17
0.10	0.08	0.028	0.19	0.19	0.17
0.10	0.10	0.004	0.16	0.19	0.19
0.10	0.12	0.020	0.17	0.18	0.20
0.11	0.12	0.015	0.21	0.22	0.24
0.19	0.16	0.033	0.22	0.22	0.19
0.20	0.16	0.060	0.24	0.22	0.20
0.20	0.18	0.030	0.22	0.22	0.20
0.21	0.22	0.009	0.25	0.21	0.23
0.19	0.19	0.001	0.26	0.21	0.23
0.19	0.21	0.025	0.27	0.22	0.25
0.23	0.22	0.004	0.27	0.26	0.26
0.24	0.23	0.018	0.27	0.28	0.22
0.21	0.22	0.008	0.27	0.26	0.26
0.19	0.22	0.051	0.29	0.26	0.26
0.21	0.21	0.004	0.28	0.28	0.28
0.25	0.24	0.007	0.28	0.28	0.26
0.24	0.27	0.047	0.30	0.29	0.18
0.25	0.25	0.012	0.32	0.30	0.22
0.25	0.25	0.008	0.32	0.30	0.30
0.25	0.25	0.012	0.32	0.32	0.28
0.27	0.27	0.011	0.33	0.34	0.29
0.27	0.24	0.042	0.34	0.34	0.23
0.29	0.26	0.046	0.35	0.35	0.28
0.28	0.26	0.023	0.35	0.33	0.28
0.30	0.29	0.012	0.36	0.37	0.30
0.29	0.28	0.009	0.38	0.38	0.33
0.31	0.30	0.015	0.35	0.38	0.29
0.35	0.33	0.034	0.37	0.40	0.32
0.37	0.33	0.056	0.37	0.38	0.32
0.33	0.30	0.032	0.39	0.43	0.36

0.35	0.32	0.040	0.37	0.40	0.32
0.34	0.35	0.015	0.39	0.39	0.29
0.26	0.30	0.066	0.39	0.40	0.31
0.30	0.33	0.043	0.37	0.40	0.30
0.29	0.33	0.063	0.39	0.40	0.31
0.34	0.35	0.025	0.40	0.39	0.34
0.36	0.37	0.016	0.39	0.24	0.36
0.32	0.34	0.035	0.37	0.23	0.31
0.36	0.35	0.013	0.36	0.33	0.34
0.35	0.35	0.010	0.43	0.35	0.32
0.37	0.36	0.004	0.40	0.43	0.30
0.37	0.36	0.021	0.43	0.40	0.35
0.39	0.35	0.053	0.39	0.44	0.35
0.41	0.36	0.071	0.39	0.45	0.38
0.42	0.40	0.037	0.34	0.43	0.33
0.37	0.36	0.008	0.35	0.43	0.40
0.43	0.41	0.025	0.40	0.43	0.39
0.43	0.42	0.006	0.37	0.42	0.38
0.42	0.41	0.001	0.37	0.42	0.40
0.43	0.41	0.021	0.39	0.44	0.41
0.45	0.44	0.013	0.42	0.41	0.39
0.40	0.42	0.030	0.40	0.41	0.38
0.42	0.45	0.035	0.38	0.43	0.35
0.38	0.42	0.052	0.37	0.43	0.38
0.38	0.41	0.037	0.40	0.40	0.37
0.42	0.43	0.019	0.39	0.45	0.41
0.39	0.41	0.035	0.37	0.49	0.37
0.38	0.37	0.006	0.36	0.42	0.39
0.33	0.36	0.044	0.38	0.39	0.39
0.38	0.39	0.014	0.39	0.39	0.39
0.38	0.40	0.025	0.36	0.39	0.43
0.41	0.43	0.028	0.37	0.40	0.41
0.39	0.41	0.023	0.40	0.43	0.43
0.47	0.47	0.003	0.38	0.43	0.40
0.45	0.44	0.013	0.38	0.46	0.42
0.43	0.46	0.032	0.33	0.44	0.44
0.47	0.46	0.012	0.38	0.44	0.40
0.47	0.45	0.033	0.35	0.41	0.41
0.45	0.47	0.023	0.37	0.38	0.39
0.45	0.46	0.020	0.38	0.39	0.46
0.44	0.46	0.032	0.41	0.36	0.42
0.44	0.45	0.025	0.39	0.35	0.43
0.46	0.48	0.022	0.39	0.36	0.43
0.40	0.45	0.069	0.40	0.36	0.41
0.42	0.45	0.045	0.41	0.34	0.45
0.41	0.44	0.040	0.39	0.30	0.43
0.39	0.45	0.081	0.42	0.32	0.43
0.44	0.45	0.014	0.40	0.32	0.44
0.43	0.44	0.021	0.44	0.35	0.45
0.47	0.48	0.004	0.41	0.37	0.43
0.45	0.45	0.001	0.42	0.37	0.44
0.46	0.47	0.011	0.41	0.33	0.46

0.47	0.48	0.007	0.44	0.34	0.47
0.47	0.47	0.006	0.46	0.35	0.45
0.48	0.47	0.009	0.47	0.36	0.45
0.47	0.47	0.004	0.44	0.35	0.42
0.47	0.44	0.052	0.45	0.34	0.42
0.48	0.46	0.020	0.39	0.34	0.45
0.46	0.48	0.023	0.38	0.32	0.45
0.46	0.47	0.013	0.36	0.30	0.42
0.44	0.45	0.016	0.31	0.30	0.41
0.43	0.47	0.050	0.26	0.33	0.41
0.45	0.46	0.025	0.22	0.33	0.44
0.44	0.45	0.016	0.26	0.31	0.42
0.40	0.45	0.071	0.28	0.33	0.43
0.40	0.46	0.074	0.33	0.35	0.41
0.43	0.44	0.020	0.38	0.36	0.44
0.33	0.39	0.093	0.33	0.39	0.45
0.40	0.43	0.030	0.33	0.40	0.40
0.37	0.42	0.059	0.31	0.37	0.44
0.42	0.44	0.026	0.29	0.33	0.46
0.41	0.45	0.054	0.30	0.41	0.47
0.41	0.42	0.014	0.30	0.42	0.42
0.40	0.42	0.030	0.36	0.44	0.45
0.43	0.43	0.001	0.39	0.43	0.45
0.37	0.38	0.014	0.37	0.44	0.45
0.34	0.40	0.095	0.39	0.41	0.45
0.34	0.40	0.081	0.36	0.41	0.46
0.32	0.38	0.081	0.38	0.39	0.45
0.34	0.40	0.093	0.40	0.41	0.43
0.33	0.38	0.069	0.35	0.38	0.46
0.37	0.41	0.057	0.39	0.38	0.44
0.34	0.39	0.078	0.40	0.38	0.47
0.29	0.35	0.088	0.40	0.41	0.47
0.32	0.39	0.094	0.36	0.41	0.44
0.32	0.38	0.076	0.36	0.41	0.46
0.31	0.35	0.059	0.34	0.40	0.43
0.36	0.37	0.019	0.40	0.40	0.43
0.33	0.39	0.083	0.42	0.40	0.45
0.30	0.35	0.079	0.43	0.40	0.43
0.29	0.36	0.098	0.41	0.36	0.42
0.32	0.33	0.020	0.38	0.35	0.43
0.38	0.34	0.054	0.34	0.35	0.44
0.38	0.38	0.006	0.30	0.32	0.37
0.43	0.37	0.079	0.25	0.33	0.37
0.40	0.39	0.015	0.32	0.32	0.42
0.38	0.37	0.014	0.33	0.31	0.39
0.38	0.39	0.017	0.35	0.33	0.37
0.38	0.40	0.033	0.33	0.33	0.39
0.38	0.39	0.013	0.32	0.33	0.39
0.38	0.37	0.017	0.25	0.35	0.37
0.31	0.34	0.047	0.24	0.35	0.44
0.35	0.34	0.013	0.26	0.36	0.41
0.34	0.33	0.023	0.26	0.36	0.39

0.35	0.32	0.045	0.27	0.37	0.43
0.34	0.31	0.042	0.30	0.36	0.41
0.30	0.32	0.031	0.29	0.36	0.36
0.32	0.31	0.020	0.30	0.39	0.36
0.35	0.34	0.006	0.32	0.41	0.34
0.32	0.35	0.041	0.40	0.43	0.33
0.30	0.33	0.040	0.33	0.42	0.30
0.25	0.29	0.062	0.29	0.45	0.32
0.32	0.31	0.015	0.27	0.43	0.31
0.25	0.23	0.033	0.31	0.45	0.28
0.22	0.20	0.027	0.33	0.47	0.25
0.22	0.19	0.040	0.35	0.42	0.24
0.23	0.19	0.057	0.35	0.40	0.25
0.27	0.22	0.074	0.42	0.37	0.24
0.26	0.21	0.067	0.40	0.34	0.25
0.22	0.17	0.066		0.33	0.21
0.29	0.21	0.110		0.28	0.22
0.28	0.24	0.059		0.24	0.22
0.26	0.25	0.009		0.20	0.19
0.25	0.23	0.033		0.27	0.12
0.26	0.23	0.052		0.26	0.10
0.30	0.24	0.080		0.10	0.12
0.27	0.26	0.013		0.12	0.16
0.25	0.27	0.025		0.08	0.13
0.31	0.30	0.010		0.09	0.07
0.34	0.30	0.052		0.07	0.06
0.34	0.29	0.062			
0.30	0.28	0.023			
0.29	0.27	0.029			
0.31	0.27	0.060			
0.26	0.28	0.033			
0.24	0.25	0.026			
0.23	0.27	0.049			
0.26	0.30	0.063			
0.30	0.29	0.016			
0.31	0.33	0.028			
0.31	0.36	0.069			
0.29	0.30	0.021			
0.25	0.28	0.050			
0.30	0.34	0.064			
0.23	0.30	0.103			
0.19	0.28	0.133			
0.20	0.27	0.094			
0.19	0.30	0.160			
0.22	0.31	0.123			
0.22	0.30	0.104			
0.25	0.28	0.050			
0.28	0.25	0.033			
0.29	0.29	0.008			
0.29	0.32	0.042			
0.29	0.35	0.077			
0.26	0.28	0.029			

0.29	0.27	0.022
0.26	0.25	0.004
0.28	0.27	0.014
0.19	0.21	0.035
0.18	0.19	0.015
0.17	0.20	0.035
0.20	0.21	0.023
0.24	0.25	0.016
0.27	0.23	0.048
0.28	0.25	0.048
0.24	0.23	0.023
0.24	0.23	0.021
0.20	0.22	0.027
0.19	0.16	0.037
0.26	0.19	0.091
0.28	0.19	0.127
	0.13	
	0.09	
	0.08	
	0.08	
	0.10	
	0.11	

Sepia pharaonis

NW5	NW4	NA03	NE03	NE04	NW02	average
Okinawa	Okinawa	Okinawa	Okinawa	Okinawa	Okinawa	
0.13	0.18	0.10	0.15	0.12	0.17	0.13
0.13	0.19	0.14	0.14	0.16	0.14	0.14
0.12	0.17	0.11	0.13	0.15	0.17	0.13
0.14	0.14	0.13	0.10	0.16	0.17	0.13
0.14	0.13	0.14	0.06	0.18	0.16	0.13
0.14	0.15	0.13	0.10	0.12	0.12	0.13
0.15	0.12	0.07	0.09	0.10	0.15	0.11
0.15	0.13	0.08	0.06	0.14	0.11	0.11
0.15	0.10	0.07	0.10	0.18	0.10	0.11
0.11	0.13	0.10	0.09	0.08	0.07	0.10
0.11	0.09	0.09	0.11	0.12	0.11	0.11
0.09	0.13	0.11		0.09	0.12	0.11
0.11	0.18	0.14	0.11	0.13	0.16	0.14
0.11	0.16	0.14	0.10	0.19	0.14	0.14
0.10	0.17	0.15	0.09	0.18	0.14	0.14
0.13	0.17	0.18	0.09	0.19	0.16	0.16
0.12	0.15	0.17	0.09	0.17	0.15	0.15
0.11	0.20	0.15	0.12	0.15	0.14	0.16
0.15	0.19	0.17	0.14	0.14	0.16	0.17
0.16	0.22	0.18	0.13	0.17	0.16	0.19
0.17	0.22	0.15	0.15	0.17	0.19	0.19
0.18	0.23	0.17	0.17	0.21	0.21	0.20
0.18	0.22	0.14	0.16	0.18	0.20	0.19
0.16	0.25	0.14	0.15	0.18	0.22	0.20
0.17	0.25	0.17	0.18	0.24	0.25	0.22
0.18	0.21	0.24	0.16	0.24	0.27	0.23
0.17	0.22	0.22	0.20	0.23	0.25	0.23
0.19	0.26	0.24	0.20	0.27	0.25	0.24
0.23	0.26	0.23	0.20	0.30	0.27	0.25
0.25	0.25	0.26	0.17	0.29	0.27	0.25
0.25	0.27	0.26	0.11	0.29	0.28	0.26
0.28	0.29	0.28	0.21	0.29	0.26	0.27
0.29	0.32	0.28	0.22	0.27	0.26	0.27
0.32	0.29	0.27	0.24	0.34	0.27	0.28
0.30	0.32	0.26	0.23	0.35	0.28	0.29
0.33	0.29	0.27	0.28	0.32	0.28	0.30
0.33	0.32	0.30	0.26	0.37	0.30	0.32
0.33	0.31	0.28	0.27	0.35	0.33	0.31
0.32	0.32	0.28	0.25	0.37	0.34	0.32
0.35	0.33	0.31	0.29	0.39	0.32	0.33
0.37	0.32	0.30	0.34	0.38	0.34	0.34
0.37	0.30	0.32	0.33	0.38	0.36	0.35
0.35	0.31	0.31	0.30	0.38	0.40	0.34
0.37	0.35	0.32	0.30	0.39	0.40	0.36
0.35	0.34	0.31	0.32	0.40	0.39	0.35
0.36	0.34	0.33	0.33	0.44	0.36	0.37

0.42	0.34	0.33	0.34	0.40	0.38	0.37
0.35	0.31	0.35	0.33	0.41	0.43	0.36
0.37	0.32	0.34	0.32	0.45	0.38	0.37
0.37	0.37	0.33	0.36	0.42	0.36	0.36
0.38	0.33	0.39	0.31	0.42	0.42	0.37
0.39	0.31	0.31	0.32	0.37	0.40	0.36
0.40	0.34	0.36	0.37	0.45	0.37	0.36
0.36	0.33	0.37	0.34	0.42	0.42	0.35
0.33	0.36	0.37	0.31	0.44	0.39	0.36
0.41	0.34	0.36	0.36	0.44	0.41	0.38
0.41	0.33	0.37	0.31	0.45	0.41	0.38
0.42	0.38	0.36	0.35	0.48	0.41	0.40
0.43	0.39	0.36	0.35	0.41	0.41	0.39
0.43	0.38	0.39	0.34	0.50	0.40	0.41
0.41	0.36	0.34	0.33	0.42	0.43	0.38
0.40	0.41	0.38	0.34	0.47	0.46	0.40
0.37	0.39	0.37	0.33	0.46	0.46	0.40
0.37	0.36	0.36	0.34	0.42	0.45	0.39
0.45	0.34	0.39	0.34	0.44	0.46	0.40
0.37	0.33	0.37	0.36	0.48	0.43	0.40
0.30	0.35	0.39	0.36	0.43	0.42	0.39
0.47	0.35	0.38	0.38	0.45	0.41	0.40
0.39	0.40	0.36	0.37	0.44	0.40	0.39
0.47	0.38	0.36	0.37	0.45	0.35	0.40
0.49	0.42	0.32	0.37	0.42	0.43	0.40
0.46	0.44	0.30	0.33	0.42	0.44	0.40
0.47	0.43	0.30	0.38	0.42	0.39	0.40
0.49	0.41	0.29	0.37	0.42	0.42	0.40
0.45	0.45	0.09	0.37	0.44	0.44	0.38
0.42	0.39	0.11	0.39	0.39	0.45	0.37
0.39	0.31	0.21	0.37	0.46	0.43	0.37
0.31	0.29	0.31	0.35	0.40	0.40	0.36
0.29	0.26	0.33	0.41	0.41	0.42	0.38
0.33	0.30	0.34	0.37	0.39	0.37	0.37
0.35	0.35	0.38	0.39	0.47	0.42	0.40
0.34	0.38	0.34	0.42	0.48	0.31	0.39
0.34	0.37	0.33	0.41	0.48	0.31	0.38
0.34	0.37	0.36	0.39	0.46	0.28	0.37
0.32	0.40	0.40	0.37	0.46	0.32	0.38
0.31	0.39	0.42	0.39	0.43	0.32	0.39
0.35	0.41	0.40	0.35	0.46	0.39	0.39
0.32	0.39	0.43	0.35	0.47	0.37	0.39
0.38	0.39	0.44	0.37	0.50	0.39	0.40
0.33	0.41	0.44	0.37	0.42	0.41	0.40
0.34	0.39	0.42	0.38	0.49	0.40	0.40
0.35	0.40	0.41	0.37	0.47	0.42	0.39
0.39	0.40	0.40	0.34	0.47	0.44	0.40
0.41	0.38	0.41	0.39	0.48	0.44	0.41
0.39	0.37	0.36	0.37	0.51	0.44	0.41
0.40	0.38	0.42	0.37	0.51	0.45	0.41
0.39	0.39	0.43	0.35	0.44	0.45	0.41
0.42	0.38	0.44	0.33	0.42	0.44	0.40

0.41	0.36	0.38	0.33	0.50	0.45	0.41
0.41	0.37	0.38	0.38	0.45	0.42	0.41
0.39	0.37	0.43	0.34	0.41	0.39	0.40
0.41	0.37	0.38	0.31	0.44	0.40	0.39
0.43	0.38	0.38	0.33	0.43	0.40	0.40
0.45	0.36	0.37	0.34	0.47	0.36	0.39
0.45	0.37	0.38	0.35	0.44	0.35	0.39
0.46	0.39	0.32	0.34	0.41	0.34	0.37
0.44	0.40	0.35	0.37	0.43	0.36	0.37
0.44	0.38	0.37	0.35	0.45	0.32	0.37
0.46	0.36	0.30	0.36	0.37	0.33	0.35
0.41	0.36	0.28	0.34	0.37	0.31	0.34
0.46	0.39	0.28	0.34	0.42	0.35	0.36
0.43	0.38	0.25	0.36	0.44	0.34	0.36
0.42	0.37	0.25	0.30	0.42	0.34	0.36
0.41	0.39	0.24	0.28	0.49	0.36	0.37
0.43	0.38	0.26	0.29	0.40	0.38	0.36
0.44	0.37	0.28	0.34	0.40	0.37	0.37
0.39	0.38	0.30	0.33	0.40	0.39	0.36
0.37	0.41	0.31	0.33	0.32	0.45	0.37
0.36	0.38	0.34	0.39	0.36	0.42	0.38
0.39	0.37	0.31	0.35	0.36	0.39	0.38
0.39	0.36	0.31	0.34	0.41	0.42	0.39
0.40	0.34	0.33	0.32	0.36	0.42	0.38
0.38	0.33	0.28	0.35	0.35	0.43	0.37
0.42	0.38	0.35	0.35	0.36	0.46	0.39
0.39	0.38	0.30	0.36	0.38	0.38	0.38
0.33	0.37	0.32	0.33	0.36	0.43	0.37
0.38	0.40	0.28	0.35	0.39	0.41	0.38
0.38	0.32	0.29	0.33	0.39	0.45	0.37
0.43	0.33	0.30	0.32	0.36	0.38	0.37
0.41	0.34	0.35	0.32	0.34	0.40	0.38
0.42	0.33	0.34	0.31	0.36	0.38	0.37
0.38	0.31	0.32	0.29	0.36	0.39	0.37
0.36	0.37	0.29	0.33	0.40	0.36	0.36
0.34	0.40	0.29	0.32	0.42	0.44	0.38
0.34	0.36	0.32	0.33	0.40	0.45	0.39
0.37	0.36	0.33	0.32	0.42	0.40	0.38
0.40	0.33	0.30	0.35	0.45	0.42	0.38
0.45	0.35	0.34	0.35	0.46	0.42	0.39
0.41	0.41	0.31	0.37	0.46	0.44	0.39
0.41	0.41	0.34	0.39	0.39	0.39	0.37
0.40	0.45	0.33	0.38	0.40	0.39	0.37
0.37	0.44	0.34	0.42	0.43	0.37	0.38
0.39	0.42	0.38	0.39	0.48	0.39	0.39
0.40	0.42	0.36	0.38	0.52	0.39	0.39
0.39	0.42	0.41	0.38	0.50	0.41	0.40
0.34	0.44	0.38	0.35	0.47	0.41	0.38
0.35	0.42	0.37	0.39	0.44	0.43	0.37
0.35	0.43	0.33	0.38	0.53	0.41	0.38
0.33	0.39	0.36	0.44	0.46	0.39	0.38
0.33	0.39	0.29	0.41	0.50	0.39	0.37

0.33	0.36	0.32	0.37	0.46	0.41	0.37
0.34	0.39	0.33	0.35	0.47	0.38	0.37
0.31	0.43	0.39	0.38	0.49	0.36	0.37
0.35	0.46	0.30	0.37	0.50	0.31	0.37
0.35	0.46	0.32	0.39	0.49	0.34	0.38
0.32	0.46	0.39	0.39	0.51	0.33	0.39
0.31	0.43	0.36	0.36	0.47	0.33	0.37
0.33	0.40	0.32	0.35	0.46	0.30	0.36
0.36	0.40	0.36	0.34	0.47	0.36	0.37
0.36	0.40	0.34	0.32	0.46	0.36	0.36
0.36	0.43	0.29	0.35	0.46	0.32	0.36
0.38	0.42	0.29	0.32	0.51	0.33	0.36
0.39	0.44	0.32	0.28	0.50	0.34	0.36
0.38	0.40	0.32	0.32	0.49	0.35	0.37
0.34	0.37	0.32	0.35	0.50	0.37	0.36
0.36	0.35	0.33	0.35	0.46	0.34	0.34
0.38	0.33	0.27		0.45	0.31	0.32
0.34	0.31	0.25		0.45	0.25	0.29
0.35	0.31	0.25		0.41	0.23	0.28
0.38	0.31	0.21		0.43	0.19	0.27
	0.29	0.20		0.39	0.14	0.23
	0.29	0.25		0.39	0.17	0.22
	0.30	0.21		0.31	0.18	0.21
	0.30	0.26		0.26		0.21
	0.28	0.22		0.23		0.18
	0.29	0.24		0.25		0.18
	0.26	0.23		0.25		0.25
	0.24	0.23		0.19		0.22
	0.24	0.17		0.18		0.19
	0.20	0.19		0.16		0.18
	0.19	0.20		0.17		0.19
	0.18	0.21				0.19
		0.21				0.21
		0.24				0.24
		0.22				0.22
		0.23				0.23
		0.27				0.27
		0.22				0.22
		0.20				0.20
		0.23				0.23
		0.17				0.17
		0.16				0.16
		0.15				0.15
		0.17				0.17
		0.16				0.16
		0.13				0.13
		0.18				0.18
		0.13				0.13
		0.11				0.11
		0.13				0.13
		0.11				0.11
		0.09				0.09

0.08 0.08

standard deviation	SJ1-3	SJ1-7	SJ1-10	SJ2-1	SJ2-2
	Sea of Harima	Sea of Harima	Sea of Harima	Sea of Harima	Sea of Harima
0.030			0.14		0.18
0.035			0.16		0.18
0.031			0.23		0.20
0.033			0.16		0.16
0.033			0.13		0.13
0.018		0.16	0.12		0.10
0.029		0.16	0.14		0.07
0.027		0.15	0.06		0.10
0.033		0.23	0.09		0.11
0.022		0.22	0.11		0.10
0.018			0.10		0.12
0.014			0.08		0.09
0.020			0.10		0.09
0.025			0.09		0.11
0.028			0.06		0.15
0.031			0.10	0.27	0.11
0.031		0.23	0.11	0.25	0.09
0.029		0.23	0.14	0.24	0.15
0.022		0.22	0.11	0.28	0.12
0.034		0.30	0.11	0.28	0.21
0.026	0.18		0.14	0.21	0.22
0.026	0.18		0.18	0.30	0.20
0.026	0.18		0.13	0.28	0.25
0.040	0.16		0.18	0.32	0.26
0.033	0.15	0.27	0.19	0.33	0.25
0.037	0.24	0.27	0.18	0.32	0.23
0.030	0.20	0.30	0.21	0.32	0.26
0.030	0.21	0.32	0.19	0.34	0.27
0.027	0.20	0.32	0.14	0.30	0.21
0.034	0.23	0.30	0.21	0.34	0.21
0.054	0.23	0.33	0.22	0.29	0.25
0.023	0.24	0.33	0.24	0.35	0.25
0.039	0.23	0.34	0.20	0.31	0.30
0.037	0.21	0.35	0.23	0.32	0.29
0.033	0.20	0.35	0.23	0.35	0.29
0.022	0.29	0.37	0.21	0.36	0.24
0.029	0.27	0.38	0.24	0.39	0.29
0.037	0.30	0.38	0.22	0.35	0.30
0.037	0.28	0.37	0.29	0.37	0.32
0.033	0.32	0.37	0.23	0.27	0.32
0.027	0.27	0.37	0.24	0.35	0.37
0.029	0.32	0.38	0.32	0.32	0.36
0.037	0.27	0.38	0.31	0.29	0.32
0.036	0.28	0.39	0.29	0.29	0.34
0.033	0.31	0.36	0.31	0.33	0.32
0.038	0.29	0.34	0.30	0.29	0.33

0.034	0.37	0.35	0.29	0.30	0.30
0.047	0.38	0.36	0.25	0.38	0.33
0.043	0.33	0.32	0.29	0.33	0.38
0.032	0.33	0.37	0.30	0.28	0.36
0.043	0.35	0.37	0.27	0.43	0.34
0.035	0.32	0.46	0.28	0.29	0.38
0.053	0.31	0.32	0.27	0.45	0.25
0.053	0.32	0.37	0.27	0.34	0.37
0.038	0.38	0.37	0.30	0.35	0.30
0.040	0.33	0.39	0.30	0.41	0.38
0.050	0.38	0.43	0.30	0.35	0.40
0.041	0.38	0.37	0.28	0.37	0.32
0.032	0.33	0.37	0.32	0.40	0.36
0.045	0.42	0.38	0.31	0.37	0.38
0.042	0.38	0.36	0.35	0.33	0.38
0.042	0.39	0.40	0.29	0.35	0.35
0.039	0.30	0.43	0.28	0.35	0.42
0.034	0.37	0.46	0.28	0.37	0.36
0.043	0.41	0.37	0.30	0.32	0.36
0.045	0.36	0.41	0.30	0.31	0.36
0.040	0.39	0.43	0.31	0.34	0.39
0.034	0.34	0.38	0.33	0.34	0.35
0.028	0.42	0.45	0.31	0.33	0.36
0.041	0.39	0.40	0.32	0.36	0.34
0.046	0.37	0.36	0.33	0.37	0.38
0.053	0.38	0.36	0.33	0.37	0.35
0.054	0.45	0.40	0.33	0.30	0.35
0.050	0.33	0.38	0.30	0.33	0.33
0.106	0.39	0.37	0.33	0.27	0.38
0.095	0.37	0.39	0.32	0.39	0.35
0.071	0.40	0.38	0.34	0.29	0.34
0.044	0.39	0.31	0.31	0.32	0.37
0.060	0.35	0.38	0.35	0.32	0.34
0.035	0.41	0.36	0.32	0.29	0.34
0.041	0.34	0.38	0.34	0.32	0.39
0.057	0.37	0.34	0.32	0.28	0.34
0.051	0.35	0.33	0.34	0.25	0.36
0.048	0.36	0.32	0.35	0.26	0.37
0.040	0.36	0.31	0.30	0.18	0.31
0.046	0.36	0.32	0.45	0.23	0.30
0.034	0.40	0.23	0.32	0.33	0.37
0.045	0.38	0.26	0.29	0.27	0.38
0.042	0.37	0.21	0.33	0.32	0.32
0.034	0.36	0.16	0.32	0.32	0.32
0.045	0.38	0.21	0.35	0.31	0.35
0.047	0.35	0.19	0.29	0.31	0.35
0.045	0.34	0.18	0.34	0.31	0.34
0.041	0.33	0.20	0.34	0.33	0.33
0.050	0.43	0.25	0.32	0.29	0.36
0.041	0.37	0.26	0.33	0.28	0.34
0.032	0.34	0.24	0.35	0.29	0.34
0.045	0.41	0.20	0.33	0.35	0.37

0.055	0.41	0.23	0.34	0.34	0.33
0.038	0.39	0.20	0.33	0.34	0.36
0.041	0.34	0.21	0.30	0.32	0.35
0.041	0.34	0.24	0.33	0.29	0.36
0.039	0.37	0.24	0.36	0.27	0.35
0.049	0.43	0.27	0.32	0.24	0.36
0.046	0.35	0.24	0.35	0.33	0.36
0.048	0.36	0.27	0.31	0.19	0.31
0.047	0.36	0.27	0.35	0.31	0.39
0.056	0.40	0.30	0.32	0.34	0.36
0.069	0.41	0.27	0.39	0.36	0.36
0.052	0.43	0.35	0.29	0.42	0.37
0.060	0.34	0.38	0.35	0.36	0.37
0.056	0.46	0.39	0.37	0.40	0.41
0.060	0.39	0.43	0.34	0.45	0.38
0.073	0.34	0.39	0.35	0.46	0.41
0.054	0.46	0.38	0.31	0.42	0.37
0.049	0.37	0.40	0.38	0.46	0.39
0.051	0.43	0.39	0.31	0.47	0.37
0.059	0.38	0.37	0.35	0.45	0.35
0.039	0.36	0.40	0.40	0.41	0.42
0.041	0.44		0.35	0.37	0.35
0.042	0.37		0.37	0.34	0.40
0.045	0.40		0.32	0.25	0.39
0.049	0.48		0.36	0.26	0.37
0.043	0.36		0.29	0.17	0.40
0.037	0.41		0.38	0.23	0.38
0.039	0.39		0.38	0.20	0.41
0.049	0.24		0.39	0.18	0.39
0.050	0.26		0.38		0.38
0.050	0.23		0.39		0.37
0.045	0.24	0.43	0.39		0.33
0.041	0.37	0.30	0.37		0.39
0.048	0.41	0.43	0.36		0.44
0.041	0.36	0.38	0.39		0.35
0.049	0.36	0.39	0.38		0.36
0.048	0.28	0.40	0.41		0.25
0.040		0.39	0.37		0.25
0.046		0.54			0.24
0.046		0.41			0.24
0.049		0.46			0.16
0.037		0.44			0.21
0.054		0.45			
0.046		0.46			
0.046		0.37			
0.052		0.37			
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Sepiella japonica

SJ2-3 Sea of Harima	SJ2-4 Sea of Harima	SJ2-5 Sea of Harima	SJ2-6 Sea of Harima	SJ2-7 Sea of Harima	SJ2-9 Sea of Harima	average
0.28	0.15	0.30	0.17	0.17	0.17	0.19
0.23	0.12	0.31	0.22	0.14	0.17	0.19
0.24	0.11	0.10	0.16	0.20	0.18	0.18
0.21	0.08	0.17	0.18	0.22	0.15	0.17
0.16	0.10	0.19	0.17	0.12	0.15	0.14
0.13	0.06	0.28	0.15	0.11	0.07	0.13
0.09	0.09	0.11	0.13	0.11	0.02	0.10
0.05	0.11	0.12	0.10	0.09	0.08	0.09
0.10	0.12	0.17	0.08	0.08	0.10	0.12
0.14	0.22	0.16	0.07	0.11	0.09	0.14
0.17	0.20	0.11	0.10	0.13	0.09	0.13
0.14	0.19	0.11	0.10	0.13	0.10	0.12
0.15	0.19	0.14	0.08	0.18	0.06	0.12
0.17	0.22	0.17	0.17	0.19	0.08	0.15
0.15	0.22	0.19	0.12	0.16	0.08	0.14
0.19	0.20	0.18	0.16	0.09	0.08	0.15
0.20	0.20	0.18	0.21	0.11	0.13	0.17
0.24	0.22	0.14	0.14	0.25	0.09	0.18
0.20	0.21	0.17	0.19	0.16	0.16	0.18
0.25	0.22	0.25	0.15	0.16	0.10	0.20
0.22	0.26	0.25	0.19	0.19	0.16	0.20
0.22	0.18	0.25	0.16	0.19	0.18	0.20
0.27	0.22	0.23	0.20	0.21	0.14	0.21
0.25	0.17	0.19	0.20	0.19	0.19	0.21
0.21	0.21	0.26	0.22	0.22	0.17	0.22
0.31	0.27	0.24	0.23	0.23	0.17	0.24
0.25	0.24	0.28	0.19	0.24	0.12	0.24
0.31	0.21	0.21	0.30	0.24	0.17	0.25
0.27	0.26	0.25	0.21	0.21	0.18	0.23
0.30	0.32	0.26	0.22	0.23	0.18	0.25
0.29	0.24	0.28	0.22	0.23	0.17	0.25
0.34	0.32	0.32	0.24	0.28	0.18	0.28
0.30	0.29	0.31	0.26	0.24	0.23	0.27
0.31	0.38	0.31	0.23	0.24	0.23	0.28
0.32	0.37	0.31	0.25	0.27	0.24	0.29
0.35	0.36	0.34	0.25	0.33	0.20	0.30
0.34	0.34	0.34	0.26	0.25	0.27	0.31
0.34	0.36	0.32	0.25	0.32	0.26	0.31
0.37	0.32	0.34	0.26	0.29	0.16	0.31
0.32	0.36	0.33	0.26	0.32	0.18	0.30
0.39	0.35	0.32	0.26	0.31	0.26	0.32
0.34	0.31	0.36	0.28	0.31	0.30	0.33
0.39	0.36	0.33	0.34	0.36	0.24	0.33
0.35	0.36	0.32	0.31	0.31	0.29	0.32
0.35	0.35	0.34	0.31	0.31	0.25	0.32
0.37	0.32	0.34	0.29	0.32	0.30	0.32

0.39	0.38	0.32	0.33	0.36	0.28	0.33
0.32	0.38	0.37	0.31	0.35	0.31	0.34
0.42	0.35	0.32	0.25	0.36	0.30	0.33
0.34	0.38	0.32	0.32	0.30	0.31	0.33
0.34	0.38	0.33	0.31	0.31	0.30	0.34
0.34	0.36	0.36	0.33	0.33	0.31	0.34
0.36	0.35	0.33	0.29	0.31	0.32	0.32
0.33	0.40	0.31	0.34	0.36	0.26	0.33
0.42	0.37	0.29	0.36	0.37	0.31	0.35
0.41	0.36	0.34	0.32	0.35	0.31	0.35
0.34	0.34	0.35	0.35	0.36	0.27	0.35
0.41	0.35	0.37	0.36	0.34	0.35	0.35
0.34	0.33	0.29	0.36	0.36	0.32	0.34
0.38	0.37	0.34	0.34	0.34	0.29	0.36
0.38	0.42	0.31	0.35	0.32	0.30	0.35
0.33	0.36	0.30	0.28	0.32	0.32	0.34
0.38	0.39	0.34	0.34	0.30	0.32	0.35
0.39	0.33	0.30	0.35	0.38	0.32	0.35
0.40	0.37	0.32	0.32	0.38	0.34	0.35
0.36	0.18	0.33	0.34	0.30	0.27	0.32
0.34	0.24	0.30	0.31	0.39	0.26	0.34
0.39	0.27	0.30	0.35	0.33	0.29	0.33
0.44	0.32	0.34	0.37	0.35	0.29	0.36
0.37	0.35	0.38	0.31	0.35	0.30	0.35
0.38	0.38	0.26	0.33	0.37	0.31	0.35
0.39	0.35	0.34	0.32	0.36	0.32	0.35
0.37	0.38	0.35	0.32	0.43	0.31	0.36
0.35	0.38	0.33	0.32	0.34	0.30	0.34
0.39	0.37	0.31	0.34	0.43	0.27	0.35
0.33	0.43	0.29	0.35	0.36	0.32	0.36
0.37	0.36	0.31	0.34	0.35	0.30	0.34
0.34	0.40	0.29	0.33	0.35	0.34	0.34
0.34	0.38	0.28	0.40	0.36	0.28	0.34
0.35	0.39	0.24	0.31	0.41	0.30	0.34
0.38	0.41	0.27	0.38	0.36	0.30	0.35
0.33	0.45	0.25	0.36	0.38	0.30	0.34
0.33	0.43	0.23	0.35	0.37	0.32	0.33
0.35	0.39	0.20	0.37	0.39	0.28	0.33
0.33	0.40	0.32	0.37	0.32	0.33	0.32
0.28	0.40	0.24	0.35	0.32	0.29	0.32
0.30	0.39	0.26	0.37	0.34	0.35	0.33
0.33	0.40	0.25	0.34	0.33	0.33	0.32
0.39	0.40	0.29	0.36	0.30	0.32	0.33
0.36	0.40	0.28	0.35	0.30	0.33	0.32
0.33	0.41	0.29	0.36	0.25	0.30	0.32
0.39	0.41	0.31	0.35	0.26	0.37	0.33
0.32	0.41	0.34	0.35	0.25	0.30	0.32
0.35	0.43	0.31	0.35	0.25	0.31	0.32
0.33	0.44	0.33	0.34	0.22	0.35	0.33
0.32	0.45	0.33	0.39	0.24	0.29	0.33
0.39	0.44	0.28	0.35	0.22	0.31	0.32
0.28	0.45	0.24	0.36	0.17	0.31	0.31

0.43	0.45	0.32	0.38	0.20	0.33	0.34
0.31	0.45	0.25	0.36	0.23	0.32	0.32
0.35	0.48	0.26	0.38	0.25	0.33	0.32
0.41	0.48	0.30	0.35	0.27	0.33	0.34
0.39	0.46	0.29	0.36	0.28	0.30	0.33
0.30	0.46	0.28	0.40	0.25	0.35	0.33
0.37	0.44	0.30	0.37	0.27	0.33	0.34
0.37	0.35	0.39	0.34	0.27	0.35	0.32
0.34	0.35	0.34	0.41	0.31	0.33	0.34
0.34	0.27	0.35	0.39	0.31	0.36	0.34
0.37	0.23	0.35	0.39	0.24	0.30	0.33
0.36	0.25	0.35	0.39	0.26	0.36	0.35
0.36	0.24	0.35	0.39	0.31	0.37	0.35
0.40	0.21	0.37	0.40	0.29	0.33	0.37
0.31	0.18	0.32	0.37	0.31	0.34	0.35
0.36	0.23	0.34	0.34	0.34	0.40	0.36
0.32	0.08	0.33	0.42	0.26	0.36	0.34
0.31	0.12	0.34	0.37	0.29	0.39	0.35
0.33		0.35	0.40	0.31	0.35	0.37
0.31		0.35	0.39	0.30	0.38	0.36
0.27		0.42	0.39	0.39	0.39	0.38
0.26		0.38	0.37	0.31	0.38	0.36
0.25		0.38	0.37	0.30	0.34	0.35
0.28		0.48	0.42	0.30	0.43	0.36
0.21		0.45	0.36	0.29	0.39	0.35
0.21		0.41	0.44	0.25	0.39	0.32
0.22		0.41	0.44	0.19	0.36	0.34
0.19		0.37	0.40	0.26	0.33	0.32
0.19		0.41	0.43	0.35	0.38	0.33
0.21		0.41	0.38	0.29	0.37	0.33
0.20		0.44	0.43	0.32	0.37	0.35
0.18		0.42	0.40	0.33	0.43	0.35
0.17		0.43	0.44	0.36	0.39	0.36
0.16		0.41	0.39	0.34	0.44	0.38
0.19		0.41	0.48	0.37	0.37	0.37
0.21		0.41	0.44	0.38	0.38	0.37
0.19		0.32	0.45	0.30	0.37	0.33
0.09		0.26	0.35	0.36	0.35	0.30
0.20		0.23	0.35	0.42	0.31	0.33
0.27		0.31	0.30	0.43	0.28	0.32
0.19		0.39	0.27	0.38	0.27	0.30
0.28		0.38	0.22	0.43	0.25	0.32
0.25		0.34	0.27	0.48	0.21	0.33
0.23		0.30		0.46	0.28	0.35
0.16		0.16		0.45		0.29
				0.47		0.42
				0.48		0.39
				0.31		0.29
				0.37		0.37
				0.26		0.26
				0.19		0.19

standard deviation
0.056
0.059
0.047
0.041
0.028
0.061
0.040
0.030
0.046
0.052
0.035
0.032
0.045
0.049
0.049
0.060
0.053
0.055
0.048
0.066
0.036
0.040
0.049
0.046
0.046
0.045
0.053
0.056
0.051
0.050
0.043
0.053
0.042
0.053
0.055
0.061
0.049
0.047
0.059
0.056
0.051
0.028
0.045
0.033
0.029
0.025

0.037
0.038
0.044
0.031
0.042
0.048
0.050
0.041
0.038
0.037
0.043
0.031
0.029
0.036
0.035
0.037
0.048
0.048
0.033
0.056
0.058
0.034
0.049
0.030
0.036
0.022
0.048
0.025
0.050
0.037
0.030
0.034
0.035
0.051
0.040
0.051
0.051
0.058
0.053
0.063
0.053
0.050
0.051
0.059
0.055
0.060
0.058
0.055
0.063
0.057
0.061
0.083

0.074
0.070
0.070
0.064
0.060
0.070
0.052
0.054
0.037
0.037
0.060
0.058
0.039
0.065
0.069
0.055
0.098
0.085
0.049
0.041
0.042
0.048
0.045
0.072
0.081
0.093
0.089
0.081
0.093
0.067
0.082
0.084
0.077
0.084
0.073
0.060
0.078
0.094
0.111
0.066
0.103
0.092
0.099
0.097
0.130
0.050
0.099
0.027