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Mass stranding of cuttlebones of *Sepia orbignyana* Férussac, 1826, on Texel, the Netherlands, in July 2002 (Cephalopoda, Decapoda, Sepiidae)

Gerhard C. CADÉE

Netherlands Institute for Sea Research (NIOZ), P.O. Box 59, NL 1790 AB Den Burg, The Netherlands;
cadee@nioz.nl

A mass stranding of hundreds of cuttlebones of *Sepia orbignyana* occurred on the coast of Texel, the Netherlands, in July 2002. Up to now usually only low numbers were found on the Dutch coast. *S. orbignyana* does not live in the North Sea. Accompanying drift material such as thong weed *Himanthalia elongata* indicates a SW origin from the Channel and skeletons of the By-the-wind-sailor *Velella velella* (Cnidaria, Hydrozoa, Chondrophora) may even indicate an origin from as far as the Bay of Biscay. Drift-bottle experiments in the past have indicated that it takes at least one to two months to drift from the entrance of the Channel near Plymouth to the Dutch coast. A large proportion of the cuttlebones (65%) showed peck marks by fulmars and 55% had scratch marks probably also made by birds supporting a drifting time of this length.

Key words: Cephalopoda, *Sepia orbignyana*, mass stranding, North Sea, The Netherlands.

INTRODUCTION

Shells of the most common North Sea cuttlefish, *Sepia officinalis* L., 1758, often wash ashore in large numbers together; thousands may be found on the beach in the summer of some years (Altena, 1937; Lacourt, 1957b; Lacourt & Huwae, 1981; Cadée, 1997a,b). The same occurs along the German North Sea coast (Grimpe, 1925; Schäfer, 1964). Such mass strandings are partly related to the fact that after spawning, in the summer of their second year, most female *S. officinalis* die. Lower numbers of two less common species, viz. *S. elegans* Orbigny, 1839, and *S. orbignyana* Férussac, 1826, are reported from the Dutch coast and *S. orbignyana* is the least frequent according to Altena (1937) and Lacourt (1957a), who summarised the older data for these species. It was therefore a great surprise to find hundreds of *S. orbignyana* cuttlebones washed ashore on Texel between 8 and 12 July 2002. This note reports on this mass stranding.

OBSERVATIONS

A three km length of beach in the southern part of Texel between Hoornderslag and de Hors – an area less frequented by tourists – was selected to collect and count all *S. orbignyana* cuttlebones stranded on four different days between 8 and 12 July. In total I picked up c. 600 specimens selecting only intact or almost intact cuttlebones. The intact specimens (240) enabled measurements to be taken to the nearest 0.1 mm of length (including the spine) and width (of the calcareous body of the cuttlebone, discarding the horny margins) using a vernier caliper. The length ranged from 24.0 to 117.5 mm.

Length and width were correlated (r = 0.974, p <0.0001, fig. 1). I measured only the width of 265 of the incomplete specimens in which length could not be measured. Histograms of length and width distribution could be constructed (figs. 2 and 3). Both histograms clearly show a bimodal distribution with an 'adult' peak between 100 and 110 mm length and 29 to 32 mm width and a 'juvenile' peak at 50 to 60 mm length and 14 to 17 mm width.

No new *S. orbignyana* shells washed ashore after the 12th of July because the wind direction changed for some time to the east. During a new period of westerly winds at the end of July, however, *S. orbignyana* shells again washed ashore: 78 fresh shells were collected on the 26th of July (intact and broken but larger than half cuttlebones; smaller fragments were discarded), on the same part of the beach visited between 8 and 12 July.

The mass stranding was preceded and accompanied by numerous shells of *S. officinalis* of which I collected the first washed ashore on the southern part of Texel on the 4th of July. Altena (1937) observed a similar sequence in 1924. During the mass stranding of *S. orbignyana* shells those of *S. officinalis* remained more numerous: on the 9th of July I counted 127 shells of *S. officinalis* against 43 of *S. orbignyana* in fresh drift along part of the beach.

The large sample made it possible to quantify the occurrence of epiphytes and epizoa, as well as the damage by birds exemplified by peck marks, as has been reported earlier for cuttlebones of *Sepia officinalis* washed ashore on Texel (Cadée, 1997 a,b). Remarkable was the almost absence of epizoa on *S. orbignyana* shells: two small barnacles (1 mm length, *Elminius modestus* Darwin, 1851) were found only on one specimen out of the 310 studied for this purpose (all the 240 intact specimens and 70 randomly selected incomplete specimens). Green algae (*Enteromorpha* sp.) occurred on 70% of the cuttlebones, peck marks by birds (fig. 4) on 65% and rectilinear scratches (fig. 5) of unknown origin but probably also by birds on 55%.

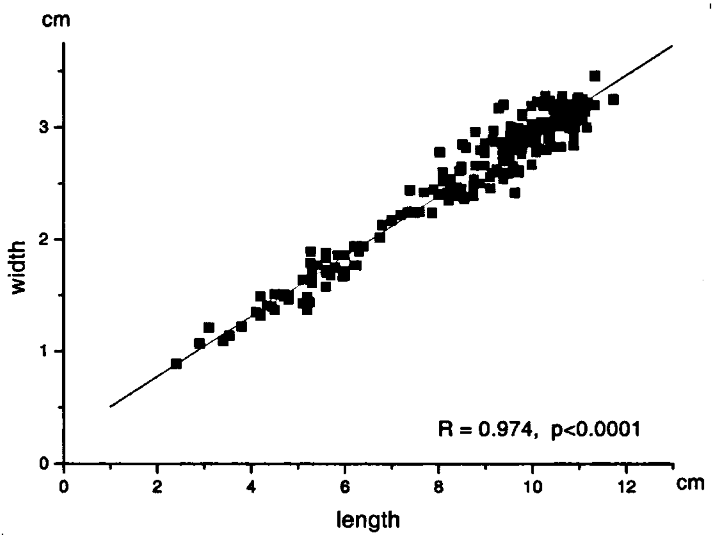

Fig. 1. Length/width ratio of 240 *Sepia orbignyana* shells from Texel, collected 8-12 July 2002.

DISCUSSION

Earlier Dutch reports

Unfortunately, the older records of *S. orbignyana* not always give exact numbers of cuttlebones found on the beach, particularly when the numbers are somewhat higher, they often state simply 'many', whereas we now usually try to count numbers per length unit of beach. Nevertheless, from the records it appears that *S. orbignyana* and *S. elegans* cuttlebones often wash ashore together and in general *S. orbignyana* is the least common of the two (Altena, 1937; Lacourt, 1957a). The largest numbers of *S. orbignyana* given by Altena (1937) are 30 for Egmond aan Zee (3 and 4 August 1924) and once 'many' also in 1924 on the 26th of July at Scheveningen. Since 1936 many records are assembled in the "Centraal Systeem" (CS) of the "Strandwerkgroep" (SWG) of which the most important records are published regularly in Het Zeepaard. Lacourt (1957a, 1963) has published on these data and Dr. P. de Wolf (NIOZ) has assembled all available data from the second half of the 19th century (published in Altena, 1937) to 2001 (CS-SWG). Tom Meijer collected up to now the highest number of *S. orbignyana* on the Dutch coast on one day (84 specimens in 1964, CS-SWG, pers. comm. P. de Wolf, 2002). This makes our observation of 600 specimens per 3 km beach indeed exceptional. Moreover, we also observed *S. orbignyana* cuttlebones on the beach near the northern part of Texel in the same period. This indicates that they washed ashore along the whole length of the ca 30 km North Sea coast of Texel, and the total amount stranded in July 2002 on Texel alone must have been thousands.

We did not find one shell of *S. elegans* in our rich material, although both Altena (1937) and Lacourt (1957) conclude that shells of *S. orbignyana* and *S. elegans* wash ashore in low numbers but often together, with *S. elegans* being the most abundant. According to Hayward et al. (1996) *S. orbignyana* is rare off SW Britain, *S. elegans* is uncommon in coastal waters of W Britain. So *S. orbignyana* lives farther to the SW than *S. elegans*. Hayward & Ryland (1995) do not even mention *S. orbignyana*. As the cuttlebones washed ashore in 2002 together with skeletons of *Velella velella* (L., 1758) (Cnidaria, Hydrozoa, Chondrophora) (Cadée & Cadée - Coenen, 2002), which is an open-ocean warm-water surface drifter, this indicates that the material washed ashore on Texel had at least partly an open ocean origin. The shells of *S. orbignyana* must have drifted for weeks.

Peck marks

The triangular peck marks were similar to those observed earlier on cuttlebones of *S. officinalis*; they are made at sea by northern fulmars, *Fulmarus glacialis glacialis* (L., 1758), as indicated by the peculiar triangular shape of the marks (Cadée, 1997a). I do not agree with Brown et al. (1987: p. 77) who describe comparable triangular peck marks in cuttlebones as due to common gulls. Fulmars might use the calcareous matter of the cuttlebones, but more probable they simply peck at all floating objects, ingesting the smaller floating particles, including indigestable plastics (Van Franeker & Meijboom, 2002) and pecking at the larger particles such as cuttlebones and styrofoam and other spongy plastics (Cadée, 2002).

The rectilinear scratches are probably also made by birds. My hypothesis is that some birds take the cuttlebones transverse in their bill, the scratches being due to the beak

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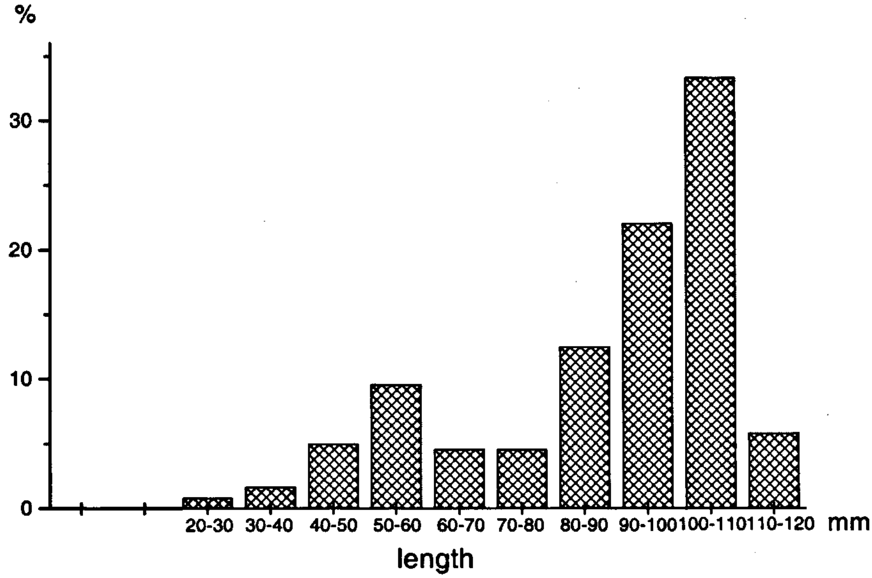

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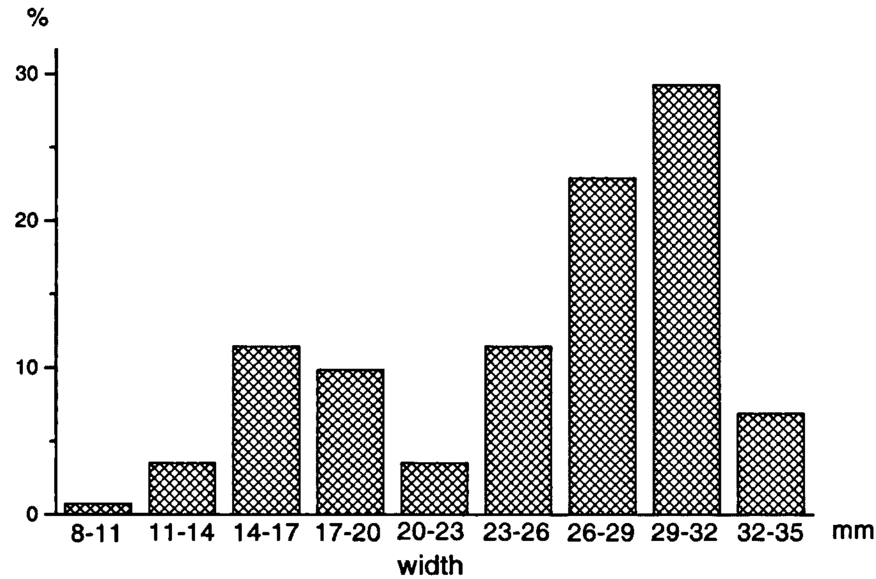

Figs 2-3. Size-frequency distributions of *Sepia orbignyana* shells from Texel collected 8-12 July 2002. 2, length (in 10-mm classes) of 240 shells; 3, width of 505 shells (in 3-mm classes).

margins. They occur in particular on the convex centre part of the shells, which supports this hypothesis. I have no direct observations, however, Herring gulls do transport *Ensis directus* (Conrad, 1845) also transverse in their bill (Cadée, 2000), which suggests gulls might pick up cuttlebones of comparable shape and size in a similar way.

Origin of the cuttlebones

Together with the shells of this warm and relatively deep water *S. orbignyana* (down to 450 m and avoiding shallow coastal waters according to Mangold-Wirz, 1963) thong weed *Himanthalia elongata* (L.) S.F. Gray washed ashore, which indicates a southern origin of the drift, as the nearest place where this alga grows is the English Channel west of the line Wight – Cotentin (Den Hartog, 1959). Also hundreds of skeletons of the warm-water open-ocean By-the-wind-sailor *Velella velella*, on which we reported elsewhere (Cadée & Cadée - Coenen, 2002), were washed ashore. These species together are a certain indication of a south-western provenance of the drift. For *Velella* this is only the second year it was reported from the Dutch coast, the first year being 1987 (M.C. Cadée, 1987; Rappé, 1988), another indication that this drift material was exceptional.

Already more than 100 years ago Garstang (1898) experimented with drift-bottles thrown in the sea at Eddystone near Plymouth and observed that most travelled east with the residual current and faster with strong SW wind. Carruthers (1925a, 1930) extended these drift-bottle experiments to the English Channel (see summaries in: Carruthers, 1925b; Den Hartog, 1959; Cadée, 2001). Most drift bottles drifted with the prevailing residual current to the NE and, if not stranded on the French or English coast, passed the Dover Straits into the North Sea, where they washed ashore on the Dutch coast (some on Texel) or even travelled as far as Denmark and Norway. Hydrographic drift-bottles, usually of glass and carefully weighted with sand to drift just under the water surface in order to diminish the influence of the wind, could travel up to 6 miles per day in NE direction. Plastic bottles, now used by many amateurs for sending messages by sea, travel faster than these hydrographic bottles because they are lighter and more influenced by the wind as they drift with 80-90% above the water surface (Cadée, 2001). Cuttlebones as drifters will be more comparable to the hydrographic drift-bottles than to plastic bottles. From these drift-bottle experiments we may conclude that the cuttlebones under a favourable SW tailwind can reach Texel from the entrance of the English Channel in one to two months

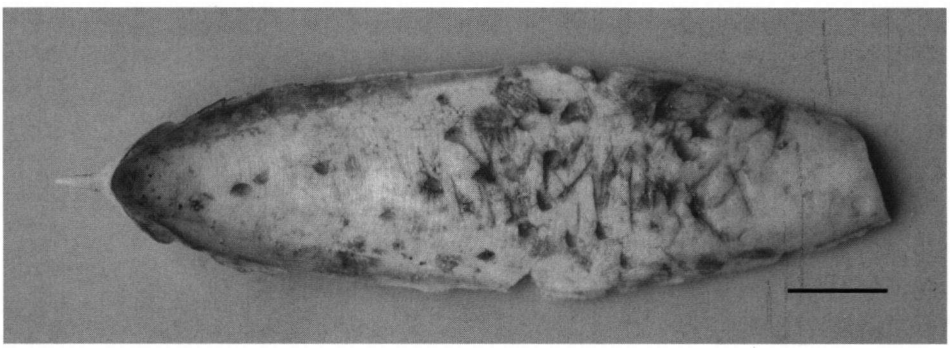

Fig. 4. A shell of *Sepia orbignyana* with many peck marks by fulmars and rectilinear scratches probably also due to birds. Scale bar 1 cm.

The near absence of barnacles growing on the cuttlebones seems to contradict a drifting time of one to two months for the cuttlebones, but we have to keep in mind that the amount of barnacle larvae in open sea will be small and as a consequence the chance of encounters between barnacle larvae and *S. orbignyana* cuttlebones will be very low. The epigrowth of green algae might have been picked up when they entered coastal waters. The high proportion of cuttlebones with peck marks (by fulmars) better supports a drifting time of one to two months. In the last century fulmars have increased their breeding range regularly to the south (Fischer, 1952) and they breed now all around the British Isles as well as in Normandy and Brittany in France (Harrison, 1983); they are typically foraging offshore all over the North Atlantic down to 40° N (Fischer, 1952).

Size distribution

S. orbignyana reaches probably a maximum age of 1.5 year; according to Mangold-Wirz (1963), females grow to a larger body size (120 mm) than males (96 mm). Bello & Piscitelli (2000) and Bello (2001) relate this sexual dimorphism to a greater feeding efficiency in females. Bello (2001) counted the number of cuttlebone chambers (or septa) as an indication of their age. The maximum number of septa Bello measured in adult *S. orbignyana* was around 100. A comparable number of septa I counted in the larger cuttlebones from Texel. The peak in the histograms of fig. 1 refers therefore to adult *S. orbignyana*, that apparently died after mating as occurs in the related *Sepia officinalis*. However, as *S. orbignyana* is a deeper water species depositing (at least in the Mediterranean Sea) its eggs on sponges at a depth of 80 to 130 m (Mangold-Wirz, 1963), its life-cycle is less well known.

Fig. 5. Shells of *Sepia orbignyana* with mainly rectilinear scratches probably also due to birds. Scale bar 1 cm.

Cuttlebones of juvenile *S. orbignyana* were not observed earlier on the Dutch coast according to Lacourt (1957a, 1963). The 'juvenile' peak in our histograms clearly indicates their presence in our material from Texel, making this probably the first Dutch record of cuttlebones of juvenile *S. orbignyana.*

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