

THE SEPIIDAE (CEPHALOPODA, DECAPODA) IN THE COLLECTIONS OF THE WESTERN AUSTRALIAN MUSEUM

W. ADAM*

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ABSTRACT

In the present paper the following sixteen species of Sepiidae in the collections of the Western Australian Museum are described in detail from Western Australian localities: *Sepia apama* Gray, 1849 (♂, ♀, shell), *S. chirotrema* Berry, 1918 (♂, ♀, shell), *S. novaehollandiae* Hoyle, 1909 (♂, ♀, shell), *S. irvingi* Meyer, 1909 (♂, ♀, shell), *S. cultrata* Hoyle, 1885 (shell), *S. elliptica* Hoyle, 1885 (♂, ♀, shell), *S. smithi* Hoyle, 1885 (♂, shell), *S. papuensis* Hoyle, 1885 (♂, ♀, shell), *S. pharaonis* Ehrenberg, 1831 (♂, ♀, shell), *S. rex* (Iredale, 1926) (♂, ♀, shell), *S. rozella* (Iredale, 1926) (shell), *S. braggi* Verco, 1907 (♂, ♀, shell), *S. vercoi* sp. nov. (♂, shell), *S. cottoni* sp. nov. (♂, ♀, shell), *S. reesi* sp. nov. (shell), *Sepia* (*Metasepia*) *pfefferi* Hoyle, 1885 (♀, shell).

In a supplementary note, three species are described from non-Western Australian localities: *Sepia mestus* Gray, 1849 (shell), *S. plangon* Gray, 1849 (shell), *S. bandensis* Adam, 1939 (♂, ♀, shell).

INTRODUCTION

In their review of the cephalopod family Sepiidae, Adam & Rees (1966) discussed all the known species of this family. Unfortunately material of most of the numerous described Australian species was lacking and these species could not be studied in detail.

Of the majority of the Australian species of *Sepia* only the shells have been described, although Iredale (1926, p. 188) stated that he had examined the animals of half of the species represented in the Australian fauna and

* Institut royal des Sciences naturelles de Belgique, 31, rue Vautier, B-1040 Bruxelles.

that he proposed to describe them in his larger essay; the latter was never published.

The present study proves once again that in many cases it is absolutely necessary to study the animals and the shells for the identification of the species.

The geographical distribution given for each species is based on the collected animals and cuttlebones. As the latter may be transported by sea currents over great distances, their presence in a certain locality is no reliable indication that the animal really inhabits this region. As the majority of the references for the Australian fauna are based on the cuttlebones, the geographical distribution given in this paper has only a very limited significance.

ABBREVIATIONS

A.L.I.	length of dorsal arms (measured from the first proximal sucker to the distal arm tip)	M.L.d.	dorsal length of mantle
		M.L.v.	ventral length of mantle
		M.Th.	thickness of mantle
A.L.II	length of dorso-lateral arms	M.W.	width of mantle
		N.S.W.	New South Wales
A.L.III	length of ventro-lateral arms	N.T.	Northern Territory
		Qld	Queensland
A.L.IV	length of ventral arms	S.a.	diameter of arm suckers
F.L.	length of fins	S.A.	South Australia
fms	fathoms	spec.	specimen
F.W.	width of fins	S.t.	diameter of tentacular suckers
H.L.	length of head	Str.z.	length of striated zone
H.W.	width of head	T.cl.	length of tentacular club
juv.	juvenile	T.L.	total length of tentacle
L.	length	W.A.	Western Australia
Loc.	locality	WAM	Western Australian Museum
m	metres		

DESCRIPTION OF SPECIES

SEPIA APAMA GRAY, 1849

(Plate 9, Fig. 1)

Sepia apama Gray, J.E., 1849: 103

Tryon, G.W., 1879: 194

McCoy, F., 1888: 325-327, pls 188-190

Whitelegge, Th., 1889: 282

Brazier, J., 1892: 11

Chapman, F., 1912: 23, pl. I

Suter, H., 1913: 1058, pls 67, 68, 69, fig. 1a

Hedley, Ch., 1918: M33

Adam, W., 1939: 51

MacPherson, H.J. & Chapple, E.H., 1951: 156

Adam, W. & Rees, W.J., 1966: 34, pl. 12, figs 64-67; pl. 45, fig. 269

Lophosepion apama Rochebrune, A.T. de, 1884: 92

Adam, W., 1944: 225

?*Amplisepia verreauxi* (non Rochebrune, 1884) Iredale, T., 1926: 194, pl. XXIII, fig. 1-2; 1954: 70

Iredale, T. & McMichael, D.F., 1962: 98

Amplisepia apama Iredale, T., 1926: 194; 1954: 70

Verco, J.C. & Cotton, B.C., 1928: 127

Cotton, B.C., 1929: 90; 1931: 40, fig. 2

MacPherson, J.H. & Gabriel, J.C., 1962: 408, fig. 478

MacPherson, J.H., 1966: 239

Sepia (Amplisepia) apama Cotton, B.C. & Godfrey, F.K., 1940: 431, fig. 419, 420

?*Sepia palmata* Owen, R., 1881: 134, pls. XXIV-XXV

Brazier, J., 1892: 13

Adam, W., 1939: 52

?*Amplisepia palmata* Iredale, T., 1954: 71

?*Amplisepia parysatis* Iredale, T., 1954: 71, pl. IV, fig. 1-2

Sepia sp. b. Voss, G.L., 1962: 3

Type localities

Port Adelaide (*S. apama*); Sydney (*A. verreauxi* Iredale, non Rochebrune)
Norfolk Island (*S. palmata*); Shark Bay (*A. parysatis*).

Distribution

Southern Australia to at least as far north as Ningaloo (Point Cloates) in
Western Australia and Port Jackson in New South Wales; Norfolk Island;
? New Zealand.

MATERIAL

Spirit specimens

- 1 Safety Bay, W.A.; October 1937; WAM 310-37: 1 ♂
- 2 Cape Peron, W.A. (32°16'S, 115°43'E); November 1954; WAM 400-54: 1 ♂ (M.L.d. approx. 158 mm)
- 3 Armstrong Pt, Rottnest I., W.A., deep rock pools open to sea at low tide; March 1958; WAM 423-65: 1 juv. spec. (Plate 9, Fig. 1)
- 4 Quindalup, Geographe Bay, W.A.; March 1972; WAM 861-75: 1 ♀
- 5 Ningaloo Station, S of North West Cape, W.A., limestone reef, 2 m; September 1968; WAM 862-75: 1 ♀

Dry specimens

- 6 Bunbury, W.A.; October 1928; WAM 500-76: 5 mandibulae
- 7 Cottesloe Beach, Perth, W.A.; February 1928; WAM 13362/3: 2 spec.
- 8 Hopetoun, W.A.; March 1929; WAM 501-75: 2 spec.
- 9 S of Naval Base Groyne, Cockburn Sound, W.A.; November 1965; WAM 511-65: 7 spec.
- 10 Bunker Bay, Cape Naturaliste, W.A.; June 1974; (a) WAM 765-75: 1 spec. (deformed) + 1 juv. spec.; (b) WAM 767-75: 4 spec.
- 11 Cape Peron, W.A. (32°16'S, 115°43'E); April 1975; (a) WAM 795-75: 2 spec. (incomplete); (b) WAM 796-75: 2 spec. (incomplete).
- 12 Two Peoples Bay, W.A.; January 1972; WAM 820-75: 1 spec.
- 13 Between Eastern I. and Seal I., Wallabi Group, Houtman Abrolhos, W.A.; April 1974; WAM 821-75: 1 spec.
- 14 Sorrento Beach, Perth, W.A.; November 1965; WAM 831-75: 8 spec.
- 15 Cape Le Grand, W.A.; January 1973; WAM 834-75: 2 spec.
- 16 Natural Jetty, Rottnest I., W.A.; April 1975; WAM 851-75: 1 spec.
- 17 No data (a) WAM 481-65: 2 spec.; (b) WAM 482-65: 2 spec.; (c) WAM 484-65: 1 spec.; (d) WAM 486-65: 1 spec. (broken).

TABLE 1
Measurements of *Sepia apama*

1a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
5	♀	152	85	54	36	37	39	99	13	33	39	36	39	92	23	1.3	2.3
4	♀	100	87	48	37	41	43	100	18	40	45	45	50	105	27	2.0	3.0
3	juv.	61	85	61	28	38	48	89	-	36	36	36	39	115	16	1.6	2.8

1b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Loc.	Sex	L. in mm	W.	Th.	Str.z.
17c	-	340	34.5	11.8	59	10a	-	93	44	10.2	56
9	-	230	38	10.8	61	14	-	90	45.5	8.9	56
17a	-	220	37	10.5	64	9	-	89	46	10.7	55
17b	-	210	39	11.2	57	9	-	86	46	10.5	58
17a	-	210	40	11.2	62	14	-	83	46	10.8	55
16	-	205	38	11.2	58	14	-	74	44.5	8.1	54
13	-	160	44	11.8	56	10b	-	74	44.5	9.4	54
17b	-	152	42	9.5	58	7	-	73.5	45	9.1	64
9	-	152	41	10.8	60	7	-	73	44	8.9	59
5	♀	150	39	8.6	59	14	-	72	43.5	9.0	60
15	-	150	41	12.6	50	9	-	70	45.5	10.4	62
14	-	145	42	11.0	56	14	-	70	43	8.6	58
9	-	120	41.5	10.0	57	10b	-	64	45.5	9.1	61
14	-	115	44.5	10.4	61	3	juv.	61	44	9.5	57
12	-	113	44	12.4	58	10b	-	60	48.5	10.0	60
15	-	110	45.5	11.8	54	8	-	53	47	8.3	53
9	-	104	47	9.6	60	10b	-	51	49	9.8	61
4	♀	100	42	10.0	57	8	-	50	46.5	10.0	53

Description

The animals correspond with the description given by Adam & Rees (1966: 35) and show the three characteristic papillae behind each eye.

The shells illustrate the gradual transformation, especially of the posterior portion. In the smallest specimens (Plate 9, Fig. 1) the general shape is broadly oval, a little bit wider in the anterior half. The dorsal surface is very flat in the anterior part, with a faint indication of three ribs; anteriorly it is finely granulous along the growth lines; in the posterior part the granulation is stronger and forms a reticulate or labyrinth-like pattern. The spine is straight, short, without keels, separated at the ventral side from the outer cone by a shallow groove which is radially ribbed. The ventral surface is very flat with a faint linear median groove in the striated zone and a broader shallow depression in the last loculus. The first striae, in the posterior part, are widely spaced, the other ones closer together, weakly convex, nearly straight in the middle. The inner cone is well-developed, its lateral limbs broad, fused to the outer cone, their outer border flat and shiny, slightly raised as a flatly rounded rim around the posterior depression. In the posterior half, the limbs of the outer cone are about as large as those of the inner cone, continuous between the spine and the inner cone as a narrow ledge. In these smallest specimens (L. = 50-53 mm) there is hardly a trace of the callous formation inside the inner cone. The anterior portions of the limbs of the inner cone are situated between the outer cone and the striated zone, at the outer side of the very narrow smooth marginal areas of the striated zone. With the growth of the animal, the shape of the shell changes gradually, the posterior part becoming more and more acuminate: the spine disappears, the posterior rim of the inner cone becomes flatter and longer, the posterior depression disappears, filled by the V-shaped callous formation. Shells with a length of about 150-200 mm show the typical form of the shell which Iredale (1954: 71, pl. IV, fig. 1-2) described and figured as '*Amplisepia parysatis*', whereas the larger shells have the typical form of *Sepia apama*, with the posterior portion still more acuminate.

Remarks

The larger specimens of *Sepia apama* are very characteristic and easily recognizable but the very young shells, in which the callous formation inside the inner cone is hardly visible, strongly resemble the young shells of *Sepia novaehollandiae*. At a same length, the shell of the latter is relatively narrower, the sculpture of the posterior part of its dorsal surface is coarser and forms radiating ridges on the two wings of the outer cone (in young specimens the median ridges are not yet developed), its mid-dorsal rib is

narrower and more developed. The ventral surface of the shell of *Sepia novaehollandiae* is thicker, with a deeper median sulcus; the first striae of the striated zone are closer together and the outline of the other striae is more convex, the inner cone is nearly the same, but the posterior portion of its lateral limbs is narrower and the anterior parts separate the striated zone from its smooth marginal areas, the spine is stronger but, as in *Sepia apama*, separated from the outer cone by a shallow groove.

SEPIA CHIROTREMA BERRY, 1918

(Plate 1, Figs 1-6; Plate 2, Figs 1-4; Plate 3, Figs 1-4; Plate 4, Figs 1-2)

Sepia chirotrema Berry, S.S., 1918: 268, fig. 57-61, pl. LXXIV, fig. 3-9, pls LXXV-LXXVII

Adam, W. & Rees, W.J., 1966: 50-52

Mesembrisepia chirotrema Iredale, T., 1926: 190, 191; 1954: 70

Verco, J. & Cotton, B.C., 1928: 127

Cotton, B.C., 1929: 89; 1931: 40, fig. 4

Sepia (Mesembrisepia) chirotrema Cotton, B.C. & Godfrey, F.K., 1940: 422, fig. 410-415

Solitosepia hendryae Cotton, B.C., 1929: 87, pl. XV, fig. 1-2

Sepia (Solitosepia) hendryae Cotton, B.C. & Godfrey, F.K., 1940: 421, fig. 409

Glyptosepia hendryae Iredale, T., 1954: 74

Type localities

Investigator Strait area, South of Kangaroo Island, South Australia (*S. chirotrema*); Rottnest Island, Western Australia (*S. hendryae*).

Distribution

South Australia to Dirk Hartog I., Western Australia.

In addition to the material examined in this study the following locality records in the literature are noted: Great Australian Bight, 80-120 fms, Investigator Strait area, S of Kangaroo I., S.A., 129°28'E, Great Australian Bight, S of Eucla, W.A., 80-120 fms (Berry, 1918). Cottesloe, Rottnest I., W.A. (Cotton, 1929). Robe, S.A. (Cotton, 1931). Geraldton, Rottnest I., Cape Leeuwin, W.A. Joslin, S.A., Pelsart Island, Abrolhos Group, (Iredale, 1954) (*S. chirotrema*). Cottesloe (Cotton, 1929). Princess Royal Harbour,

King George Sound, Pelsart Island, Abrolhos, Dirk Hartog Island, Rottnest Island (Iredale, 1954) (*S. hendryae*).

MATERIAL

Spirit specimens

- 1 W of Rottnest I., W.A. (32°03'S, 114°20'E), 114-136 m; February 1964; WAM 421-65: 1 ♀ (Plate 1, Figs 3-4).
- 2 NW of Bluff Pt., W.A. (27°40'S, 113°20'E), 131 m; October 1963; WAM 25-76; 1 ♂, 2 ♀, 3 juv. spec. (Plate 2, Figs 1-4).
- 3 W of Lancelin, W.A. (31°05'S, 114°55'E), 114-122 m; February 1964; WAM 26-76, 2 juv. spec.
- 4 W of Guilderton, W.A. (31°30' to 31°34'S, 115°06'E); March 1972; WAM 858-75: 2 juv. spec. (M.L.d. 10 mm and 21 mm).
- 5 W of Mandurah, W.A. (32°33'S, 115°04'E), 110 m; November 1970; WAM 860-75: 1 ♀ (Plate 1, Figs 1, 2, 5 and 6).

Dry specimens

- 6 Cottesloe Beach, Perth, W.A.; September 1927; WAM 502-76: 6 spec. (Plate 3, Figs 3-4).
- 7 Cottesloe Beach, Perth, W.A.; July 1928; WAM 503-76: 3 spec. (Plate 3, Figs 1-2).
- 8 Cottesloe Beach, Perth, W.A.; (a) WAM 504-76: 1 spec. (b) WAM 476-65: 5 spec. (c) WAM 477-65: 2 spec. + 2 broken shells (identified by Iredale as "*Solitosepia glauerti*"). (d) WAM 479-65: 1 spec.
- 9 Hopetoun, W.A.; March 1929; WAM 505-76: 8 spec. (Plate 4, Fig. 1).
- 10 S of Naval Base Groyne, Cockburn Sound, W.A.; November 1965; (a) WAM 498-65: 1 spec. (b) WAM 503-65: 2 spec. (c) WAM 504-65: 1 spec.
- 11 Sorrento Beach, Perth, W.A.; November 1965; (a) WAM 499-65: 1 spec. (b) WAM 500-65: 2 spec. + 1 broken shell; (c) WAM 507-65: 1 spec. (Plate 4, Fig. 2); (d) WAM 816-75: 5 spec. (damaged).
- 12 Ocean Beach, Augusta, W.A.; March 1975; (a) WAM 799-75: 1 spec. (b) WAM 817-75: 2 spec.
- 13 Salmon Bay, Rottnest I., W.A.; 1969; WAM 818-75: 1 spec.
- 14 Myalup Beach, Harvey, W.A.; September 1965; WAM 819-75: 1 spec.
- 15 No data (a) WAM 470-65: 3 spec. + 1 fragment; (b) WAM 471-65: 3 spec. (c) WAM 473-65: 2 spec. + 2 spec. (broken); (d) WAM 487-76: 1 spec.

TABLE 2
Measurements of *Sepia chirostrema*.

2a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.el.	S.a.	S.t.
2	♂	70	74	51	33	20	39	80	9	26	24	30	37	86	18.5	2.3	4.3
5	♀	112	91	47	38	17	45	88	11.7	27	27	32	41	117	22.5	2.7	6.3
1	♀	78	79	45	29	28	35	85	9	26	26	28	36	90	15.5	1.3	3.5
2	♀	73	79	47	27	26	34	84	7	27	27	30	36	62	15	1.4	3.7
2	♀	63	83	44	29	27	35	89	8	32	32	32	43	80	16	1.6	4.0
2	juv.	50	80	45	28	34	34	80	6	30	30	30	40	110	16	1.8	4.0

2b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
13	♂	159	27	8.8	67	5.0
6	♂	154	28.5	8.6	67	5.5
6	♂	153	27	10.8	62	5.2
6	♂	152	29.5	9.2	68	5.9
15b	♂	152	29.5	8.8	72	5.1
15b	♂	150	28	9.3	71	5.2
7	♂	150	29.5	9.3	72	6.3
6	♂	148	28.5	8.1	68	5.4
14	♂	144	30	9.0	71	4.2
15b	♂	144	27.5	9.6	68	4.9
12b	♂	142	29	9.2	72	—
7	♂	139	29.5	9.4	70	6.1
7	♂	137	29	9.1	66	5.8
8a	♂	135	29	8.9	67	5.5
6	♂	133	30	9.4	64	5.6
6	♂	132	28	8.3	68	4.5
12b	♂	125	29.5	10.0	62	5.2
10c	♂	124	32	9.7	68	4.8
5	♀	112	34	10.7	68	—
15d	♀	111	32.5	9.3	66	5.0
11d	♂	110	31	9.5	63	5.4
11d	♂	110	33.5	10.4	63	5.4
15a	♂	108.3	32.5	10.3	64	5.5
10b	♂	104.8	35.5	9.4	69	4.6
15a	♂	101	33	10.4	58	5.4
10b	♂	91.5	34.5	10.7	63	5.1
15a	♂	90	36	11.6	69	—
9	♀	89	29	7.3	66	5.6
9	♀	86.5	25	7.2	70	4.0

2b (continued): Shell (in % of shell-length)

Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine
9	?♀	85.5	29	6.9	72	4.8
11b	?♀	84	29	7.6	70	5.0
10a	?♀	83.3	27.5	6.2	74	4.2
12a	?♂	82	37	11.0	60	4.9
15c	?♀	79.4	28	8.0	71	4.4
1	♀	78	28	—	—	—
9	?♀	76.8	29	7.8	73	4.6
9	?♀	75	29	6.0	73	4.9
9	?♀	74	32	8.6	72	5.3
2	♀	73	31.5	9.3	66	—
9	?♀	72	32	8.2	71	5.1
15c	?♀	72	31	7.2	72	4.2
8b	?♀	71.6	29	8.4	70	3.2
2	♂	70	38.5	11.5	59	—
9	?♀	70	30	8.3	71	4.7
11b	?♀	70	31.5	8.6	71	5.9
2	♀	66	31	9.1	65	—
8b	?♀	65	32	8.5	69	—
8b	?♀	62.5	32	7.7	66	3.2
2	juv.	52	34.5	9.0	60	—
11c	?♂	49.5	43	11.7	59	5.0
8b	?♀	46.2	33	7.6	68	—
8b	?♀	46.2	35	8.6	63	5.8
8d	?♀	38	39	8.9	66	4.7
8c	?♂	38	46	11.0	59	3.9
8c	?♂	26.3	52.5	9.5	59	—
11a	?♂	24	50.5	9.6	58	—
4	juv.	20.2	46.5	9.9	57	4.9
2	juv.	18.5	51	—	59	—
2	juv.	17.5	54	—	—	—

Description

The few animals (Plate 1, Fig. 1) in this collection are rather small in comparison with the types of *Sepia chirotrema*, especially the only male specimen, which measures 70 mm in dorsal mantle-length, but their main characters do not differ essentially from the original description. The dorsal arms are rounded at their outer sides, without swimming-membranes, but they are compressed and slightly keeled near the distal ends. Swimming-membranes are present on all the other arms and widest on the ventral ones.

The arm-suckers are quadriserial, those of the inner rows slightly larger than those of the marginal rows. In the female, the suckers of the ventrolateral and ventral arms are slightly larger than those of the dorsal and dorsolateral arms; in the male this difference is much more pronounced and the suckers of all the arms are larger than those of a female of the same size. In the original specimens, these differences were still more pronounced. The left ventral arm of the male shows a beginning of the hectocotylization described by Berry (1918: 269); the basal two-thirds bears ten or eleven transverse rows of normal suckers, which attain their largest size in the fifth or sixth row, whereas on the distal third the suckers are abruptly much smaller; on the right ventral arm, the basal portion is the same, but the suckers diminish gradually in size on the distal part. In this young male specimen the distal part of the hectocotylus is not laterally compressed and the protective membranes are not wider, thickened and elevated; however this may be due to a stronger contraction during preservation. The tentacles are long and slender, their absolute length depending on the state of contraction. The tentacular stem is rounded at its outer side, more or less flattened on the inner side. The club is rather short, but well-developed and very characteristic (Plate 1, Figs 2-4). The swimming-membrane is strong and reaches beyond the base of the club for a short distance. The protective membranes (Berry, 1918: 269, calls these the swimming-membranes) are united at the base of the club and attached to the stem by a unique short membrane. The dorsal protective membrane is rather thick and wide, separated from the swimming-membrane by a deep cleft and perforated by three large openings (*fenestrae*), each situated opposite one of the three big tentacular suckers. In the very young specimens these openings do not yet seem to exist, but it is very difficult to ascertain this without damaging the membrane. The greater part of the club is occupied by a median series of three very big suckers, the second one being largest, the first one nearly as large, but the third one smaller. These three suckers have long slender stalks, each attached at the bottom of a deep pit, the dorsal wall of which is formed by the dorsal protective membrane which shows the above-mentioned opening near the bottom of the pit. These pits are separated by transverse membranes, which bear at their dorsal side, near the edge of the protective membrane, a single small sucker and at their ventral side a pair of still smaller suckers. The distal part of the club bears 40-50 small suckers. On the base of the club there is generally in the middle a sucker of variable size, sometimes already situated in a distinct pit and which may be considered as a fourth main sucker, without attaining the size of the three main suckers; this basal main sucker is also separated from the following main

sucker by a transverse ridge or membrane, bearing one sucker at the dorsal side and a pair of suckers at the ventral side. At the proximal side of the median basal sucker there may be one to three minute suckers; this may vary on the two clubs of the same animal. All the large suckers, those of the arms and of the tentacular clubs have their chitinous rings smooth, but the small suckers are finely dentate.

There does not seem to be any doubt that the above described animals belong to a single species, *Sepia chirotrema*, the animal of which was only known by the original description.

As to the shell, in the original description the author (Berry, 1918: 271, fig. 58-59) gave a partially reconstructed drawing of the shell of a female specimen (M.L.d. = 168 mm); the description (p. 272) was probably based on the same specimen. Cotton (1931: fig. 4) and Cotton & Godfrey (1940: fig. 413) gave new figures of a shell of *Sepia chirotrema*, which differ a good deal from the original reconstruction of the shell of this species. Without having seen any material it would have been justified to wonder if they really represented the same species. The few animals and the many dry shells which I had the opportunity to study seem to justify the solution of this problem, although many more animals are needed to arrive at a definite conclusion. In fact there seem to exist important differences between the shells of the females and those of the males.

The following description of the shells is first of all based on the shells extracted from the male and female specimens from the same station (Loc. 2), which animals do not show any specific differences. The description is completed by the study of the remaining material. A first rather unexpected observation was that the shell of the young male is relatively much wider than those of female specimens of the same size. This difference seems to disappear in larger animals, but the present collection contained only a female specimen of medium size (L. = 112 mm) and no larger animals at all; consequently it is impossible to ascertain this point, except by study of the numerous dry shells, which according to other characters, especially the ornamentation of the dorsal surface, may be attributed with some doubt to males or females (see table of measurements, p. 121 and 122).

In the shell of the male, the anterior end is rather acuminate (Plate 1, Figs 1-2), the posterior end more broadly rounded. The dorsal surface shows a very distinct, well limited, median rib and two less-developed lateral ribs separated at each side from the former by a flat surface, about as wide as the ribs. The whole dorsal surface is granulous; in the anterior portion these granules are disposed more or less along the growthlines, but on the lateral

parts, and especially on the posterior portion, the granules become more and more coarse and form an irregular reticulate pattern. At the base of the lateral parts of the outer cone, the granules are more elongate and form at each side an irregular keel, separated from the middle part of the dorsal surface by a groove. The terminal spine is strong, rounded without any keels, straight and directed upwards. Its base is thickened, more or less expanded, and forms in the large shells (Plate 3, Figs 1-2) a thick collar, separated from the spine by a circular, radially striated groove, and separated from the dorsal surface of the shell by a deep cleft, but united with the dorsal surface by calcareous pillars or septa. The ventral surface is rather flat, with a shallow median sulcus along its whole length. The inner cone is well-developed, its lateral limbs reflected and fused with the outer cone, their lateral and ventral margins more or less rose-coloured, shiny and thickened in the posterior portion, which surrounds a distinct posterior depression. Along about half the length of the striated area, the posterior parts of the limbs of the inner cone are rather wide, diminishing gradually towards the anterior end. Along the anterior half of the striated zone, the limbs of the inner cone are very narrow, slightly raised ridges. At each side, the striated area is generally separated from the limbs of the inner cone by a narrow non-striated zone. On the other hand, the striated area is at each side separated from the outer cone by a rather wide smooth zone; in the small male shell, the latter shows a faint transverse striation. The striae of the striated area are convex in its posterior part, weakly angular, reversed V-shaped near the last loculus. The outer cone is rather narrow along the greater part of its length; it is more expanded and broadly rounded in its posterior portion, forming two wings in the larger specimens; it is continuous between the posterior part of the inner cone and the spine. The shell of the female is much narrower than that of the male in the small specimens (Plate 2, Figs 3-4; Plate 4, Fig. 1); it is flatter and presents a more slender general form, more acuminate at its anterior end, less expanded at the posterior end. The ribs of the dorsal side are less pronounced and the areas between the median and the lateral ribs less flattened (Plate 1, Figs 5-6; Plate 3, Figs 3-4). The whole dorsal surface is less rugose, but the keels at the bases of the lateral parts of the outer cone exist. The base of the spine is not thickened and expanded (Plate 3, Figs 3-4) as in the shell of the male. On the other hand, the spine shows sometimes a very weak ventral keel or a dorsal keel, or both. The ventral surface, although generally flatter, shows a more distinct median sulcus over its whole length. The limbs of the inner and of the outer cone are narrower. In both sexes the well preserved shells are on their dorsal sides more or less salmon-coloured, especially those of the female. The sexual differences

between these shells are sufficiently pronounced to distinguish them even without having seen the animals. In fact, the shell figured by Cotton & Godfrey (1940: fig. 413) represents a typical male shell. But the shells we extracted from the small female animals do not differ at all from the shell which Cotton (1929: 87, pls. XV, fig. 1-2) described as '*Solitosepia hendryae*'. Before having examined the animals, I had separated the abovementioned dry shells in two species: *Sepia chirotrema* and *Sepia hendryae* (the animal of the latter had never been described). When I studied the animals, it turned out that the only male specimen possessed a '*chirotrema*'-like shell, whereas the young females had a '*hendryae*'-like shell. The reconstructed female shell, figured by Berry (1918: fig. 58-59) also strongly resembles the latter species.

Discussion

The above-described animals have such a characteristic tentacular club, which is the same in the male and in the female specimens, that we can hardly believe that these animals, especially those captured together (Loc. 2) could belong to different species. Of course we cannot absolutely exclude this possibility, because the John Murray Expedition captured in the same locality (Stat. 75, Gulf of Oman) male and female specimens of *Sepia prashadi* Winckworth, 1936 and of *Sepia omani* Adam & Rees, 1966. The tentacular clubs of these two species show only minor differences, but the shells are completely different (see: Adam & Rees, 1966: 26 & 92). In the present case the tentacular clubs are absolutely the same and the shells show lesser differences. If my interpretation is correct, the shells of the males and females have not only been described as belonging to different species, but have been placed in different genera: the male in *Mesembrisepia* and the female in *Solitosepia* or *Glyptosepia*.

Iredale (1926: 188), who unfortunately never described the animals of his numerous different species, stated: 'that if an animal be met with it may be recognised and the bone will absolutely determine the species'. And in 1954 (p. 63), the same author, speaking about the 'bones', stated: 'the conclusions here recorded from their study, will be found to be stable when the animals are treated in as much detail'. After our experience with *Sepia chirotrema* and *Sepia hendryae*, it would be very interesting to study the animals of more Australian species.

Up to the present, *Sepia chirotrema* seemed to have been the only species in which the tentacular club possesses in the dorsal protective membrane openings (*fenestrae*) at the level of the big suckers. In this respect, I can add three other species which possess these openings: *Sepia prashadi*

Winckworth, 1936, *Sepia omani* Adam & Rees, 1966, and *Sepia rex* (Iredale, 1926) (see p. 178). In the original description of *Sepia omani*, we did not mention them, but in re-examining some of the paratypes (all the types were rather small), I discovered at the spots where *Sepia chirotrema* shows these openings, a very thin membrane, which was sometimes damaged. But in much larger specimens from Hong Kong, which Dr G.L. Voss kindly put at my disposal there are in each club three distinct openings at the levels of the three biggest suckers. In *Sepia prashadi* I found only two openings at the levels of the biggest suckers. The tentacular clubs of *Sepia rex* have been described on page 178. It is possible that in other species with very big suckers, these openings may exist and have been overlooked. Sometimes it is very difficult, owing to the contraction during fixation, to examine the dorsal protective membrane without damaging it. In *Sepia (Metasepia) pfefferi* I did not see any openings (see page 204).

According to Iredale (1926: 191) *Sepia chirotrema* appears to be the benthic form of *Sepia novaehollandiae*. Cotton (1929: 89) was of the same opinion. It is clear from the description (p. 135). of *Sepia novaehollandiae*, the animal of which was unknown up to the present, that these two species are quite distinct. The shells certainly show a certain resemblance, but differ in many details, especially as regards the sculpture of the posterior part of the dorsal surface. These differences are less pronounced in the females than in the males.

SEPIA NOVAEHOLLANDIAE HOYLE, 1909

(Plate 7, Figs 1-5; Plate 8, Figs 1-2)

Sepia australis Férussac, A. de, 1835: pl. VII, fig. 4

Orbigny, A. d', 1845: 294

Férussac, A. de & Orbigny, A. d', 1848: 285, pl. VII, fig. 4

Hoyle, W.E., 1886: 22, 220 (*non* Quoy & Gaimard, 1832)

Sepia novaehollandiae Hoyle, W.E., 1909: 266

MacPherson, J.H. & Chapple, E.H., 1951: 156

Adam, W. & Rees, W.J., 1966: 48, pl. 15, fig. 84-90

Mesembrisepia novaehollandiae Iredale, T., 1926: 191; 1954: 68

Verco, J.C. & Cotton, B.C., 1928: 127

Cotton, B.C., 1929: 88; 1931: 40, fig. 3

MacPherson, J.H. & Gabriel, C.J., 1962: 409

Sepia (Mesembrisepia) novaehollandiae Cotton, B.C. & Godfrey, F.K., 1940: 428, fig. 418 (*non* fig. 416, 417)

Type locality

Kangaroo Island, S. Australia.

Geographical distribution

Southern Australia from Victoria and Tasmania to Point Cloates in Western Australia.

MATERIAL

Spirit specimens

- 1 Off Naval Base, Cockburn Sound, W.A., 6 m on *Posidonia* banks; August 1958; (a) WAM 415-65: 2 ♂ (Plate 7, Figs 1-2); (b) WAM 416-65: 1 ♂.
- 2 Cockburn Sound, W.A.; July 1951; WAM 417-65; 1 spec. (M.L.d. 74 mm).
- 3 ? Shark Bay, W.A.; 1962; WAM 418-65; 2 spec. (M.L.d. 72 mm and 79 mm).
- 4 SW of Pt Cloates, W.A. (23°39'S, 113°11'E), 134 m; October 1963; WAM 422-65: 2 juv. spec.
- 5 SW of Pt Cloates, W.A. (24°04'S, 112°52'E), 135 m; October 1963; WAM 438-65: 1 juv. spec. (M.L.d. 39 mm).
- 6 W of Rottnest I., W.A. (32°00'S, 115°08'E), 137 m; August 1963; WAM 439-65: 2 juv. spec. (M.L.d. 31 mm and 38.5 mm).
- 7 North Cottesloe Beach, Perth, W.A.; July 1916; WAM 9357: 1 ♂ (M.L.d. 120 mm).
- 8 NE of Pelsart Group, Houtman Abrolhos, W.A.; August 1970; WAM 863-75: 1 ♀.
- 9 Cockburn Sound, W.A.; July 1972; WAM 864-75: 2 ♂ (M.L.d. 90 mm and 125 mm), 1 ♀ (M.L.d. 103 mm).
- 10 Off Rockingham and Kwinana, Cockburn Sound, W.A.; February 1970; (a) WAM 866-75: 1 ♂, 3 ♀ (Plate 7, Fig. 3); (b) WAM 867-75: 2 ♂, 3 ♀, 2 juv. spec. (one in bad condition: M.L.d. 62 mm); (c) WAM 868-75: 1 ♂, 3 ♀.
- 11 Shark Bay, W.A.; early 1966; WAM 869-75: 1 ♀ (M.L.d. 125 mm).
- 12 60 km NW of Cape Cuvier, W.A., 155-172 m; July 1972; WAM 876-75: 1 ♀, 1 ♂ (misformed) (Plate 8, Figs 1-2).
- 13 No data WAM 426-65: 1 juv. spec.

Dry specimens

- 14 Rottnest I.(?), W.A.; WAM 475-65: 12 spec. + 2 broken shells.
- 15 S of Naval Base Groyne, Cockburn Sound, W.A.; November 1965; (a) WAM 28-76: 47 spec.; (b) WAM 506-65: 14 spec. + 3 broken shells.

- 16 Sorrento Beach, Perth, W.A.; November 1965; (a) WAM 29-76: 5 spec. (Plate 7, Figs 4-5); (b) WAM 510-65: 10 spec. + 1 broken shell.
- 17 Bunker Bay, Cape Naturaliste, W.A.; June 1974; (a) WAM 764-75; 1 spec.; (b) WAM 766-75: 3 spec.
- 18 West End, Rottnest I., W.A.; June 1974; WAM 783-75: 1 spec.
- 19 Deadwater, near Hardy Inlet, Augusta, W.A.; March 1975; WAM 784-75: 4 fragments.
- 20 S of Woodman Pt, Cockburn Sound, W.A.; July 1965; WAM 788-75: 1 spec.
- 21 Two People Bay, W.A.; January 1972; (a) WAM 789-75: 1 spec. (b) WAM 792-75: 1 spec.
- 22 Between Eastern I. and Seal I., Morning Reef, Wallabi Group, Houtman Abrolhos, W.A.; April 1974; WAM 790-75: 1 spec. incomplete.
- 23 Ocean Beach, Augusta, W.A.; March 1975; (a) WAM 791-75: 6 spec.; (b) WAM 797-75: 3 spec. + 1 spec. incomplete; (c) WAM 30-76; 1 spec.; (d) WAM 800-75: 11 spec. + 4 damaged spec.
- 24 Coast between Middle Mt Barren and Thumb Peak, Fitzgerald River Reserve, W.A.; January 1971; WAM 793-75; 1 spec.
- 25 Cape Peron, W.A. (32°16'S, 115°43'E); April 1975; WAM 794-75: 1 incomplete spec.
- 26 Cheyne Beach (Hassell Beach), W of Cape Riche, W.A.: December 1968; WAM 798-75; 2 spec. + 2 fragments.
- 27 Cape Le Grand, W.A.; January 1973; WAM 807-75: 6 spec.
- 28 Back Beach, Geraldton, W.A.; September 1974; WAM 808-75; 5 spec.
- 29 Windy Harbour, E of C. d'Entrecasteaux, W.A.; March 1965; WAM 811-75: 10 spec.
- 30 Myalup Beach, Harvey, W.A.; September 1965; WAM 814-75: 1 spec.
- 31 Longreach Bay, Rottnest I., W.A.; April 1975; WAM 852-75: 2 spec.
- 32 Salmon Bay, Rottnest I., W.A.; September 1931; WAM 819-31: 1 spec.
- 33 Cottesloe(?), W.A.; (a) WAM 1286-76: 14 spec.; (b) WAM 1287-76: 7 spec.; (c) WAM 1288-76: 6 spec.
- 34 Cottesloe Beach, Perth, W.A.; July 1928; WAM 13660/80: 21 spec.
- 35 Hopetoun, W.A.; March 1929; WAM 1289-76: 1 fragment.
- 36 No data (a) WAM 27-76: 19 spec.; (b) WAM 480-65: 1 spec.; (c) WAM 487-65: 19 spec.

TABLE 3

Measurements of *Sepia novaehollandiae*

3a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I.	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
1b	♂	136	72	46	—	37	40	99	18.5	44	48	57	59	88	20	1.5	2.1
1a	♂	132	84	45	—	27	36	98	13.5	42	40	43	51	72	19	1.4	1.8
1a	♂	113	75	47	—	38	37	100	19.5	42	44	46	53	88	20	1.8	2.0
10c	♂	82	89	45	32	35	35	92	12	37	43	37	49	135	18	1.5	1.5
10b	♂	79	86	47	30	32	42	93	11.5	38	44	44	51	140	19	1.5	1.6
10a	♂	78	86	49	31	32	38	90	9	45	38	45	49	166	18	1.5	1.7
10b	♂	75	87	47	33	36	37	91	5.3	40	40	40	40	120	17	1.6	1.7
8	♀	100	91	38	36	41	36	102	13	40	45	45	45	—	16	1.3	1.3
10a	♀	89	84	48	34	34	40	94	11	39	34	39	39	100	18	1.3	1.6
10b	♀	83	87	47	37	34	37	93	11	42	42	48	48	132	18	1.6	1.6
10b	♀	76	87	50	37	33	43	89	10.5	33	33	33	39	92	16	1.4	1.6
10c	♀	76	87	43	35	30	39	89	8	39	33	33	39	86	18	1.6	1.7
10a	♀	73	86	44	34	29	40	95	8	34	34	34	41	—	—	1.4	—
10c	♀	71	87	48	34	32	38	92	14	32	35	35	39	92	20	1.5	1.8
10a	♀	66	88	45	30	30	41	87	12	33	33	33	38	91	15	1.5	1.7
10c	♀	61	89	51	34	36	43	92	10	36	33	36	44	107	20	1.5	1.5
13	juv.	64	82	45	—	31	39	94	10	36	36	38	39	102	17	—	—
10b	juv.	58	90	48	38	36	38	90	12	35	35	35	43	104	16	1.4	1.6

3b: Shell (in % of shell-length)

Loc	Sex	L.in mm	W.	Th.	Str.z.	Spine	Loc	Sex	L. in mm	W.	Th.	Str.z	Spine
16b	—	170	28	11.8	70	—	34	—	130	30.5	10.0	62	5.0
34	—	165	25.5	8.1	—	3.0	34	—	130	29.5	12.3	—	3.9
27	—	158	29	11.4	61	4.4	23b	—	130	29	9.2	69	5.4
12	♀	153	29	9.1	73	3.3	28	—	130	27	10.0	61	3.5
28	—	150	28	10.6	64	3.3	12	♂	128	27.5	9.4	73	3.1
26	—	146	27.5	8.9	73	4.1	36c	—	127.8	29.5	9.7	67	4.7
33a	—	145	30	9.6	62	4.5	33b	—	127	27.5	—	—	3.5
31	—	143	28.5	9.1	73	4.9	29	—	127	29	8.7	65	3.2
31	—	142	27.5	9.9	75	4.2	15b	—	126	31	10.9	—	4.6
27	—	140	28	8.9	67	—	15b	—	125.5	31	9.6	—	4.0
33a	—	140	26.5	9.3	68	3.9	34	—	125	33.5	10.8	61	4.0
28	—	139	25	9.7	65	—	21a	—	125	33	9.6	68	4.8
33a	—	138	29	9.4	72	4.7	27	—	125	31	9.6	70	3.6
36c	—	137	29.5	8.7	72	4.4	33a	—	124	31.5	10.0	60	4.0
16b	—	136.5	28	11.5	59	4.8	16b	—	124	31	8.4	—	3.5
1b	♂	136	33	11.8	70	—	16b	—	123.5	29	9.7	67	4.1
17a	—	136	26.5	8.4	70	3.7	15a	—	123.4	32.5	10.8	64	4.6
16b	—	135	31	10.4	72	3.7	33a	—	123	32	10.2	55	4.5
29	—	135	30.5	9.1	67	3.0	34	—	123	30	9.8	67	3.3
34	—	134	30	10.4	69	4.9	34	—	123	31.5	10.6	55	4.9
15b	—	133	31.5	9.4	—	4.5	15a	—	122	32	9.0	—	—
15a	—	133	31.5	9.4	66	4.5	34	—	121	30.5	9.5	63	3.3
36a	—	132.5	27	9.4	—	4.0	34	—	121	30	8.7	70	4.1
27	—	132	29.5	9.1	66	4.6	36c	—	121	30	9.5	69	4.5
34	—	131	29	9.4	69	4.6	34	—	120	33	8.4	71	3.8
15a	—	131	29	9.3	66	—	36a	—	120	32	10.0	63	5.0

3b: Shell (in % of shell-length) cont.

Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine
36a	—	119	32	10.9	69	4.6	15a	—	111	32	10.4	—	4.5
15a	—	119	30.5	9.2	64	4.6	16b	—	110.5	31	9.5	74	5.0
15a	—	119	32	9.2	71	4.2	34	—	110	31	9.6	68	4.1
23d	—	119	31.5	8.8	67	4.2	34	—	110	32	9.5	—	3.6
34	—	118	30.5	9.3	—	3.4	15a	—	110	30	10.4	62	4.8
34	—	118	34	10.2	66	4.2	36a	—	110	33.5	10.6	66	5.0
33a	—	117	32	—	—	3.9	23d	—	110	33.5	10.0	73	5.4
36a	—	116.5	32.5	8.6	—	—	23d	—	110	30	8.6	66	3.6
33a	—	116	33	11.2	65	4.3	23d	—	110	32.5	8.6	—	3.6
23b	—	116	33	9.1	72	5.2	15d	—	110	31	10.0	66	4.1
36c	—	115.5	30	9.7	59	3.9	15d	—	110	32	9.6	61	3.6
34	—	115	29.5	11.3	62	4.4	21b	—	110	32	9.1	70	4.6
15a	—	115	29	9.6	64	4.8	29	—	110	30	9.2	71	2.3
36a	—	114.5	31.5	9.1	66	4.4	36a	—	109.5	30	9.8	67	5.0
15a	—	114.5	32	10.2	—	4.4	36c	—	108.3	32	11.4	—	4.6
36a	—	114	31.5	—	—	5.3	16b	—	108	29.5	9.4	—	4.2
36a	—	114	30.5	9.2	69	4.4	15a	—	108	32.5	9.2	71	4.1
15b	—	114	31.5	11.0	60	4.8	36c	—	107.5	29	10.4	60	4.1
29	—	114	31.5	9.0	70	4.4	33a	—	107	31	9.3	69	4.2
36a	—	113	31	—	—	4.9	15b	—	107	32.5	9.4	71	4.7
36c	—	112.2	29	9.2	67	4.5	15a	—	107	31	8.9	73	4.7
36a	—	112	31.5	—	—	4.5	15a	—	106.8	32	11.0	61	5.0
36c	—	112	27.5	8.7	—	2.9	15a	—	106.5	31.5	10.3	61	3.9
34	—	112	32	10.3	63	4.5	36c	—	106.2	29	10.1	—	4.1
15b	—	112	30.5	10.3	63	4.5	33a	—	106	35	9.9	59	3.8
15a	—	112	33	9.8	68	4.5	29	—	106	31.5	9.4	73	3.8
36a	—	111.4	34	10.3	62	4.0	29	—	106	34	10.4	60	2.4

3b: Shell (in % of shell-length) cont.

Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine
33a	—	105	31	10.0	54	4.3	36a	—	97	28	—	—	3.6
34	—	105	31.5	10.0	65	4.8	23a	—	97	31	8.2	65	4.1
23a	—	105	28.5	9.5	62	3.8	15a	—	97	32	9.3	62	4.1
36c	—	104.8	29.5	9.0	66	4.8	36a	—	96.5	28.5	—	—	4.1
15a	—	104	34	10.1	60	4.5	36c	—	96	36	11.2	72	4.7
15b	—	104	31.5	11.8	57	4.3	15a	—	96	34.5	10.4	66	4.4
36c	—	103.5	34	10.0	67	4.1	23b	—	96	32.5	8.3	76	4.2
36c	—	103	30	10.0	—	3.9	23d	—	96	30	9.4	68	3.6
15a	—	103	35	9.7	68	5.8	15a	—	96	33.5	9.4	60	4.7
15a	—	103	34	9.7	67	—	15a	—	96	34.5	9.4	71	4.2
9	♀	103	34	10.2	66	—	33a	—	95	32	10.3	58	4.7
15a	—	102	31.5	9.8	59	4.4	15a	—	95	34	10.0	68	4.2
33a	—	100	34	11.0	58	4.0	15a	—	95	36	10.7	68	—
33a	—	100	34	9.5	—	4.5	23a	—	95	32.5	10.5	59	4.2
33b	—	100	33.5	9.5	69	—	34	—	94	34	10.1	61	4.2
16b	—	100	31	9.5	63	4.5	15a	—	92	32.5	10.4	60	4.3
8	♀	100	31	10.0	71	3.0	36a	—	91.3	31	9.9	61	3.8
27	—	100	32	8.5	68	4.5	16b	—	91	28	9.0	67	2.8
23d	—	100	31	8.5	70	5.0	28	—	90	31	10.0	56	3.3
36a	—	99	29.5	10.2	62	4.0	33b	—	89	31.5	9.0	—	3.9
34	—	99	33	9.7	—	3.5	33b	—	88	33	9.1	—	4.0
29	—	99	33.5	9.1	68	3.5	36a	—	87.5	34	—	—	5.7
29	—	98	34	8.1	71	2.0	10a	♀	87	34.5	10.4	54	4.0
33c	—	97.4	32.5	9.2	65	5.1	15a	—	87	33.5	9.8	69	4.6
33b	—	97	31	10.3	—	4.6	15a	—	86.8	33.5	10.0	66	5.0
33c	—	97	33.5	9.1	68	4.6	23d	—	86	30	9.3	61	3.5
15b	—	97	31.5	10.3	64	5.1	15b	—	85.5	33	8.9	66	3.9

3b: Shell (in % of shell-length) cont.

Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc	Sex	L. in mm	W.	Th.	Str.z.	Spine
23a	—	85	34	10.6	59	—	15a	—	69.8	37	—	—	4.6
10b	♀	83	35	10.8	51	3.6	15b	—	68.3	36	9.1	—	4.4
33a	—	83	33.5	10.2	57	5.4	15a	—	68	36	—	—	4.4
36b	—	82	29.5	9.2	—	4.1	24	—	68	34	9.6	68	3.7
23a	—	82	35.5	8.5	63	3.7	36c	—	66	34	9.5	54	5.2
36c	—	81.4	32	10.5	—	4.9	15a	—	66	34	9.1	61	4.5
33b	—	81	36	—	—	4.9	33c	—	65	34	10.8	55	4.3
15b	—	81	34.5	9.3	74	4.3	16a	—	65	35.5	11.1	57	5.4
36a	—	80.5	33.5	10.8	56	5.0	13	juv.	64	34.5	11.4	55	—
10c	♂	80	34.5	10.6	50	—	15b	—	64	34	—	—	4.7
10b	♀	80	35	11.2	58	3.7	14	—	62.5	34.5	—	—	4.8
23d	—	80	33	9.4	71	—	36c	—	62	35.5	11.3	58	4.0
15b	—	79.7	34.5	10.6	63	4.8	29	—	59	34	11.4	58	2.5
23d	—	78	31.5	9.2	69	—	16a	—	56.7	33.5	10.4	60	4.2
34	—	77	31	9.1	64	3.9	14	—	56.5	34.5	9.2	55	5.0
33c	—	76	30.5	10.6	53	5.3	14	—	55.8	36	10.8	61	4.8
33c	—	75.8	30	—	—	6.1	14	—	55.7	33.5	—	—	3.6
36c	—	75	31.5	—	—	4.9	16a	—	55.3	37.5	10.8	66	5.4
23d	—	75	32	8.0	70	4.0	14	—	54.5	35.5	10.7	61	4.6
17b	—	75	37.5	12.6	59	4.7	14	—	53	36.5	11.0	60	5.7
23a	—	74	34	10.1	58	4.1	36c	—	52.6	34.5	10.4	50	4.8
20	—	74	35	9.5	63	3.4	26	—	52	33.5	10.6	69	4.8
10b	♂	73	35.5	10.3	52	4.1	17b	—	51	37	11.8	61	4.9
10a	♀	73	34	11.7	47	4.1	14	—	51	34.5	—	—	4.3
33c	—	73	32	—	—	5.5	16b	—	50	36.5	11.0	62	4.6
27	—	72	34.5	9.7	69	5.5	16b	—	49.5	34	10.1	61	4.7
33b	—	71.5	33.5	8.4	—	4.2	15a	—	49.2	36.5	12.6	59	4.5

3b: Shell (in % of shell-length) cont.

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
17b	—	49	34.5	10.6	57	4.1
16a	—	48	37.5	9.6	62	4.2
14	—	48	35.5	—	—	4.6
14	—	47	36	10.6	62	4.3
15b	—	43	37	10.5	60	5.8
14	—	40	36	10.2	59	5.0
14	—	40	37.5	11.0	58	4.3
5	—	39	41.5	10.5	49	—
6	—	38.5	36.5	10.7	60	3.6
4	juv.	37.3	43.5	10.7	48	7.2
16a	—	35	40.5	10.9	54	5.1
4	juv.	35	43	10.6	47	7.7
30	—	35	43	12.3	58	4.3
32	—	34.4	40.5	9.9	58	—
14	—	31.8	38.5	9.4	56	—
18	—	25	40	10.0	58	6.0
23c	—	25	42	9.6	62	4.0

Description

The dorsal mantle-margin projects strongly forward, reaching the mid-level of the eyes; the ventral margin is emarginate. In well-preserved specimens the fins are wide, their anterior ends reaching beyond the lateral mantle-margins, their posterior ends separated and surpassing the posterior end of the mantle. The head is wide; the eyes are very big, but not protruding. The arms are subequal, the ventral ones generally slightly longer than the other ones. All the arms are laterally compressed, the dorsal and lateral ones with a narrow swimming-membrane, the ventral ones with a wide swimming-membrane. The arm-suckers are rather small, quadriserial along the whole length of the arms. The protective membranes are well developed. The interbrachial membrane is well-developed especially between the ventrolateral and ventral arms, where it attains about one third of the length of the ventral arms; between the latter ones it is absent. The left ventral arm of the male hardly shows any transformation which might be interpreted as a hectocotylization; only in the biggest male, the suckers of the 7th to the 10th transverse rows are slightly smaller than the other ones. The tentacular club is rather short, with a distinct swimming-membrane which extends slightly beyond the base of the club. The well-developed protective membranes are often separated at the base in the young specimens and united

in the larger ones, but this character is very variable. In one specimen they are united but after a short distance again separated. The ventral membrane always continues as a very low, rounded, membranous ridge, sometimes retracted in a very narrow furrow along the whole length of the tentacular stem. When the two membranes are separated, the dorsal one is generally very short, not reaching beyond the swimming-membrane. At the base of the club the two protective membranes come close together but further down the stem become widely separated. The tentacular suckers are arranged in oblique rows of eight, giving the impression that there are only five longitudinal series; those of the second and especially the third series from the dorsal side are distinctly wider than the other ones. The largest tentacular suckers are only slightly wider than the arm-suckers. All the suckers have their chitinous rings armed with numerous very fine denticles, which are highest at the distal sides of the rings. The rings of the tentacular suckers are relatively wider than those of the arm-suckers.

In the largest male specimen, the skin of the dorsal side of the mantle shows a more or less reticulate pattern of fine wrinkles which, near the bases of the fins, form dark longitudinal lines and at the bases of the fins at each side a series of elongate, narrow and low papillae. In this specimen the dorsal sides of the arms show a zebra-like colour-pattern, which is strongly developed on the ventral arms and probably is a secondary sexual character.

The shell is elongate-oval, rather acuminate towards both ends, widest in front of the middle. As the table of measurements shows, there is some variation in the relative width, the small specimens being wider than the larger ones. For the moment it is impossible to state whether the differences in specimens of the same length constitute a sexual character. The dorsal surface is often more or less rose-coloured, especially in its posterior part. There is a median rib, the width of which varies a good deal, and two less defined lateral ribs, separated from the median one by rather flat portions. The anterior part is delicately granulous, the granules partly arranged along the growth-lines and sometimes forming longitudinal lines on the median rib. The posterior part is more strongly rugose, the granules forming an irregular reticulate pattern near the posterior end and radiating ridges in the median portion, often extending on the outer cone. At the bases of the lateral parts of the outer cone the granules form a weak keel separated from the remaining part of the dorsal surface by a groove. The strong spine, devoid of any keels, is straight or slightly turned upwards. The base of the spine is swollen on the dorsal and lateral sides, with a deep radially striated groove on the ventral side and, in large specimens, separated from the dorsal surface of the shell by another groove. In this way, a strong transverse

ridge separates the spine from the dorsal surface. The ventral surface is rather variable. There is always a median sulcus, which is more or less wide and deep along the striated area and continues as a slight depression on the last loculus. The median sulcus is flanked by two rounded ribs at the outer side of which is at each side a less pronounced longitudinal depression. The length of the striated zone is very variable, but the larger shells possess generally a longer striated area than the smaller ones. It is separated from the outer cone by two narrow smooth areas. The inner cone is completely fused to the outer cone, its posterior portion being slightly thicker, surrounding a weak depression. The outer cone forms two long posterior wings. In well-preserved specimens it continues between the inner cone and the spine as a very thin, mostly chitinous wall, which partly covers the ventral depression of the base of the spine.

Remarks

Up to the present, the animal of *Sepia novaehollandiae* has never been described. Cotton & Godfrey (1940: 428, fig. 416-417) gave several figures of the animal of *Sepia novaehollandiae*, without mentioning that these figures were copies of the original figures of *Sepia dannevigii* Berry, 1918, which they considered to be a synonym, although, according to the original description, the shell of the latter species was unknown. The above-described animals belong without any doubt to *Sepia novaehollandiae* and the tentacular club proves that *Sepia dannevigii* is certainly a different species, probably synonymous with *Sepia elliptica* Hoyle, 1885 (see p. 165). In fact, the tentacular club of *Sepia dannevigii* has been described as having the 'suckers excessively numerous and minute, in perhaps 10-12 longitudinal series at the middle of the club.'

Cotton (1929: 91) stated that *Sepia irvingi* Meyer, 1909, 'is possibly a variant of *Mesembrisepia novaehollandiae* Hoyle'. According to Adam & Rees (1966: 52) the shell of *Sepia irvingi* seemed to be identical with the shells from Adelaide, which they attributed to *Sepia novaehollandiae*. But if the animals and shells described on page 141 really belong to *Sepia irvingi*, the two species are certainly not synonymous.

Several authors (Iredale, 1926: 190; 1954: 70; Cotton, 1929: 89; Cotton & Godfrey, 1940: 428) have mentioned the resemblance between the shells of *Sepia novaehollandiae* and *Sepia chirotrema* Berry, 1918, which they supposed to be the benthal form of the former species. The description of the animal of *Sepia novaehollandiae* leaves no doubt that these two species are completely different.

'*Mesembrisepia macandrewi*' Iredale, 1926 (p. 191, pl. XXI, fig. 8-9) from New South Wales, which according to the author 'is the Peronian representative of *S. novaehollandiae* Hoyle', does not seem to differ from the latter species, but '*Mesembrisepia ostanes*' Iredale, 1954 (p. 69, pl. IV, fig. 5,6) shows a different general form, the posterior part being relatively wider.

SEPIA IRVINGI MEYER, 1909

(Plate 8, Figs 3-7)

Sepia irvingi Meyer, W.Th., 1909: 333, fig. 7-10

Cotton, B.C., 1929: 91

?*Mesembrisepia irvingi* Iredale, T., 1954: 68, pl. IV, fig. 3-4

Type localities

Cockburn Sound, Garden Island, Port Royal and Warnbro Sound.

Geographical distribution

Central west coast of Western Australia from Cockburn Sound to Cape Cuvier.

MATERIAL

Spirit specimens

1 60 km NW of Cape Cuvier, W.A., 156-181 m; July 1972; WAM 875-75:
2 ♂, 1 ♀ (Plate 8, Figs 3-7).

TABLE 4

Measurements of *Sepia irvingi*.

4a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
1	♂	175	86	41	40	38	42	86	14	40	40	40	46	—	23	1.4	2.3
1	♂	155	86	55	29	—	45	90	13	35	39	45	48	103	23	1.5	2.6
1	♀	150	85	53	27	43	45	93	13	37	40	40	40	—	23	1.5	2.7

4b: Shell (in % of shell-length)

Loc.	Sex	L.in mm	W.	Th.	Str.z.	Spine	Author
1	♂	175	31.5	9.2	63	3.1	
1	♂	155	32	9.7	57	3.2	
1	♀	150	35	9.7	55	3.3	
Type	♀	115	35.5	11.3	67 (fig. 8)		Meyer, 1909: 334
Point Cloates		142	28	11.3			Iredale, 1954: 69
Geraldton		130	31				Iredale, 1954: 69
"		104	35.5				Iredale, 1954: 69
"		78	31				Iredale, 1954: 69
"		62	32				Iredale, 1954: 69
Pelsart Island		173	26				Iredale, 1954: 69

Description

The mantle-margin is broadly rounded at the dorsal side, slightly emarginate at the ventral side. The broad fins are distinctly separated at the acuminate posterior end of the mantle. The dorsal mantle surface is reddish-purple and shows in both the male specimens at the base of the fins four or five narrow lighter coloured longitudinal bands, separated by larger dark intervals. In the anterior half of the mantle, these bands are followed at the inner side by a rather wide area with a reticulate light-coloured pattern, whereas the remaining part of the dorsal surface is mottled with minute densely crowded light spots on a dark background.

The arms are laterally compressed, keeled at their outer sides, with a well-developed swimming-membrane on the ventral arms. The interbrachial web attains about half the arm-length, except between the ventral arms where it is absent; it is highest between the dorsal arms. The arm-suckers are quadriserial, the protective membranes wide.

The tentacular club (Plate 8, Fig. 7) strongly resembles that of *Sepia latimanus* and of *Sepia apama* in the sucker-bearing surface being completely surrounded by the protective membranes which are fused at the base, and in the deep groove between the swimming-membrane and the dorsal protective membrane. The groove separates the sucker-bearing surface nearly completely from the stem with which it is connected at the base by a thin membrane which is covered by the basal part of the sucker-bearing surface. The swimming-membrane extends slightly beyond the base of the club. The tentacular suckers seem to be arranged in five longitudinal series, but are in fact arranged in oblique transverse rows of eight, the second and especially the third sucker of each row, starting from the dorsal side, being

larger than the other ones. The chitinous rings of the arm-suckers and tentacular suckers are finely dentate, those of the biggest ones sometimes smooth.

The males do not show any trace of a hectocotylization of the left ventral arm.

The shell of the female is relatively slightly wider than that of the male but otherwise there does not seem to be any sexual difference. The anterior end is very slightly acuminate, more acuminate towards the posterior end; the shell being widest in the anterior half. In the anterior part, the dorsal surface is slightly convex, with a very weak but very broad median rib and two ill-defined lateral ribs. The non-calcified chitinous marginal areas are very large. Towards the posterior end the surface becomes more and more convex. In the anterior part the dorsal surface is finely granulous, the granules being arranged along the growthlines. Near the posterior end the granulation is more pronounced and very characteristic. About at the level of the beginning of the striated zone, the median part of the dorsal surface curves downward and from this point strong keels radiate in all directions, those on the basal portion of the dorsal ribs being less developed than those towards the spine and those situated on the outer cone. The ventral surface is rather flat. The striated area shows a very weak indication of a narrow median groove; the striae are regularly convex. The inner cone is completely fused with the outer cone; its limbs are very narrow and situated at the base of the outer cone, there being no smooth areas between the striated zone and the outer cone. The posterior part of the inner cone, surrounding the weak posterior depression, is a little bit more elongated and attains about the same length as the surrounding part of the outer cone, which separates it from the spine. The latter is rather strong, straight and devoid of keels. Between the base of the spine and the posterior part of the outer cone is a deep groove with strong, calcareous, sharp-edged keels, extending up to the margin of the outer cone.

Remarks

The original description of *Sepia irvingi* was based on four female specimens, but if the above-described material really belongs to this species, the sex can only be established by opening the mantle, as the male does not show any hectocotylization.

Cotton (1929: 91) stated that *Sepia irvingi* 'is possibly a variant of *Mesembrisepia novaehollandiae* Hoyle'. And speaking about the latter

species (p. 89), this author was of the opinion that 'Among hundreds of specimens from South and Western Australia the numerous variants are not separable into any distinct varieties'. But according to Iredale (1954: 69) 'The collections made by Whitley suggest that the Western Australian bones, north of the Swan River, are constant enough, in their narrowness and prominent ventral surface anteriorly, to be admitted as different. Consequently, the western name (*Mesembrisepia irvingi*) may be used for these bones until the matter is decided absolutely by study of animals'. The shell which Iredale (1954: IV, fig. 3,4) figured from Point Cloates as belonging to *Sepia irvingi*, does not differ at all from that of *Sepia novaehollandiae*, but his other references are doubtful.

The above described and figured shells, which we believe to belong to *Sepia irvingi*, differ in many respects from those of *Sepia novaehollandiae*, although there is a certain superficial resemblance. The shell of *Sepia irvingi* is relatively broader and much less acuminate at both ends. The striated area is shorter and the median ventral sulcus very shallow, hardly indicated; the striae being regularly convex and not protruding in the middle. In the original figure of *Sepia irvingi* the foremost striae are slightly protruding; this seems to be the only difference with the above-described specimens. The dorsal surface of the shell of *Sepia irvingi* differs from that of *Sepia novaehollandiae* by the much broader non-calcified marginal areas and especially by the characteristic sculpture of the posterior part, where the median area curves downward at a certain distance from the spine, whereas in *Sepia novaehollandiae* it curves regularly towards the base of the spine (Plate 8, Figs 2, 4 and 5).

The animals of the two species differ principally by their tentacular clubs, those of *Sepia irvingi* being longer and broader with larger suckers and with the protective membranes completely fused at the base, where the sucker-bearing surface is much more detached from the tentacular stem. None of the specimens shows the triangular expansion of the dorsal membrane figured by Meyer (1909: p. 333, fig. 7) which might be an artifact or due to contraction.

It is very interesting that the three specimens of *Sepia irvingi* were collected together with two specimens of *Sepia novaehollandiae*, which proves that the former species is not a local form of the second. Among the numerous shells of *Sepia novaehollandiae* we did not find a single one which resembles *Sepia irvingi*.

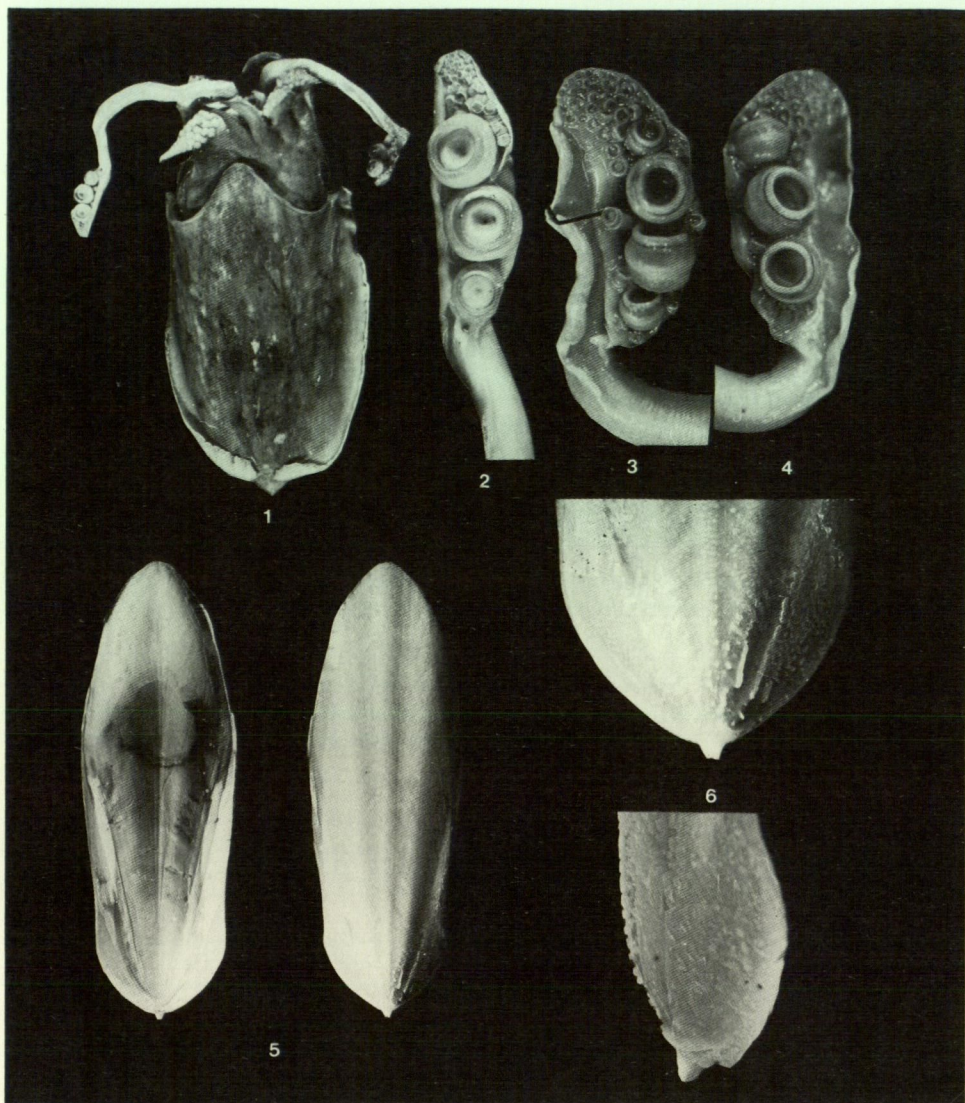


PLATE 1

Sepia chirotrema Berry, 1918

Fig. 1: ♀ (M.L.d. = 112 mm), 32°33'S, 115°04'E, W of Mandurah, W.A., 110 m; November 1970, WAM 860-75.

Fig. 2: Idem, left tentacular club (L. = 25 mm).

Fig. 3: ♀ (M.L.d. = 78 mm), left tentacular club (L. = 12 mm), 32°03'S, 114°20'E, W of Rottnest I., W.A., 114-136 m, February 1964, WAM 421-65.

Fig. 4: Idem, right tentacular club (L. = 12 mm).

Fig. 5: Shell of ♀ (Fig. 1) (L. = 112 mm).

Fig. 6: Idem, enlarged details of posterior end of shell (Fig. 5).



PLATE 2

Sepia chirotrema Berry, 1918

Fig. 1: Shell of ♂ (L. = 70 mm), 27°40'S, 113°20'E, NW of Bluff Pt., W.A., 131 m, October 1963, WAM 25-76.

Fig. 2: Idem, enlarged detail of posterior end of shell (Fig. 1).

Fig. 3: Shell of ♀ (L. = 72 mm), same locality as Figs 1-2.

Fig. 4: Idem, enlarged detail of posterior end of shell (Fig. 3).



PLATE 3

Sepia chirotrema Berry, 1918

Fig. 1: Shell of ♂ (?) (L. = 139 mm), Cottesloe Beach, Perth, W.A., July, 1928, WAM 503-76.

Fig. 2: *Idem*, enlarged details of posterior end of shell (Fig. 1).

Fig. 3: Shell of ♀ (?) (L. = 153 mm), Cottesloe Beach, Perth, W.A., September 1927, WAM 502-76.

Fig. 4: *Idem*, enlarged detail of posterior end of shell (Fig. 3).

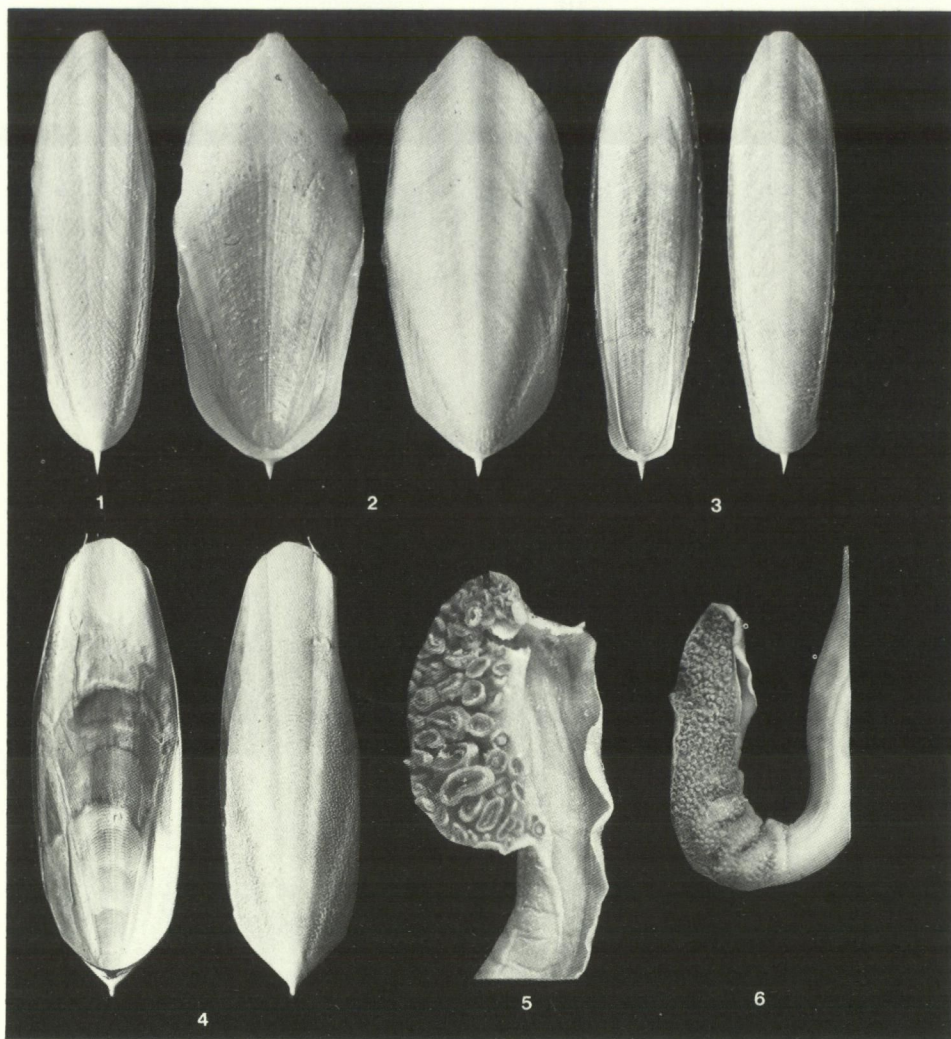


PLATE 4

Fig. 1: *Sepia chirotrema* Berry, 1918: dorsal view of shell (L. = 85.5 mm), Hopetoun, W.A., March 1929, WAM 505-76.

Fig. 2: *Sepia chirotrema* Berry, 1918: juvenile shell (L. = 49.5 mm), Sorrento Beach, Perth, W.A., November 1965, WAM 507-65.

Fig. 3: *Sepia reesi* sp. nov.: Holotype, shell (L. = 45.2 mm), Salmon Bay, Rottnest I., W.A., September 1931, WAM 497-76.

Fig. 4: *Sepia papuensis* Hoyle, 1885: shell of ♂ (L. = 72 mm, 10 km S of Double I. (Barrow I.), W.A., September 1958, WAM 425-65.

Fig. 5: *Sepia papuensis* Hoyle, 1885: right tentacular club (L. = 8 mm) of ♀ (M.L.d. = 69 mm), Shark Bay, W.A., early 1966, WAM 402-76.

Fig. 6: *Sepia smithi* Hoyle, 1885: right tentacular club (L. = 20 mm) of ♂ (M.L.d. = 74 mm), Shark Bay, W.A., early 1966, WAM 398-76.



PLATE 5

Sepia cultrata Hoyle, 1885

Fig. 1: Shell (L. = 110.5 mm), Cottesloe Beach, Perth, W.A., July 1928, WAM 1290-76; February 1928, WAM 1291-76.

Fig. 2: Shell (L. = 78.2 mm), Cottesloe Beach, Perth, W.A., WAM 472-65.

Fig. 3: Shell (L. = 30.6 mm), probably Rottnest I., W.A., WAM 394-76.

Fig. 4: Shell (L. = 18 mm), probably Rottnest I., W.A., WAM 394-76.



PLATE 6

Fig. 1: *Sepia pharaonis* Ehrenberg, 1831: shell of ♂ (L. = 76 mm), 17°31.5'S, 121°27.0'E, NW of Broome, W.A., 83 m, December 1969, WAM 853-75.

Fig. 2: *Sepia plangon* Gray, 1849: shell (L. = 95.5 mm), Flinders Beach, near Amity, Stradbroke I., Qld, June 1973, WAM 802-75.

Fig. 3: *Sepia rozella* (Iredale, 1926): shell (L. = 106 mm), Flinders Beach, near Amity, Stradbroke I., Qld, June 1973, WAM 809-75.

Fig. 4: *Sepia smithi* Hoyle, 1885: shell (L. = 127 mm), 33 km and 320° from Darwin, N.T., September 1965, WAM 873-75.



PLATE 7

Sepia novaehollandiae Hoyle, 1909

Fig. 1: ♂ (M.L.d. = 132 mm), off Naval Base, Cockburn Sound, W.A., 6 m, August 1958, WAM 415-65.

Fig. 2: Idem, left tentacular club (L. = 25 mm).

Fig. 3: Shell of ♀ (L. = 73 mm), Cockburn Sound, off Rockingham and Kwinana, W.A., February 1970, WAM 866-75.

Fig. 4: Shell (L. = 55.3 mm), Sorrento Beach, Perth, W.A., November 1965, WAM 29-76.

Fig. 5: Shell (L. = 35 mm), same locality as Fig. 4.

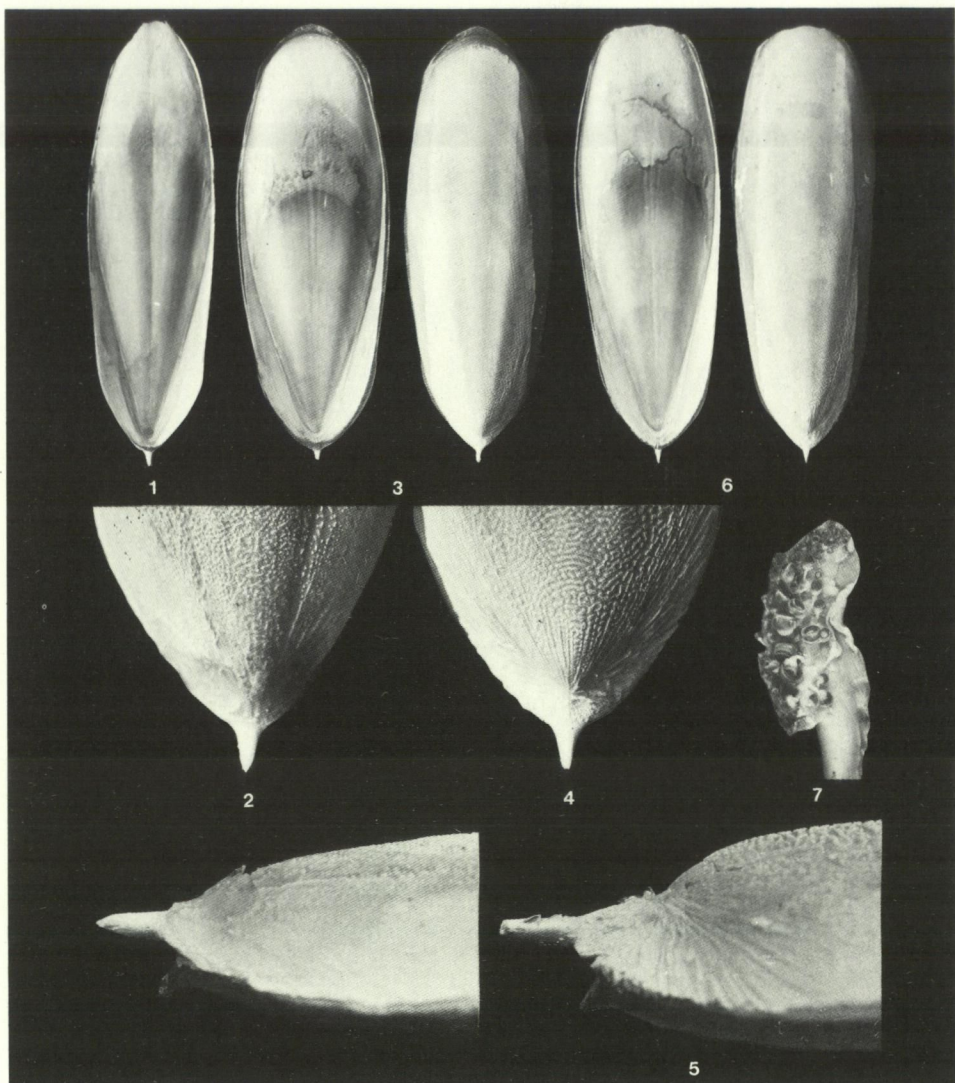


PLATE 8

Fig. 1: *Sepia novaehollandiae* Hoyle, 1909: Shell of ♀ (L. = 153 mm), 60 km NW of Cape Cuvier, W.A., 155-172 m; July 1972, WAM 876-75.

Fig. 2: Idem, enlarged detail of posterior end of shell (Fig. 1).

Fig. 3: *Sepia irvingi* Meyer, 1909: Shell of ♀ (L. = 150 mm), 60 km NW of Cape Cuvier, W.A., 156-181 m, July 1972, WAM 875-75.

Fig. 4: Idem, enlarged detail of posterior end of shell (Fig. 3).

Fig. 5: Enlarged detail of shell of ♂ (L. = 175 mm), same locality as Figs 3-4.

Fig. 6: Shell of ♂ (L. = 155 mm), same locality as Figs 3-5.

Fig. 7: Right tentacular club (L. = 35 mm) of ♂ (M.L.d. = 155 mm), same locality as Figs 3-6.



PLATE 9

Fig. 1: *Sepia apama* Gray, 1849: shell of juv. spec. (L. = 61 mm), Armstrong Pt., Rottneest I., W.A., March 1958, WAM 423-65.

Fig. 2: *Sepia elliptica* Hoyle, 1885: shell of ♀ (L. = 49 mm), Aru I., Indonesia, June 1971, 2-6 m, WAM 857-75.

Fig. 3: *Sepia mestus* Gray, 1849: shell (L. = 68.2 mm), Flinders Beach, near Amity, Stradbroke I., Qld, June 1973, WAM 810-75.

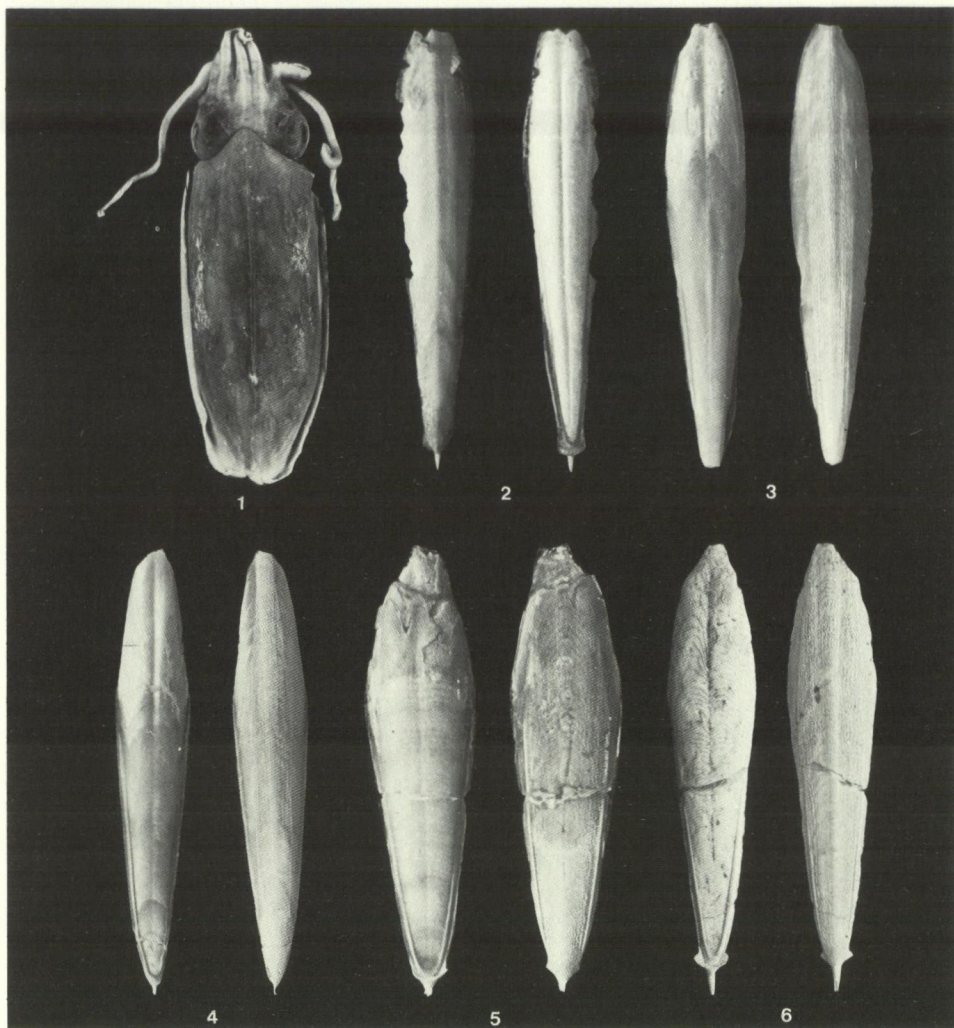


PLATE 10

Fig. 1: *Sepia braggi* Verco, 1907: ♀ (M.L.d. = 56 mm), Cockburn Sound, off Rockingham and Kwinana, W.A., February 1958, WAM 871-75.

Fig. 2: *Sepia braggi* Verco, 1907: shell (L. = ± 50 mm), South Australia (Manchester Museum).

Fig. 3: *Sepia braggi* Verco, 1907: shell of ♀ (L. = 58 mm), NE of Rottnest I., W.A., 34 m, September 1965, WAM 437-65.

Fig. 4: *Sepia braggi* Verco, 1907: shell of ♂ (L. = 46 mm), 31°56.8'S, 115°29.4'E to 31°51.8'S, 115°35.3'E, W.A., 38 m, February 1972, WAM 855-75.

Fig. 5: *Sepia vercoi* sp. nov.: shell of ♂ (holotype) (L. = 31 mm), 25°31'S, 112°29'E, W of Shark Bay, W.A., 130 m, October 1963, WAM 441-65.

Fig. 6: *Sepia vercoi* sp. nov.: dry shell (paratype) (L. = 50.5 mm), 24°04'S, 112°59'E, NW of Carnarvon, W.A., 138 m, October 1963, WAM 772-75.

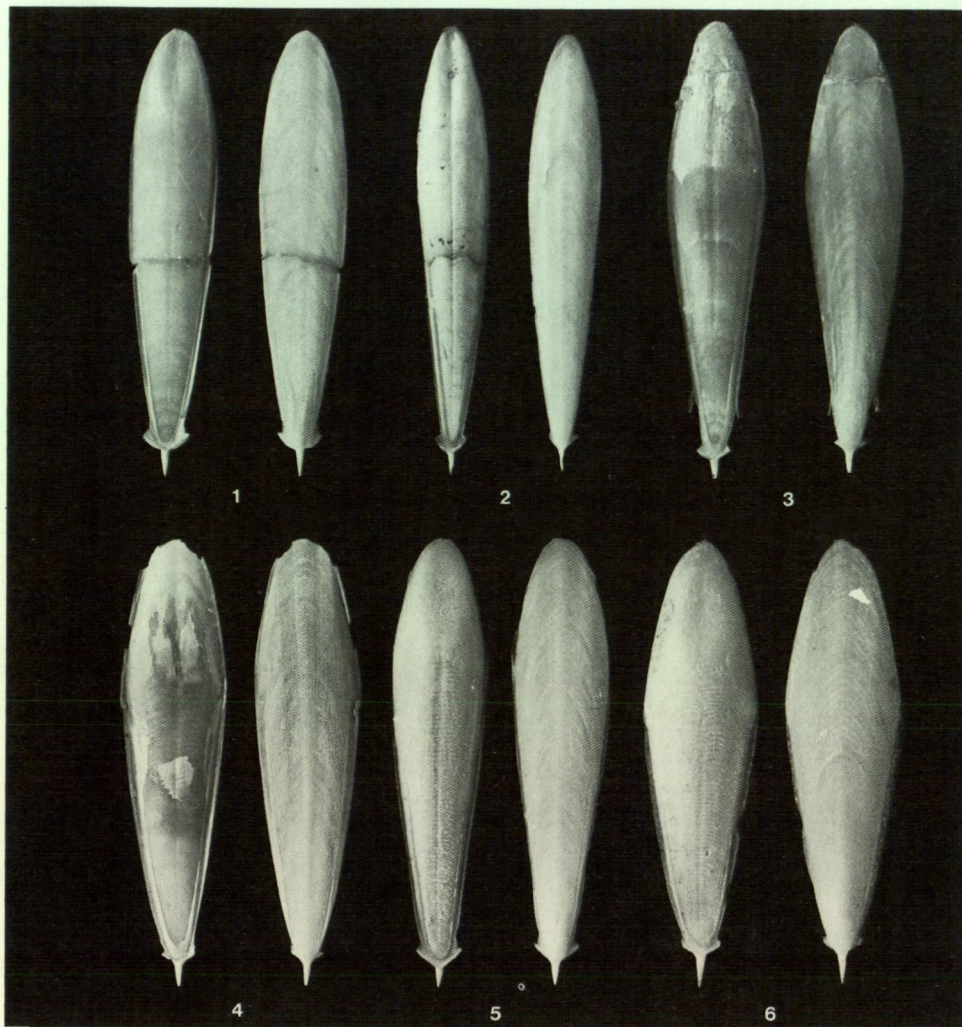


PLATE 11

Sepia cottoni sp. nov.

Fig. 1: Shell of ♂ (holotype) (L. = 43.5 mm), 31°05'S, 114°55'E, W of Lancelin W.A., 114-122 m, February 1964, WAM 435-65.

Fig. 2: Shell (L. = 64.6 mm), Cottesloe Beach, Perth, W.A., July 1928, WAM 13595.

Fig. 3: Shell of ♀ (L. = 43 mm), 27°40'S, 113°20'E, NW of Bluff Pt., W.A., 130 m, October 1963, WAM 424-65.

Fig. 4: Shell of ♀ (L. = 41 mm), 23°39'S, 113°11'E, SW of Pt Cloates, W.A., 134 m, October 1963, WAM 494-76.

Fig. 5: Shell (L. = 34.3 mm), Cottesloe Beach, Perth, W.A., July 1928, WAM 13596.

Fig. 6: Shell (L. = 27.3 mm), Cottesloe Beach, Perth, W.A., July 1928, WAM 13597/13607.

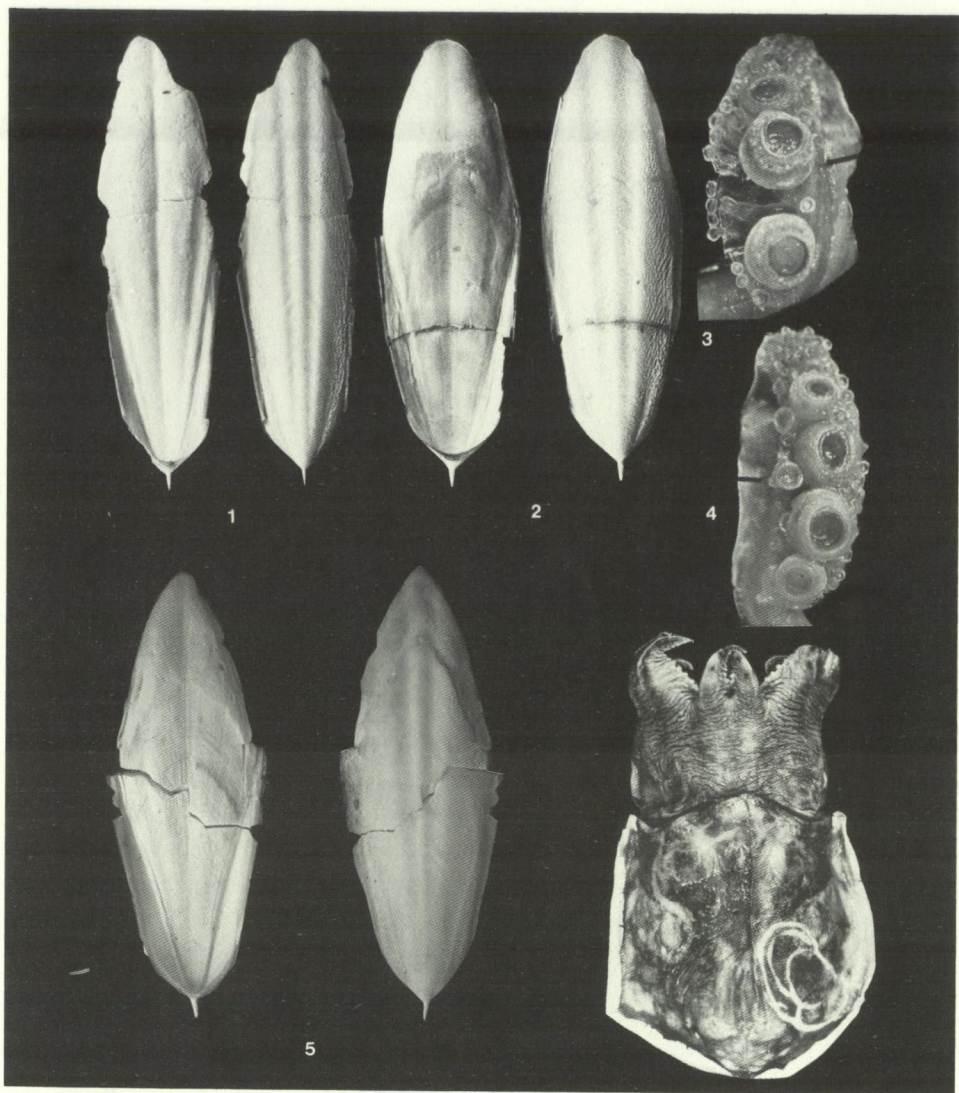


PLATE 12

Fig. 1: *Sepia rex* (Iredale, 1926): shell (L. = 94 mm), Thevenard I., W.A., WAM 492-65.

Fig. 2: *Sepia rex* (Iredale, 1926): shell of ♀ (L. = 71 mm), 25°54'S, 112°31'E, W of Dirk Hartog I., W.A., 128-132 m, February 1964, WAM 420-65.

Fig. 3: Idem, right tentacular club (L. = 13 mm) of the same ♀ (Fig. 2).

Fig. 4: Idem, left tentacular club (L. = 13 mm) of the same ♀ (Fig. 2).

Fig. 5: *Sepia jaenschi* (Cotton, 1931): shell (holotype) (L. = 101.9 mm), Robe, S.A.

Fig. 6: *Sepia* (*Metasepia*) *pfefferi* Hoyle, 1885: ♀ (M.L.d. = 44 mm), Shark Bay, W.A., September 1963, WAM 466-65.

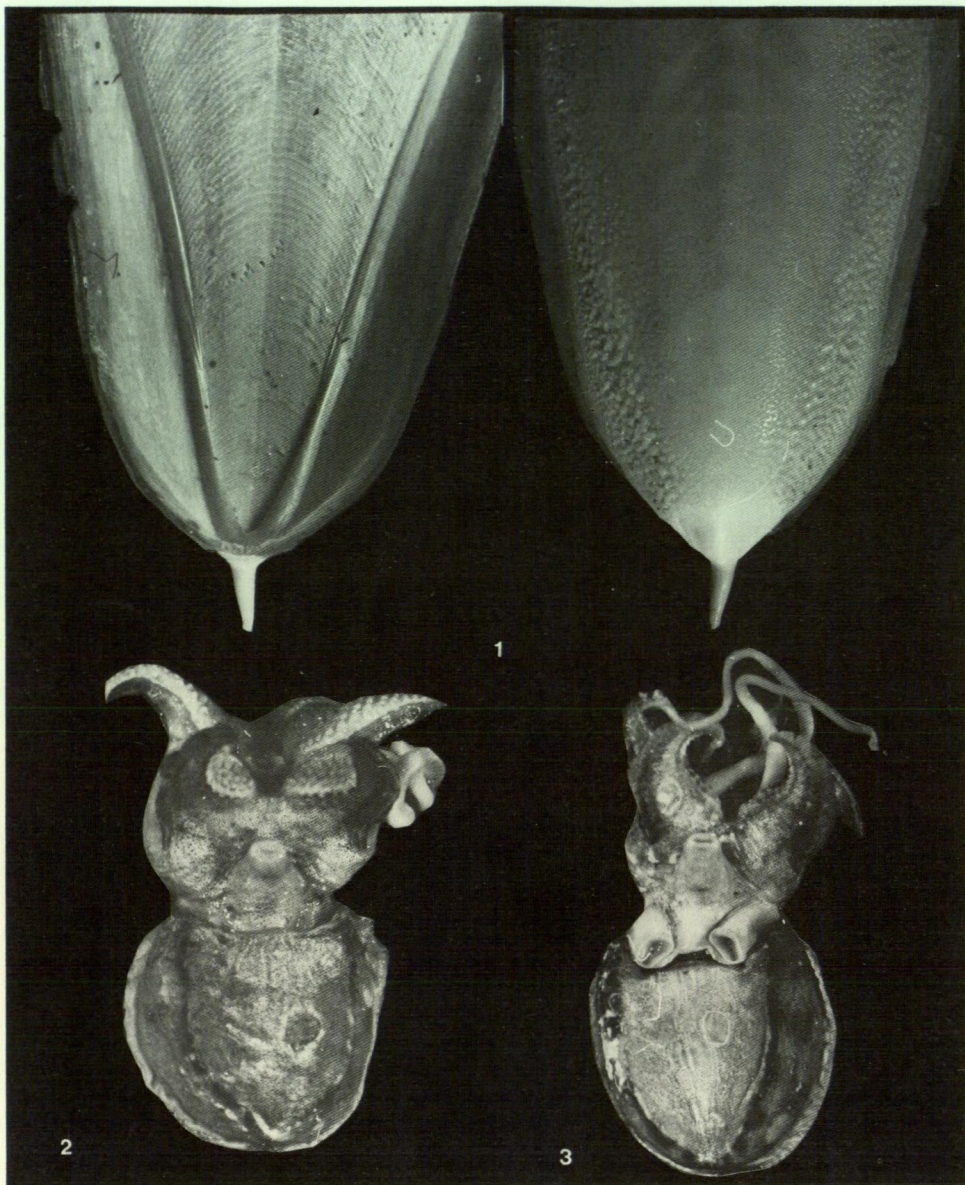


PLATE 13

Fig. 1: *Sepia jaenschi* (Cotton, 1931): enlarged details of posterior end of shell (holotype) (L. = 101.9 mm) (see Plate 12, Fig. 5), Robe, S.A.

Fig. 2: *Sepia (Metasepia) pfefferi* Hoyle, 1885: ♀ (M.L.d. = 16 mm), SW of Jurien Bay, 30°38'S, 114°47'E, W.A., 110 m, December 1970, WAM 856-75.

Fig. 3: *Sepia (Metasepia) pfefferi* Hoyle, 1885: ♀ (M.L.d. = 27 mm), W of Mandurah, W.A., 32°33'S, 115°04'E, 110 m, November 1970, WAM 859-75.

SEPIA CULTRATA HOYLE, 1885

(Plate 5, Figs 1-4)

- Sepia cultrata* Hoyle, W.E., 1885: 198; 1885a: 303; 1886: 133, pl. XX
Whitelegge, Th., 1889: 282
Brazier, J., 1892: 12
Chapman, F., 1912: 25
Hedley, Ch., 1918: M33
Adam, W. & Rees, W.J., 1966: 58, pl. 17, fig. 99-100
- Sepia capensis* var. Gray, J.E., 1849: 110 (*non* d'Orbigny, 1835)
- Glyptosepia cultrata* Iredale, T., 1926: 192, pl. XXII, fig. 5-6; 1954: 73
Garrard, T.A., 1961: 36
Iredale, T., & McMichael, D.F., 1962: 99
- Glyptosepia macilenta* Iredale, 1926: 192, pl. XXII, fig. 3-4; 1954: 73; 1955:
78-79
- Glyptosepia gemellus* Iredale, T., 1926: 192, pl. XXII, fig. 1-2; 1954: 73
Iredale, T. & McMichael, D.F., 1962: 99
MacPherson, J.H. & Gabriel, C.J., 1962: 409
- Glyptosepia hedleyi* (*non* Berry, 1918), Verco, J.C. & Cotton, B.C., 1928:
127
Cotton, B.C., 1929: 89, pl. XVI, fig. 3-4; 1931: 41, fig. 7-8
MacPherson, J.H. & Gabriel, C.J., 1962: 409
- Sepia (Glyptosepia) hedleyi* (*non* Berry, 1918), Cotton, B.C. & Godfrey,
F.K., 1940: 434, fig. 424 (*non* fig. 422, 423, 425)

Type localities

Off Twofold Bay, Australia, 36°59'S, 150°20'E (*S. cultrata*); Sydney (*S. capensis* var.); Manly Beach, N.S.W. (*G. macilenta*); Manly Beach, N.S.W. (*G. gemellus*).

Geographical distribution

Recorded from southern Queensland, New South Wales and Victoria in eastern Australia. In this study the species is recorded at localities between Fremantle and the Houtman Abrolhos in Western Australia.

MATERIAL

Dry specimens

- 1 Cottesloe Beach, Perth, W.A.; mixed lot of 25 specimens: July 1928; WAM 1290-76 and February 1928; WAM 1291-76 (Plate 5, Fig. 1).
- 2 Rottnest I.(?), W.A.; (a) WAM 474-65: 5 spec.; (b) WAM 394-76: 5 spec. (Plate 5, Figs 3-4).
- 3 Cottesloe Beach, Perth, W.A.; (a) WAM 472-65: 5 spec. + 1 broken shell (Plate 5, Fig. 2); (b) WAM 395-76: 1 small spec. (identification doubtful).
- 4 Sorrento Beach, Perth, W.A.; November 1965; (a) WAM 396-76: 5 juv. spec. + broken shells; (b) WAM 512-65: 2 spec. + 1 broken shell.
- 5 S of Naval Base Groyne, Cockburn Sound, W.A.; September 1965; WAM 505-65: 2 spec.
- 6 Ocean Beach, Augusta, W.A.; March 1975: WAM 779-75: 1 spec.
- 7 West End, Rottnest I., W.A.; June 1974; WAM 397-76: 3 spec.
- 8 NW side of North I., Houtman Abrolhos, W.A.; August 1974; WAM 787-75: 1 spec.
- 9 No data WAM 469-65: 4 spec.

Description

The shell is elongate oval, attaining its greatest width in front of the middle; its anterior margin forming a triangle which is short in the small specimens (Plate 5, Figs 3-4) with straight lateral sides and a rounded median angle, but which becomes gradually longer, with concave sides, in the larger specimens (Plate 5, Figs 1-2). The posterior two-thirds of the shell become gradually narrower, forming a rounded posterior angle, which is continued by a strong spine, which is slightly curved upwards and possesses a strong ventral and a strong dorsal keel; sometimes the latter is strongest, sometimes the former. The dorsal surface is cream-coloured or salmon-coloured, rather flat in its anterior part with a more or less distinct, rather narrow median rib and two indistinct lateral ribs; moreover the whole dorsal surface shows numerous faint thread-like longitudinal ribs. In the posterior part, all the ribs become gradually fainter and disappear completely near the spine. There is also a faint granulation, partially arranged along the reversed V-shaped growthlines. On the white dorsal part of the outer cone, the granulation is stronger and forms a more or less reticulate pattern. At each side the outer cone is separated from the remaining part of the dorsal surface by a calcareous ridge.

The ventral surface is rather flat, concave in the extreme posterior part of the striated zone, slightly convex in its anterior part, with at each side, near

the lateral margin, a faint longitudinal depression. The striated area possesses a weak median sulcus in the very small specimens, but it disappears generally in the larger ones, although a very narrow sulcus may subsist; the striae are weakly convex. The last loculus shows a faint median depression and the continuation of the lateral depressions of the striated area. The limbs of the inner cone are narrow and almost completely fused with the outer cone, except in the posterior part where they form a rounded rim surrounding the posterior depression. The outer cone is very narrow in its anterior part, wider in the posterior portion, and continuous between the inner cone and the spine.

There is a good deal of variation in the relative width of the shell and in the shape of the anterior margin; probably the females have a wider shell than the males and the very small shells are much wider than the larger ones.

Remarks

Although the dry shells seem to be rather common, the present collection from Western Australia did not contain any animals. Adam & Rees (1966: 58) redescribed the female holotype of *Sepia cultrata*. Garrard (1961: 36) mentioned two live specimens of this species, collected east of Newcastle, N.S.W., but unfortunately did not describe them. The above-described shells correspond with the description given by Adam & Rees, which was based on the incomplete shell of the holotype and the shell from Sydney, which J.E. Gray had identified as '*Sepia capensis* var.' and which Hoyle (1886: 136) supposed already to be a variety of *Sepia cultrata*.

On the other hand, the above-described shells belong certainly to the species which Verco & Cotton (1928: 127), Cotton (1929: 89; 1931: 41) and Cotton & Godfrey (1940: 434) identified as *Sepia hedleyi*. Berry (1918: 258, pl. LXXI, LXXII) described the latter species from the following localities: Investigator St. Area, S of Kangaroo I., S.A.; Great Australian Bight; and S of Eucla, Great Australian Bight, W.A. Unfortunately the shell was absent or fragmentary in all the specimens he studied and he could only give a reconstruction of it (pl. LXXII, fig. 2) which certainly resembles that of the type of *Sepia cultrata* and the above-described shells. But *Sepia cultrata* and *Sepia hedleyi* cannot be synonymous, because the animals are different, the former having a tentacular club with small subequal suckers arranged in about five longitudinal series, whereas the second species has much smaller suckers arranged in about twelve series. More animal material is necessary to establish the status of both species, and especially of *Sepia hedleyi*.

TABLE 5
Measurements of *Sepia cultrata*. Shell (in % of shell-length).

Loc.	L. in mm	W.	Th.	Str.z.	Spine	Loc	L. in mm	W.	Th.	Str.z.	Spine
4b	120	34	8.5	70	8.3	1	90	31	7.2	65	8.9
1	112.7	32	8.0	67	8.0	2a	89.7	33	7.3	67	7.8
5	112.5	32	8.0	70	6.2	1	89	35	8.4	68	8.8
3a	112.3	34	7.7	68	6.4	9	88	33	6.8	67	6.2
5	110.6	34	8.2	67	7.4	1	87.5	32	7.8	66	6.3
1	110.5	34	8.2	68	7.7	9	87	32	7.2	69	7.5
1	110.5	33	8.4	68	6.3	3a	85.4	33	8.2	61	8.2
1	109.5	35	8.9	69	6.9	9	84	35	8.2	70	7.1
1	108.5	36	7.4	69	6.9	1	82.3	32	7.9	65	8.5
3a	108.3	35	8.8	65	6.5	2a	82	34	8.5	67	7.1
1	107.3	34	10.1	63	7.0	2a	82	34	7.9	65	7.1
1	107	34	8.7	65	7.0	1	79.5	34	8.2	65	8.1
9	107	34	8.3	66	7.5	3a	78.2	31	7.9	65	6.3
1	106.6	37	9.7	64	8.0	1	75.5	34	9.3	65	6.0
1	104.8	34	8.6	67	7.1	1	71.3	38	7.7	66	7.7
1	103	34	8.2	67	6.3	6	63	37	8.8	68	—
1	103	33	8.1	68	7.8	3a	58.4	37	8.6	58	6.3
1	101	37	9.4	66	6.4	2b	30.6	47	10.8	62	4.9
1	100.7	31	7.9	64	7.4	7	28	50	8.9	68	3.6
1	100.4	30	7.9	66	8.1	2b	26	46	10.8	61	—
1	100	34	10.7	65	7.8	4a	24.8	48	9.3	60	—
2a	98	35	8.7	69	7.1	2b	24.5	48	13.0	61	—
8	97	37	9.3	65	8.2	2b	23.5	47	9.8	64	—
2a	91.3	33	7.9	66	5.9	4a	19	53	7.9	68	—
1	91	34	8.0	69	7.1	2b	18	53	11.6	61	—
4b	91	37	9.9	68	5.5	7	17.5	53	12.6	60	—
1	90	40	11.0	70	—	3b	14	57	11.4	64	—

TABLE 6

Measurements of the species of *Glyptosepia*, given by Iredale (1954: 72-74)

<i>S. hedleyi</i>		<i>S. gemellus</i>		<i>S. gemellus</i> ¹ (Betka River mouth)		<i>S. macilenta</i>		<i>S. opipara</i>	
L. in mm	W. (%)	L. in mm	W. (%)	L. in mm	W.(%)	L. in mm	W. (%)	L. in mm	W. (%)
120	34	109	32	98	33.5	92	30.5	169	27
116	33.5	104	33.5	98	33.5	79	33	151	30
115	35.5	96	36.5	92	35	75	34.5	132	32
110	35.5	95	36	91	36	60	40	68	32.5
107	36.5	90	38	85	31.5	17	53	63	30
106	36.5			85	36.5			56	34
84	31			80	31.5				
44	34			78	32				
				77	36.5				
				77	32.5				
				76	33				
				75	33				
				74	32.5				
				64	34.5				
	31-36.5%		32-38%		31.5-36.5%		30.5-53%		27-34%

- 1) About these specimens, Iredale (1954: 73) states that they appear referable to *gemellus* and that the figures agree 'fairly well with those of a typical series, but also suggesting the later suppression of *macilenta*'.

Iredale (1926: 191) created a new genus, *Glyptosepia*, for species without an inner cone and without a ventral sulcus. In the descriptions of the three new species *G. opipara*, *G. gemellus* and *G. macilenta*, this author repeats these characters, but the figures (pl. XXII, fig. 7-8, fig. 1-2 and fig. 3-4) show an inner cone and a ventral sulcus. As to the first character, there does not exist a single species of *Sepia* without an inner cone. As to the ventral sulcus, many of the above-described specimens show a very narrow and shallow median groove and it is possible that in the figures of Iredale's species, this groove has been exaggerated by the artist.

Sepia opipara and *Sepia gemellus* have been described (Iredale, 1926: 191 and 192) as being about twice as long as broad, whereas according to the above-mentioned measurements (Table 6), given by the author himself (1954: 72-74), the width varies between 27 and 34% of the length in *Sepia opipara*, and between 31.5 and 38% in *Sepia gemellus*. Iredale (1954: 73) compared *Sepia gemellus* and *Sepia hedleyi* (*sensu* Cotton) and stated about the latter species: 'It will be noted that all these bones are larger and broader than the broadest eastern shells of *gemellus*'. This statement is again in contradiction with his own figures, as he gives the width of the shells of *Sepia hedleyi* as being 31-36.5% of the length.

Under *Sepia macilenta* he mentions a possible sexual difference in the proportions: 'On this subject it may be noted that when *hedleyi* was proposed on animals, no distinct characters for separating the sexes were indicated, and the broad bone was taken from a male. It should be added that this form approaches nearest the missing *cultrata* in proportions, but *cultrata* was almost as narrow, and it was from a female.' In fact Berry (1918: 259) described the hectocotylized arm of *Sepia hedleyi*, and the reconstructed shell (pl. LXXII, fig. 2) was of a female specimen with a dorsal mantle-length of 91 mm. According to the original figure, the width of this shell is 35% of the length. Iredale (1954: 73) concludes his observations with the following statement: 'So until animals are well studied it is best to allow *cultrata* to remain in suspense, and use *hedleyi*, *gemellus* and *macilenta*, noting the far west *hedleyi* have larger and broader bones'. This statement is not substantiated by his own figures. Iredale (1955: 79) arrived at the conclusion, speaking about *Sepia cultrata*: 'the type bone did not essentially disagree with the variety, and both are undoubtedly the local shell which I named *macilenta*, so that *cultrata* can be reinstated, and *macilenta* dropped as a synonym of *Glyptosepia cultrata*'. 'This still leaves unresolved the status of *gemellus*, which agrees closely but is a broader shell, even as the southern and western *hedleyi*'.

According to Adam & Rees (1966: 59) 'The original figures of *Glyptosepia macilenta* Iredale (1926: 192, pl. XXII, fig. 3 & 4) represent an entirely different species, which cannot be considered to be identical with *Sepia cultrata*.' After having examined the numerous shells which belong certainly to *Sepia hedleyi* as several Australian authors understood this species, I believe, as mentioned above (p. 160) that the original figure of the ventral surface of the shell of *Sepia macilenta* does not give an exact idea of this species and that, in fact, *Sepia macilenta* is a synonym of *Sepia cultrata*. On the other hand, a comparison of the numerous above-described shells with Iredale's figures of *Sepia gemellus* and *Sepia macilenta*, does not permit a specific separation of these three species.

As to '*Glyptosepia opipara* Iredale, 1926', I cannot give an opinion about its status without having seen any material. According to Iredale (1954: 72) 'This beautiful bone is so far only known from Queensland, drifted bones from New South Wales as far south as Sydney, and Lord Howe Island. It is one of the most brittle of all bones, the majority being broken. It is easily recognisable by its form, its strongly sculptured back and its deep dorsal coloration, with its long spine.'

SEPIA ELLIPTICA HOYLE, 1885

(Plate 9, Fig. 2)

Sepia elliptica Hoyle, W.E., 1885: 189; 1885a: 293; 1886: 131, pl. XIX, fig. 14-24

Brazier, J., 1892: 13

Massy, A.L., 1916: 226

Adam, W., 1939: 72

Adam, W. & Rees, W.J., 1966: 14, pl. 5, fig. 24-27; pl. 43, fig. 258

Acanthosepion (Fiscisepia) ellipticum adjacens Iredale, T., 1926a: 239, pl. XXXV, fig. 5-6; 1954: 77

Iredale, T. & McMichael, D.F., 1962: 99

Acanthosepion ellipticum Iredale, T., 1954: 77

?*Acanthosepion whitleyanum* Iredale, T., 1926: 195, pl. XXIII, fig. 9-10; 1954: 76

Iredale, T. & McMichael, D.F., 1962: 99

?*Sepia whitleyana* Adam, W. & Rees, W.J., 1966: 16, pl. 6, fig. 28-29

?*Sepia dannevigii* Berry, S.S., 1918: 264, text fig. 51-55, pl. LXXIII; pl. LXXIV, fig. 1-2

Type localities

Challenger Sta. 188, 9°59'S, 139°42'E, Arafura Sea, S of Papua, 28 fms [green mud], 10-IX-1874; Challenger Sta. 190, 8°56'S, 136°5'E, Arafura Sea, S of Papua, 49 fms [green mud], 12-IX-1874 (*Sepia elliptica*); Northwest Islet (subsp. *adjacens*); Port Macquarie, N.S.W. (*Sepia whitleyana*); Investigator Strait area, S of Kangaroo Island, S.A. (*Sepia dannevigii*).

Geographical distribution

Indo-West Pacific; northern Australia southwards to at least the Exmouth Gulf area in Western Australia and southern Queensland (Capricorn Group) on the east coast. (If the names *S. whitleyana* and *S. dannevigii* are correctly placed in the synonymy then the species' range must include New South Wales, South Australia and the southwestern coast of Western Australia.)

MATERIAL

Spirit specimens

- 1 Aru Is, Indonesia, 2-6 m, mud bottom; June 1971; WAM 857-75: 1 ♀ (Plate 9, Fig. 2).
- 2 Joseph Bonaparte Gulf, W.A. (13°43.5'S, 128°38.6'E), 62 m; December 1969; WAM 872-75: 3 ♀.
- 3 Joseph Bonaparte Gulf, W.A. (13°54.8'S, 128°33'E), 52 m; December 1969; WAM 874-75: 2 ♀, 1 ♂.

Dry specimens

- 4 Onslow Beach, W.A.; September 1958; WAM 489-65: 3 spec.
- 5 Thevenard I., W.A.; WAM 493-65: 3 spec.
- 6 Passage I. in Mary Ann Passage, S of Barrow I., W.A.; September 1958; WAM 495-65: 4 spec.
- 7 Barrow I., W.A.; September 1958; WAM 497-65: 1 spec.
- 8 Pasco I., S of Barrow I., W.A. (20°55'S, 115°20'E); August 1966; WAM 774-75: 1 spec.
- 9 Cockatoo I., W.A.; August 1968; WAM 775-75: 1 spec.
- 10 Cape Wessel, Northern Territory; WAM 777-75: 2 spec.
- 11 Coburg Peninsula(?), Northern Territory; WAM 778-75: 4 spec.
- 12 Kendrew I., Dampier Arch., W.A. (20°28'30"S, 116°32'E); 1973; WAM 841-75: 17 spec.

TABLE 7
Measurements of *Sepia elliptica*.

7a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a	S.t.
3	♂	71	91	56	38	30	49	91	14	42	49	49	58	180	22.5	1.8	0.6
3	♀	84	82	—	—	39	51	95	12	36	36	42	48	140	21.5	1.4	0.5
3	♀	78	86	56	33	36	49	94	13	38	42	42	49	—	—	1.5	—
2	♀	75	88	—	—	29	41	88	8	40	47	47	49	160	20	1.6	0.5
2	♀	72	83	64	29	25	49	93	12	49	44	44	47	—	21	1.7	0.6
2	♀	60	88	55	32	41	—	90	10	42	50	50	50	—	21.5	1.7	0.5
1	♀	49	86	51	37	33	47	96	10	33	33	33	41	82	16	1.6	0.4

7b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
6	—	106.5	41	9.5	71	3.3	12	—	76	43	9.9	68	5.3
4	—	106	42	8.7	70	3.3	12	—	75	41	9.3	61	5.3
5	—	104.5	42	9.1	70	3.8	2	♀	75	45	11.4	59	4.0
6	—	101.4	43	9.9	73	3.2	8	—	74.5	42	8.7	71	5.4
7	—	96	43	9.4	67	—	5	—	73	43	10.7	59	5.5
5	—	95	40	8.8	—	3.7	11	—	72.5	42	8.3	69	4.8
6	—	91.4	45	9.3	68	3.8	2	♀	72	43	11.1	58	4.2
12	—	90	42	9.1	74	4.4	12	—	72	44	9.7	61	4.2
12	—	85	43	9.4	74	—	3	♂	71	41	10.6	69	—
3	♀	84	45	11.4	64	3.6	12	—	71	39	8.5	73	5.6
10	—	84	44	8.9	71	4.8	4	—	70	42	10.3	66	5.0
12	—	83.5	42	9.0	76	4.8	12	—	70	41	10.0	60	5.0
12	—	82	43	9.9	67	—	12	—	70	46	10.0	60	5.0
6	—	80	39	9.1	71	3.7	12	—	66	42	9.1	63	4.5
3	♀	78	42	10.5	64	3.8	12	—	66	41	9.1	71	6.1
12	—	78	44	9.6	67	—	11	—	62.5	41	8.8	67	4.8
10	—	77.5	44	9.7	70	5.1	2	♀	60	44	10.3	60	—
11	—	77.5	45	10.8	68	5.1	12	—	60	42	9.2	60	5.0
12	—	77	44	9.7	71	3.9	1	♀	49	42	9.2	57	5.1
12	—	77	43	10.4	62	5.2	9	—	46	46	10.4	56	6.5
4	—	76.4	44	9.7	64	3.9							

7c: Literature records

Loc.	L. in mm	W. (%)	Reference
North-west I., Qld	105	44	Holotype <i>Sepia elliptica adjacens</i> (Iredale, 1926a: 239)
Melville Island	99	43.5	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Melville Island	98	43	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Melville Island,	97	38	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Melville Island	47	42.5	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Low Island, Qld	106	41.5	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Low Island, Qld	101	44.5	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Low Island, Qld	99	45.5	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Low Island, Qld	49	47	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Broome, W.A.	80	46	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Broome, W.A.	80	44	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Broome, W.A.	68	47	<i>Sepia elliptica</i> (Iredale, 1954: 77)
Port Macquarie, N.S.W.	168	38.5 ¹	Holotype <i>Sepia whitleyana</i> (Iredale, 1926: 195)
Bribie Island, Qld	235	33	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	114	37	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	102	40	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	90	38	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	50	42	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	43	47.5	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	34	53 ²	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	30	46.5	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Michaelmas Cay	26	38.5	<i>Sepia whitleyana</i> (Iredale, 1954: 76)
Caloundra, Qld	89	42	? <i>Sepia whitleyana</i> (Adam and Rees, 1966: 16)

¹ In the original description, Iredale (1926: 195) states that the dimensions of the holotype are 168 x 65 mm; in his later description (1954: 76) he mentions them as being 168 x 56 mm. Compared with the original figure (pl. XXIII, fig. 9-10) the former statement seems to be the correct one.

² Owing to a typographical error, Adam and Rees (1966: 17) cited this width as 47%.

Description

The animals correspond with the original description, with the exception of the tentacular club, which as Adam & Rees (1966: 15) stated, is covered with 10 to 12 longitudinal series of minute suckers. In the larger specimens the protective membranes are fused at the base of the club, but in the smaller ones they seem to be separated; the state of preservation does not always allow a decision. As in the male types, the hectocotylus has seven or eight transverse rows of normal suckers at the base, followed by about seven rows of transformed suckers, the ventral ones being only slightly smaller while the dorsal ones are considerably smaller than the normal ones.

The shells are typical and show especially the characteristic posterior part of the inner cone, which is raised as a flat, rather thin ledge, with a thickened rim from which radiate a few ribs towards the outer cone (Plate 9, Fig. 2).

Remarks

Adam & Rees (1966: 16) have discussed the status of this species and the differences between it and *Sepia esculenta* Hoyle, 1885. The latter species seems to attain a much larger size, which may explain certain differences, but much more material of both species is needed to establish their relationship.

In the same paper, Adam & Rees (1966: 16, pl. 6, fig. 28, 29) described and figured a shell from Caloundra, which Cotton had identified as *Sepia whitleyana* (Iredale, 1926). This shell does not differ at all from the above-mentioned shells of *Sepia elliptica*. In fact I do not believe that this shell belongs to *Sepia whitleyana*. The latter species seems to be more closely related to *Sepia smithi* Hoyle, 1885, and may even be a synonym of this species; a decision is only possible by the study of the original material of Iredale's species.

As to *Sepia dannevigii* Berry, 1918, the shell of which is unknown, the author stated (p. 267) that 'in most characters, with the exception of the unknown cuttlebone, it stands apparently nearest to *S. elliptica*. They can scarcely be identical, however, since the latter is not only from a different faunal area, but is described as having subequal arms and only eight series of tentacular suckers, the horny rings of which are smooth.' In fact, the arm length may vary a good deal owing to contraction during preservation; *Sepia elliptica* has also ten to twelve series of tentacular suckers, and the latter have their chitinous rings dentate as in *Sepia dannevigii*. The only difference seems to be the geographical distribution and the unknown shell. Only the collection of topotypical material can solve the problem.

SEPIA SMITHI HOYLE, 1885

(Plate 4, Fig. 6; Plate 6, Fig. 4)

Sepia smithi Hoyle, W.E., 1885: 190; 1886: 21, 124, pl. 16, fig. 1-12

Brazier, J., 1892: 11

Adam, W., 1939: 78

Adam, W. & Rees, W.J., 1966: 19, pl. 7, fig. 34-35; pl. 41, fig. 239

Acanthosepion smithi Iredale, T., 1954: 77

Acanthosepion pageorum Iredale, T., 1954: 76, pl. IV, fig. 7-9

Sepia pageora Adam, W. & Rees, W.J., 1966: 20, pl. 7, fig. 36-37; pl. 42, fig. 253

Sepia indica Gray, J.E., 1849: 108 (*non* d'Orbigny, 1848)

Type localities

Challenger Sta. 188, 9°59'S, 139°42'E, Arafura Sea, S of Papua, 10-IX-1874, 28 fms [green mud], (*Sepia smithi*); Keppel Bay, Queensland (*Sepia pageora*).

Geographical distribution

Northern Australia and New Guinea; southwards to Shark Bay in Western Australia and Keppel Bay in Queensland.

MATERIAL

Spirit specimens

- 1 Shark Bay, W.A.; early 1966; WAM 398-76: 1 ♂ (Plate 4, Fig. 6).
- 2 33 km and 320° from Darwin, N.T.; September 1965; WAM 873-75: 4 spec. (Plate 6, Fig. 4).

Dry specimens

- 3 Onslow Beach, W.A.; September 1958; WAM 488-65: 3 spec.
- 4 Lowendahl I., NNE of Onslow, W.A.; WAM 490-65: 1 spec.
- 5 Thevenard I., N of Onslow, W.A.; WAM 400-76: 1 spec.
- 6 Passage I., Mary Ann Passage, S of Barrow I., W.A.; September 1958; (a) WAM 494-65: 1 spec.; (b) WAM 401-76: 1 spec.
- 7 South Pasco I., S of Barrow I., W.A. (20°55'S, 115°20'E); August 1966; WAM 399-76: 2 spec.
- 8 Barrow I., W.A.; August-September 1966; WAM 776-75: 1 spec.
- 9 Flinders Beach near Amity, Stradbroke I., Qld; June 1973; WAM 780-75: 1 spec.
- 10 Kendrew I., Dampier Arch., W.A. (20°28'30"S, 116°32'E); (a) November 1974; WAM 845-75: 1 spec.; (b) February 1974; WAM 847-75: 1 spec.; (c) 1973; WAM 848-75: 3 spec.

Description

Of the five spirit specimens only the young male from Shark Bay (Loc. 1) is well preserved. It agrees with the syntypes of *Sepia smithi*, redescribed by Adam & Rees (1966: 19) and with the male specimen from Cape Upstart, which these authors mentioned under *Sepia pageora*. As the specimen from Shark Bay is smaller than the one from Cape Upstart, a slight difference in the hectocotylus may be attributed to its youth. In fact the first specimen has only six transverse rows of smaller suckers, which in each row are grouped in two marginal pairs, the ventral suckers being smaller than the dorsal ones.

TABLE 8

Measurements of *Sepia smithi*

8a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.cl.	S.a.	S.t.
1	♂	74	91	50	35	31	40	96	12	34	34	34	34+	27	1.5	0.5

8b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
7	—	165	33	7.0	80	3.0	9	—	110	39	8.7	72	3.6
4	—	147	35	9.1	73	5.4	10c	—	105	35	7.6	73	4.3
6b	—	145 ⁺	37	7.3	78	3.8	3	—	102	34	6.9	74	4.9
3	—	135	35	8.6	77	4.3	2	?	100	32	7.0	76	4.5
7	—	132	37	7.2	77	3.0	6a	—	99	36	6.8	71	4.3
3	—	131.2	37	8.0	74	4.0	10b	—	90	36	6.7	67	4.4
10a	—	130	37	8.0	72	—	10c	—	90	36	7.2	71	5.6
2	?	126	34	7.5	78	—	10c	—	74	40	8.1	70	—
5	—	121	36	7.7	71	4.1	1	♂	72	39	7.5	68	4.9
2	?	114	38	8.3	80	—	2	?	66.5	40	9.8	63	4.5
8	—	111	35	7.4	77	3.6							

8c: Literature records

Loc.	L. in mm	W. (%)	Reference
Lindeman I., Qld	146	35	<i>pageora</i> (Iredale, 1954: 76)
Point Cloates, W.A.	140	36	<i>pageora</i> (Iredale, 1954: 76)
Keppel Bay, Qld	135	37	<i>pageora</i> (Iredale, 1954: 76) (Holotype)
Lindeman I., Qld	124	34	<i>pageora</i> (Iredale, 1954: 76)
Timor Sea	120	33	<i>pageora</i> (Iredale, 1954: 76)
Bucasra Beach, Qld	110	39	<i>pageora</i> (Iredale, 1954: 76)
Lindeman I., Qld	90	37	<i>pageora</i> (Iredale, 1954: 76)
Shark Bay, W.A.	60	42	<i>pageora</i> (Iredale, 1954: 76)
Lindeman I., Qld	58	41	<i>pageora</i> (Iredale, 1954: 76)

Remarks

Without examining the shells, the animals of *Sepia smithi* and *Sepia elliptica* may be easily confused, because of the minute tentacular suckers, but in the former species the tentacular club is relatively much longer, its protective membranes are widely separated at the base and the numerous suckers are disposed in about 20 longitudinal series (Plate 4, Fig. 6), whereas in *Sepia elliptica* the protective membranes are fused at the base of the club and the less numerous suckers are arranged in 10 to 12 series in the middle of the club.

Compared with that of *Sepia elliptica*, the shell of *Sepia smithi* (Plate 6, Fig. 4) is much narrower, the striated area longer and the striae more angular in the anterior portion, the posterior ridge of the inner cone is thicker and rounded, not flattened, and the limbs of the inner cone are situated at the lateral limits of the striated zone, and not in the middle of the smooth marginal areas between the striated zone and the outer cone.

After having studied the above-mentioned material, we do not hesitate any more to consider *Sepia pageora* as a synonym of *Sepia smithi*.

As mentioned on p. 165, *Sepia whitleyana* (Iredale, 1926) seems to be closely related to *Sepia smithi*.

SEPIA PAPUENSIS HOYLE, 1885

(Plate 4, Figs 4-5)

Sepia papuensis Hoyle, W.E., 1885: 197; 1886: 126, pl. 16, fig. 13-23

Brazier, J., 1892: 11

Joubin, L., 1897: 102

- Appelöf, A., 1898: 561
Adam, W., 1939: 85
Voss, G.L., 1963: 35
Adam, W. & Rees, W.J., 1966: 38, pl. 12, fig. 68-69; pl. 42, fig. 250
Sepia prionota Voss, G.L., 1962a: 169; 1963: 24, pl. I, fig. f-g; text fig. 1a-e
Adam, W. & Rees, W.J., 1966: 41, pl. 4, fig. 22-23; pl. 42, fig. 252
Solitosepia occidua Cotton, B.C., 1929: 88, pl. XIV, fig. 1-2
Sepia occidua Adam, W. 1939: 85, pl. I, fig. 5
Sepia galei Meyer, W.Th., 1909: 332, fig. 4-6
Solitosepia submestus Iredale, T., 1926: 238, pl. XXXV, fig. 3-4; 1954: 65
? *Solitosepia genista* Iredale, T., 1954: 66, pl. V, fig. 17-18
? *Solitosepia lana* Iredale, T., 1954: 66

Type localities

Challenger Sta. 188, 9°59'S, 139°42'E, Arafura Sea, S of Papua, 28 fms [green mud], (*S. papuensis*); off Sirun I., Sulu Archipelago, Tawi Tawi Group (*S. prionota*); Rottneet I. (*S. occidua*); Shark Bay, near Brown Station on Dirk Hartog (*S. galei*); Masthead Island (*S. submestus*); Broome, W.A. (*S. genista*); Low Isles, Queensland (*S. lana*).

Geographical distribution

Central Indo-West Pacific (Arafura Sea, Philippines, Ternate, Bali); northern Australia southwards to Fremantle in Western Australia and perhaps on the east coast (if *S. lana* is considered as a synonym).

MATERIAL

Spirit specimens

- 1 120 km NW of Bedout I., W.A., 96 m; October 1962; WAM 419-65: 1 ♂.
- 2 10 km S of Double I., Barrow I., W.A.; September 1958; WAM 425-65: 1 ♂ (Plate 4, Fig. 4).
- 3 W of Rottneet I., W.A. (32°00'S, 115°08'E), 137 m; August 1963; WAM 429-65: 1 juv. spec. (M.L.d. 7 mm).
- 4 W of Kalbarri, W.A. (27°40'S, 113°20'E), 131 m; October 1963; WAM 442-65: 1 juv. spec. (M.L.d. 24 mm) (doubtful identification).

- 5 1 km SW of Doc Can I., Laparan Group, Sulu Arch., Philippines, 56 m; February 1964; WAM 444-65: 1 juv. spec. (M.L.d. 24.5 mm).
- 6 Shark Bay, W.A.; early 1966; WAM 402-76: 2 ♂, 1 ♀ (Plate 4, Fig. 5).
- 7 Monte Bello Is, W.A.; May 1973; WAM 870-75: 1 ♂.

Dry specimens

- 8 Rottneest I.(?), W.A.; WAM 496-76: 2 spec. + 3 broken shells.
- 9 Cottesloe Beach, Perth, W.A.; WAM 478-65: 2 spec.
- 10 Onslow Beach, W.A.; September 1958; WAM 488-76: 4 spec.
- 11 Lowendahl I., NNE of Onslow, W.A.; WAM 491-65: 1 spec.
- 12 Thevenard I., N of Onslow, W.A.; WAM 489-76: 1 spec.
- 13 Barrow I., W.A.; September 1958; WAM 496-65: 3 spec.
- 14 Sorrento Beach, Perth, W.A.; November 1965; WAM 509-65: 5 spec. (4 broken).
- 15 Salmon Bay, Rottneest I., W.A.; September 1931; WAM 820/23-31: 4 spec.
- 16 South Passage, Shark Bay, W.A.; March 1963; WAM 785-75: 3 spec.
- 17 Turtle Bay, East Wallabi I., Houtman Abrolhos, W.A.; April 1974; WAM 801-75: 1 spec.
- 18 Coburg Peninsula (?), Northern Territory; WAM 803-75: 2 spec.
- 19 South Pasco I., S of Barrow I., W.A. (20°58'S, 115°20'E); August 1966; WAM 804-75: 3 spec.
- 20 Cape Wessel, N.T.; WAM 805-75: 2 spec.
- 21 Barrow I., W.A.; September 1966; WAM 806-75: 1 spec.
- 22 Kendrew I., Dampier Arch., W.A. (20°28'30"S, 116°32'E); (a) October 1974; WAM 842-75: 1 spec., (b) May 1973; WAM 843-75: 1 spec., (c) February 1974; WAM 844-75: 3 spec.; (d) WAM 846-75: 1 spec.

Description

The male specimens of localities 1 and 2 are in a rather poor condition and cannot be properly measured, but those of localities 6 and 7 are better preserved as well as the young specimens from the other localities. Even the very small specimen of locality 3 (with a dorsal mantle-length of 7 mm), shows very distinctly the character, which Voss (1962: 169; 1963: 24) mentioned for *Sepia prionota*: the swimming-membranes of the dorsal, dorso-lateral and ventro-lateral arms bearing a series of semicircular, more or less elongated lappets. In some cases these lappets descend on the dorsal side of the swimming-membrane in its proximal half. In well-preserved specimens smaller papillae cover the dorsal and ventral surfaces of the mantle

TABLE 9
Measurements of *Sepia papuensis*

9a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
7	♂	64	81	53	27	31	42	84	12	38	36	36	39	117	14	1.7	1.4
6	♂	59	83	44	34	24	39	88	10	31	31	31	36	93	15	2.2	1.5
6	♂	51	88	47	31	29	41	84	10	25	25	31	39	79	10	2.0	1.4
6	♀	69	85	43	30	27	33	89	10	30	—	40	—	94	12	—	1.4

9b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
19	—	100	33.5	8	67	3	7	♂	63	35	7.9	60	4.8
22c	—	90	33.5	8.3	70	4.4	22a	—	63	33	7.9	67	—
22c	—	88	35	8.2	73	4.5	6	♂	57	31.5	7.0	61	3.5
12	—	84.7	32.5	7.7	65	—	8	—	52.7	36	8.2	59	—
10	—	83.5	33.5	6.7	61	—	20	—	50.5	37.5	7.5	57	5.9
19	—	83	35	6.7	69	3.6	20	—	50	38	8.6	62	5.0
13	—	82.4	33	7.3	61	—	15	—	46	39.5	8.7	61	—
22b	—	81	34.5	7.4	68	—	14	—	45.9	40	8.1	61	—
10	—	79.5	32.5	7.5	63	—	15	—	45	40	8.2	58	—
21	—	77.5	32	7.1	70	3.9	15	—	43.8	38	8.0	61	—
13	—	73	33.5	8.1	60	—	17	—	43	38	9.3	58	7.0
2	♂	72	33.	7.5	64	—	8	—	39.7	42	9.3	60	—
11	—	72	33	7.2	62	—	15	—	39.6	38	8.8	63	—
13	—	70.5	34.5	8.1	60	—	9	—	39.3	40.5	7.9	60	—
22c	—	70	38.5	8.1	64	—	9	—	39	39.5	8.2	59	—
10	—	69	33.5	7.3	66	—	5	juv.	24.5	46	11.0	57	—
6	♀	67	34	7.7	63	—	4	juv.	24	46	9.2	57	—
19	—	67	35	7.4	70	3.0							

9c: Literature records

Species	Sex	L. in mm	W. (%)	Author
<i>S. papuensis</i>	♂	63	35	Adam & Rees, 1966
<i>S. papuensis</i>	—	71	34	Iredale, 1954
<i>S. papuensis</i>	—	70	34	Iredale, 1954
<i>S. papuensis</i>	—	68	35	Iredale, 1954
<i>S. papuensis</i>	—	64	36	Iredale, 1954
<i>S. prionota</i>	♀	61	34	Voss, 1963-Type
<i>S. prionota</i>	♀	35	42	Voss, 1963
<i>S. galei</i>	—	80	34	Meyer, 1909-Type
<i>S. galei</i>	—	110	34	Iredale, 1954
<i>S. galei</i>	—	38	34	Iredale, 1954
<i>S. occidua</i>	—	48	40	Cotton, 1929-Type
<i>S. occidua</i>	—	72.3 ⁺	39	Adam, 1939
<i>S. occidua</i>	—	68.4	37	Adam, 1939
<i>S. occidua</i>	—	68	38	Iredale, 1954
<i>S. occidua</i>	—	49	39	Iredale, 1954
<i>S. submestus</i>	—	68	35	Iredale, 1926-Type
<i>S. submestus</i>	—	89	36	Iredale, 1954
<i>S. submestus</i>	—	74	38	Iredale, 1954
<i>S. submestus</i>	—	24	38	Iredale, 1954
<i>S. submestus</i>	—	24	42	Iredale, 1954
<i>S. genista</i>	—	67	34	Iredale, 1954-Type
<i>S. genista</i>	—	69	32	Iredale, 1954
<i>S. genista</i>	—	59	39	Iredale, 1954
<i>S. genista</i>	—	46	35	Iredale, 1954
<i>S. lana</i>	—	99	37	Iredale, 1954-Type

and the dorsal and lateral surfaces of the head and the arms, but they are lacking on the ventral surface of the head and of the ventral arms. According to Adam & Rees (1966: 39) these papillae in *Sepia papuensis* did not have any special taxonomic value. This may be true for adult specimens, which are not well enough preserved, but the typical lappets on the keels of the arms, especially in young specimens, seem to be a specific character, which has not been described in any other species. Voss (1963: 24) only mentioned female specimens of *Sepia prionota*, but as in *Sepia papuensis* the males do not show any trace of hectocotylization on the left ventral arm, it is not impossible that some of his specimens were males. The presence of a female specimen in the above-mentioned material proves that there exists nevertheless another secondary sexual character in the males. In fact the latter have their lateral and especially their dorsal arms effiliated at the tips. On the

distal parts of these arms the suckers change gradually their quadriserial arrangement in a biserial one. First the median suckers become smaller than the marginal ones and finally disappear completely, whereas the marginal suckers persist but become very minute and may also disappear on the extreme tips of the dorsal arms. In the female all the arms are simply acuminate with quadriserial suckers throughout, and not effiliated.

In the young specimen (Loc. 5, M.L.d. = 24.5 mm) the protective membranes of the tentacular club are separated at the base of the club, the dorsal one extending much further on the stem than the ventral one. But in the larger specimens these membranes are fused, the ventral membrane becoming attached to the dorsal one.

The larger shells are characterized by the wide, well limited mid-dorsal rib, and by the thick chitinous ledge formed by the posterior part of the fused outer and inner cones.

The very young shells differ a good deal from the adult ones. They are relatively wider and thicker, with a shorter striated zone. The dorsal surface shows only a faint indication of the beginning of the broad median rib. The striated zone is rather narrow, flanked by two broad smooth marginal zones, which persist in the later stages. The broad limbs of the inner cone are completely fused with the outer cone, but the posterior part is slightly raised, surrounding the posterior depression. The posterior part of the outer cone is narrow and does not yet show the chitinous ledge, which is characteristic for larger specimens. The anterior end of the shell is slightly acuminate, less rounded than in larger specimens.

Remarks

I have nothing to add to the discussion by Adam & Rees (1966: 39) of the relationship of *Sepia papuensis* with other species. I consider *Sepia prionota*, *S. occidua*, *S. galei* and *S. submestus* as synonyms of *Sepia papuensis*. As to *Sepia lana* and *Sepia genista* their status cannot be established without having seen the original material, but they may also be synonyms of *Sepia papuensis*.

SEPIA PHARAONIS EHRENBERG, 1831

(Plate 6, Fig. 1)

Sepia pharaonis Ehrenberg, C.G., 1831: ?

Adam, W., 1941: 5, pl. II, fig. 1; 1959: 130, fig. 2, pl. I-III, IV, fig. 3; 1960: 3; 1973: 10

- Voss, G.L., 1963: 20, pl. I, fig. b-c; text fig. 1f, g
 Adam, W. & Rees, W.J., 1966: 22, pl. 8, fig. 38-43; pl. 41, fig. 240
 Voss, G.L., & Williamson, G., 1971: 23, pls 1-4, figs 4, 7, 8
- Sepia rouxii* Férussac, A. de & Orbigny, A. d', 1841: 271, pl. 19
 Adam, W., 1939: 56, pl. I, fig. 4; pl. II, fig. 6-7
 Satyamurti, S.T., 1956: 179, pl. XXVI, fig. 3
- Acanthosepion rouxi* Rochebrune, A.T. de, 1884: 108
 Adam, W., 1944: 232
- Sepia torosa* Ortmann, A., 1888: 652, pl. XXIII, fig. 2
 Sasaki, M., 1929: 163, fig. 100-101; pl. XVI, fig. 11
 Adam, W., 1939: 61
- Sepia framea* Ortmann, A., 1891: 675, pl. XLVI, fig. 2
 Adam, W., 1939: 62
- Sepia singalensis* Goodrich, E.S., 1896: 3, pl. I, fig. 4-8
 Adam, W., 1939: 62
- Ascarosepion singhalensis* var. *foxi* Robson, G.C., 1927: 325
- Sepia koettlitzii* Hoyle, W.E. & Standen, R., 1901: 1, pl. I
 Adam, W., 1939: 63
- Sepia formosana* Berry, S.S., 1912: 420, fig. 2, pl. IX, fig. 7
 Sasaki, M., 1929: 165, fig. 165-166, pl. XXX, fig. 9-11
 Adam, W., 1939: 64
- Crumenasepia hulliana* Iredale, T., 1926a: 239, pl. XXXV, fig. 1-2; 1954: 77
- Sepia hulliana* Adam, W., 1939: 65
- Sepia tigris* Sasaki, M., 1929: 168, fig. 167, pl. XXVIII, fig. 13-16
 Adam, W., 1939: 65
- Crumenasepia ursulae* Cotton, B.C., 1929: 90, pl. XV, fig. 3-4
- Sepia ursulae* Adam, W., 1939: 66
- Sepia (Crumenasepia) ursulae* Cotton, B.C. & Godfrey, F.K., 1940: 434,
 fig. 421
- ?*Sepia venusta* Pfeffer, G., 1884: 12, fig. 15, 15a
 Hoyle, W.E., 1905: 982 (*non* Münster, 1837)
- ?*Sepia venustoides* Hoyle, W.E., 1909: 266 (= *Sepia venusta* Pfeffer, *non* Münster, 1837)
- Sepia sinope* Voss, G.L., 1962: 3 (*non* Gray, 1849)

Type localities

Tor, Sinai; Massaouah (*S. pharaonis*); Bombay; Red Sea (*S. rouxii*); Tokyo Bay (*S. torosa*); Ceylon (*S. framea*); Colombo; off Point de Galle (*S. singalensis*); Zeila, nearly opposite to Aden (*S. koettlitzii*); Takao, Formosa (*S. formosana*); Howick Island, N. Queensland (*S. hulliana*); Taihoku market, Formosa (*S. tigris*); Cottesloe, Rottnest Island (*S. ursulae*); Kabret; Port Taufiq (*S. singalensis* var. *foxi*); Zanzibar (*S. venusta*); Manila market (*S. sinope* Voss, non Gray).

Geographical distribution

Indo-West Pacific; northern Australia southwards to Cape Le Grande in Western Australia and Masthead I., Capricorn Group, Queensland, on the east coast.

MATERIAL

Spirit specimens

- 1 Shark Bay, W.A.; March 1962; WAM 427-65: 2 spec. (damaged).
- 2 NW of Broome, W.A. (17°31.5'S, 121°27'E), 83 m; December 1969; WAM 853-75: 1 ♂, 1 ♀ (Plate 6, Fig. 1).
- 3 Monte Bello Is, W.A.; May 1973; WAM 493-76: 1 ♀.

Dry specimens

- 4 Cottesloe Beach, Perth, W.A.; (a) July 1937; WAM 186-37: 1 spec. (L. > 270 mm); (b) WAM 564-31: 1 spec.; (c) July 1931; WAM 584-31: 1 spec. (L. > 260 mm); (d) July 1931; WAM 586-31: 1 spec.
- 5 No data; (a) WAM 483-65: 3 spec.; (b) WAM 485-65: 4 spec. (broken); (c) WAM 486-76: 2 spec. (broken).
- 6 Back Beach, Geraldton, W.A.; September 1974; WAM 827-75: 2 spec.
- 7 Coburg Peninsula(?), N.T.; WAM 828-75: 1 spec. (damaged).
- 8 Cape Le Grande, W.A.; January 1973; WAM 830-75: 1 spec.
- 9 Kendrew I., Dampier Arch., W.A. (20°28'30"S, 116°32'E); (a) May 1973; WAM 840-75: 1 spec.; (b) February 1974; WAM 849-75: 1 spec.; (c) February 1974; WAM 850-75: 4 spec. (3 incomplete).

Description

The above-mentioned material does not differ from previous descriptions (see Adam & Rees, 1966: 22). The young male specimen (M.L.d. = 76 mm) shows only the beginning of the transformation of the hectocotylus.

TABLE 10

Measurements of *Sepia pharaonis*

10a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
3	♀	155	86	48	33	23	35	94	9.7	35	39	39	42	—	26	1.6	2.9
2	♂	76	89	53	33	29	43	92	6.6	37	37	37	45	200	26	1.6	2.4
2	♀	53	89	60	26	30	41	94	9.4	34	38	38	43	—	—	1.5	—

10b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
6	—	195	36	10.8	59	4.6	6	—	130	37.5	10.4	64	4.6
8	—	190	37	11.0	58	4.7	9b	—	101	35.5	9.4	60	4.0
9c	—	182	35	9.2	77	3.8	2	♂	75	37.5	8.0	61	—
4b	—	161	35	10.8	56	6.2	2	♀	52	38.5	7.7	58	—
5a	—	144	34.5	9.7	58	4.2	1	?	50	37.5	8.4	58	—
5a	—	137	35	10.2	58	5.8	4d	—	43	40.5	9.3	53	4.2
5a	—	132	36	9.8	56	5.3							

SEPIA REX (IREDALE, 1926)

(Plate 12, Figs 1-5; Plate 13, Fig. 1)

Decorisepia rex Iredale, T., 1926: 193, pl. XXII, fig. 9-10; 1954: 72
Garrard, T.A., 1961: 36.

Iredale, T. & McMichael, D.F., 1962: 99

MacPherson, J.H. & Gabriel, C.J., 1962: 409

?*Sepia capensis* Chapman, F. (*non d'Orbigny*, 1835), 1912: 24, pl. I.

Decorisepia jaenschi Cotton, B.C., 1931: 41, fig. 5-6

Sepia (Decorisepia) jaenschi Cotton, B.C. & Godfrey, F.K., 1940: 439,
fig. 427

Sepia jaenschi Adam, W. & Rees, W.J., 1966: 55, pl. 16, fig. 93-94

?*Decorisepia cottesloensis* Cotton, B.C., 1929: 90, pl. XVI, fig. 1-2

?*Sepia (Decorisepia) cottesloensis* Cotton, B.C. & Godfrey, F.K., 1940:
438, fig. 426

Type localities

Manly Beach, N.S.W. (*S. rex*); Torquay, Victoria (*S. capensis*); Robe,
S.A. (*S. jaenschi*), Cottesloe, W.A. (*S. cottesloensis*).

Geographical distribution

All Australian States including Lord Howe Island; here recorded from
localities from Shark Bay to Thevenard I. on the northwestern coast of
Western Australia.

MATERIAL

Spirit specimens

- 1 W of Dirk Hartog I., W.A. (25°54'S, 112°38'E), 128-132 m; February
1964; WAM 420-65: 2 ♀, 1 ♂ (Plate 12, Figs 2-4).
- 2 SW of Point Cloates, W.A. (23°39'S, 113°11'E), 134 m; October
1963; WAM 495-76: 1 ♂, 1 juv. spec.
- 3 W of Shark Bay, W.A. (25°31'S, 112°29'E), 130 m; October 1963;
WAM 485-76: 2 juv. spec. (M.L.d. 14 mm and 31 mm).
- 4 Off W coast of W.A.; 1963; WAM 447-65: 1 ♂, 1 juv. spec.

Dry specimen

- 5 Thevenard I., N of Onslow, W.A.; WAM 492-65: 1 spec. (Plate 12,
Fig. 1).

TABLE 11

Measurements of *Sepia rex*.

11a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
1	♀	71	±76	±41	21	35	75	5.6	35	35	35	35	85	18	2.1	4.7
1	♀	55	69	42	22	33	76	—	36	33	33	36	145	18	2.2	4.7
1	♂	66	±75	±38	23	38	76	7.6	38	38	38	38	91	20	2.3	4.7

11b: Shell (in % of shell-length)

Loc.	Sex	L.in mm	W.	Th.	Str.z.	Spine
5	—	94	26.5 ⁺	8.7	71	4.3
1	♀	71	32.5	8.7	61	5.6
1	♂	66	32	8.3	62	4.5
2	♂	44	34	7.7	57	4.5
4	♂	32.5	38.5	8.3	61	6.1
2	juv.	21.2	45	8.5	54	4.7

Description

The mantle is elongate-oval but it is impossible to give exact measurements of the largest specimens owing to their strong contraction after fixation. The dorsal mantle-margin is strongly protruding, surpassing the mid-level of the eyes; the ventral margin is very slightly emarginate. The dorsal arms are slightly keeled at the outer side, the other ones have a distinct swimming-membrane, which, on the ventral arms descends on the ventral side of the head. The sectors of the interbrachial web are low and subequal, absent between the ventral arms. The tentacles are very long and slender, with a relatively short club (Plate 12, Figs 3-4). The swimming-membrane is well-developed and extends for a short distance beyond the base of the club. The protective membranes are well-developed, especially the ventral one, which is very wide and thin. These membranes are not fused at the base of the club. The latter bears in the middle a series of four, occasionally five, big suckers, the second one being the largest. These suckers are situated each in a deep pit, the dorsal wall of which has an opening through the protective membrane. These pits are separated by transverse membranes, which bear at the dorsal side a small lateral sucker and a very small marginal sucker; at the ventral side a small lateral sucker and four minute marginal suckers, two at the proximal side and two at the distal side of the lateral sucker. At the base of the club are eight small

suckers and at the distal end 25-30 small suckers. The chitinous rings of the globular arm-suckers, which are quadriserial, the median ones larger than the marginal ones, are smooth. Those of the small tentacular suckers are finely dentate. The left ventral arm of the male is hectocotylyzed and possesses at its base two or three transverse rows of normal suckers, followed by ten rows of much smaller suckers, which in each row are arranged in two pairs of widely spaced suckers, the ventral ones being smaller than the dorsal ones.

The shell is elongate oval, widest a little in front of the middle, and bluntly acuminate at both ends. The relative width decreases with the size, the small shells being much wider than the greater ones. The rose-coloured or salmon-coloured dorsal surface shows three strong longitudinal ribs, separated by two rather narrow grooves. In the posterior part a lesser furrow is situated at each side at the base of the outer cone. The whole dorsal surface, except the rather narrow chitinous outer cone, is granulous, the granules following partly the growthlines, but forming an irregular reticulate pattern on the lateral portions. The extreme posterior area, near the spine, is smooth and glossy. The spine is slightly directed upwards, with a strong dorsal and a weaker ventral keel. The ventral surface is rather flat, with a narrow median groove over its whole length. The striae are slightly convex in the posterior part, more and more reversed V-shaped towards the last loculus. The median groove is flanked by two low, wide ribs, flanked in their turn at each side by a narrow, shallow, lateral groove, which is separated from the outer cone by a narrow rib. The inner cone has very narrow, obsolete limbs, fused with the outer cone, and a slightly raised and rounded posterior rim, surrounding the slightly excavated posterior portion of the striated area. The outer cone is somewhat enlarged in its posterior part, forming two calcareous wings, united by the chitinous membrane between the spine and the inner cone; the whole forming a cup-like formation as in *Sepia papuensis* Hoyle and *Sepia plangon* Gray.

Remarks

It is after much hesitation that I have identified the above-described material as *Sepia rex* Iredale. The animal of this species has never been described, although Garrard (1961: 36) reported two live specimens from east of Lake Macquarie. Although Iredale (1926: 193) described this species as having 'no inner cone and no ventral sulcus', his figure (pl. XXII, fig. 10) shows both and strongly resembles the figures of the present material (Plate 12, Figs 1-2). Unfortunately a final decision about the status of this species is impossible; Mrs S.M. Slack-Smith kindly informed me (pers. comm. 11-VIII-1975) that according to Dr Ponder of the Australian Museum

in Sydney the type of '*Decorisepia rex*' cannot be found. 'As with many of Iredale's types, it might have been stored in the general collection and is now lost or without distinguishing label'. As the type is a dry shell and as cuttlebones can float for a long time and be transported over large distances, it is impossible to collect topotypical material. Iredale described the spine as being rounded and does not mention any keels, but these might have been worn. In 1954 (p. 72) he spoke again about this species and stated that 'similar shells have been named *jaenschi* from western Victoria and South Australia, and another shell from Rottnest Island, Western Australia, *cottesloensis*'. (In fact the latter species came from Cottesloe.) He states also: 'As noted under *Mesembrisepia macandrewi*, bones from north Tasmania and east Victoria agree completely with typical specimens of *Decorisepia rex*, and at present cannot be separated'. In fact it is under '*Mesembrisepia ostanes*' (p. 69) that he speaks about these specimens. On p. 72, he further mentions that 'Chapman recorded *capensis* from Torquay, Victoria, fortunately giving a figure, so it is recognisable as *Decorisepia rex*'. In fact the figure which Chapman (1912: 24, pl. I) gives of a species which he believed to be *Sepia capensis* d'Orbigny, does not show the slightest resemblance with *Sepia rex*, but on p. 70, under '*Mesembrisepia ostanes*', Iredale mentions that he has seen the specimens recorded by Chapman, and that the 'plesiotype' of *capensis* is also *Decorisepia rex*.

As to *Sepia jaenschi*, Adam & Rees (1966: 55, pl. 16, fig. 93-94) described and figured a specimen from Robe, South Australia, which had been identified by Cotton himself. This specimen, which was rather damaged, exactly resembles the dry shell from Thevenard Island, northwestern Australia, which was also damaged (see Plate 12, Fig. 1), except that the spine did not show any keels, which might have been worn. Fortunately the type of *Sepia jaenschi* still exists and Mrs S.M. Slack-Smith was kind enough to send me photographs (see Plate 12, Fig. 5; Plate 13, Fig. 1) and a detailed description of this type, which had been lent to her by the South Australian Museum. According to this description of the holotype, the spine is 'oval in cross section', which may indicate that it had been keeled, otherwise, the cross section would have been round. The dorsal surface has a median rib, which is 'well marked and bordered by moderately deep sulci'; the lateral ribs are 'less obvious than the median rib but obvious from about 1.5 cm anterior to spine tip'. As to the sculpture: 'very fine granular surface (pink) except for white areas extending on either side from about 0.5 cm before base of spine — these areas have opaque white vermiculate sculpture and overlie outer cone — medially to these white areas are two vague areas (more yellowish pink than is remainder of dorsal surface) which have slightly stronger granular sculpture than does rest of median section of dorsal surface: this area lies over edges of striated area and inner

cone limbs. Behind termination of lateral limbs of inner cone the slightly heavier granulation extends along sides of shell and over posterior tip — the base of spine is smooth and unsculptured and has a ventral extension surrounded by edge of outer cone'. The ventral surface has a 'median depression, shallow — best marked in central third of shell — lateral zones narrow and extending only just posterior to area of greatest width of shell, i.e. about 1 cm long. Inner cone cream in colour — very slightly hollow under posterior angle — posterior border slopes down over base of spine — lateral limbs raised to form slight hollow for about 0.7 cm in front of angle — extend to about point of greatest width of shell — becoming less well marked about 3.7 cm anterior to angle of inner cone. Outer cone appears thin around anterior half of shell — expands posterior to poorly marked waste (which is about 2.6 cm from spine tip) — surrounds inner cone posteriorly, forming a vertical shelf below base of spine.' The holotype has a total length of 10.19 cm and a width of 3.7 cm (36.5%) whereas the above mentioned shell from Robe, identified by Cotton, had a length of 112 mm and a width of 28.5+% and the one from Thevenard Island, a length of 94 mm and a width of 26.5+%, but both the latter specimens were damaged and their real width was certainly much greater. The figured shell (Plate 12, Fig. 2) of the largest female specimen (L. = 71 mm) is a little less acuminate, but the other specimens have the anterior end acuminate as in the type of *Sepia jaenschii*, although they are not as broad as the latter, taking into account that the smaller shells have generally wider shells.

Sepia cottesloensis (Cotton, 1929), based on a shell of only 42.6 mm had a width of 43%. I have not seen a single specimen of this species among the numerous shells studied for the present report. It may be a juvenile specimen of *Sepia jaenschii*.

If the above described material really represents *Sepia rex*, which I cannot prove in absence of the holotype, but what I believe to be the case, I consider *Sepia jaenschii* and probably also *Sepia cottesloensis* as synonyms of the former species.

It is noteworthy that the animal strongly resembles *Sepia prashadi* Winckworth, 1936 and *Sepia omani* Adam & Rees, 1966 by the tentacular clubs and by the hectocotyli, but the shells are completely different (see Adam & Rees, 1966); without examining the latter it would be practically impossible to identify these three species. *Sepia prashadi* has been reported from Madras (shells), Mauritius (shells), Madagascar (shells), Gulf of Suez (animals), South Red Sea (animals) and the Gulf of Oman (animals). *Sepia omani* from the Gulf of Oman and from Hong Kong (animals); *Sepia rex*

only from Australia. In these three species the dorsal protective membrane of the tentacular club shows the perforations on the levels of the large suckers. This character had hitherto only been described by Berry for his *Sepia chirotrema* (see p. 123) and had not been mentioned by Adam & Rees (1966) for *Sepia prashadi* and *Sepia omani*.

Finally I have to mention a small error in the key to species which Cotton & Godfrey (1940: 438) give for *Decorisepia*: for *cottesloensis* they state 'Gladius nearly three times as long as wide', and for *jaenschi* 'Gladius less than two and a half times as long as wide', whereas the contrary is the case, as their figures 426 and 427 prove.

SEPIA ROZELLA (IREDALE, 1926)

(Plate 6, Fig. 3)

Solitosepia rozella Iredale, T., 1926: 190, pl. XXI, fig. 6-7; 1954: 67

Iredale, T. & McMichael, D.F., 1962: 98

Solitosepia rozella peregrina Iredale, T., 1926a: 238; 1954: 67

Type localities

Manly Beach, N.S.W. (*S. rozella*); North-west Islet, Capricorn Group, Queensland (*S. rozella peregrina*).

Geographical distribution

Queensland and New South Wales; here tentatively identified from Shark Bay, Western Australia.

MATERIAL

Dry specimens

- 1 Flinders Beach near Amity, Stradbroke I., Qld; June 1973; (a) WAM 781-75: 1 juv. spec.; (b) WAM 809-75: 1 spec. (Plate 6, Fig. 3).
- 2 ? South Passage, Shark Bay, W.A.; March 1966; WAM 786-75: 1 fragment.

Description

The shell is oval-elongate, broadest in the middle, rounded acuminate at both ends, rather thick in front of the middle. Dorsal surface with three faint longitudinal ribs, the median one more distinct; marginal areas broad,

TABLE 12
Measurements of *Sepia rozella*

12a: Shell (in % of shell-length)

Loc.	L. in mm	W.	Th.	Str.z.	Spine
1b	106	34	10.4	64	6.6
1a	56	28.5+	9.0	68	6.2

12b: Literature records

Loc.	L. in mm	W. (%)	Author
<i>Sepia rozella rozella</i>			
Manly Beach	135	35	Holotype (Iredale, 1926: 190)
Manly Beach	150	32	(Iredale, 1954: 67)
Manly Beach	145	31	(Iredale, 1954: 67)
Manly Beach	130	34	(Iredale, 1954: 67)
Manly Beach	115	33	(Iredale, 1954: 67)
Manly Beach	80	36	(Iredale, 1954: 67)
Manly Beach	58	36	(Iredale, 1954: 67)
Manly Beach	50	40	(Iredale, 1954: 67)
Manly Beach	42	40.5	(Iredale, 1954: 67)
Manly Beach	34	44	(Iredale, 1954: 67)
<i>Sepia rozella peregrina</i>			
North-West Islet	89	38	Holotype (Iredale, 1926a: 238)

chitinous with a thin calcareous covering. Nearly the whole dorsal surface is granulous; in the anterior portion of the shell the granules are disposed more or less along the growthlines, but on the posterior part and especially on the marginal areas they form an irregular reticulate pattern. The posterior end in front of the spine is smooth and shiny. The ventral surface shows a deep median sulcus in the striated zone and a narrow shallow median depression on the last loculus. The deep sulcus is flanked by two strongly convex, rounded ribs, which diminish gradually towards the posterior end. At the posterior end the striae are slightly convex and become more and more reversed V-shaped in the sulcus. At each side the striated area is limited by a narrow marginal smooth zone. In the posterior half, the limbs of the rose-coloured inner cone are rather broad, reflected and fused with the outer cone; their outer margin is flat and shiny, broadest at the posterior end, which surrounds a rather deep depression. The outer cone is continuous

between the inner cone and the spine. The latter is strong, directed upwards, with a distinct, straight, ventral keel and a ventral notch at its base, whereas the dorsal side is convex in the basal half. In the juvenile specimen, this dorsal side of the spine is straight and the ventral keel slightly convex.

Remarks

The largest specimen corresponds with the original description, but the median dorsal rib is much narrower than in the original figure (pl. XXI, fig. 7). As in Iredale's species the descriptions and figures often show differences; I believe that the above-described specimens belong to *Sepia rozella* (Iredale, 1926).

As to '*Solitosepia rozella peregrina* Iredale, 1926', the author states: 'shell smaller, shorter and comparatively broader, the inner cone wider, the rose colour restricted to a narrow band; the dorsal sculpture more pronounced than in the typical form'. As this subspecies has not been figured, it is difficult to appreciate its value, but the differences mentioned do not seem to justify a subspecific separation. More material is needed to decide about its status.

Addendum

Up to the present the animal of this species had not been described. But after this text was finished, the Royal Institute of Natural Sciences (Brussels) received two female specimens, collected at La Perouse, New South Wales, in 1972, by Mr Van Hauwe. Unfortunately these two specimens, with a dorsal mantle-length of 108 and 120 mm, are in rather poor condition and do not allow a detailed description, except of the tentacular club. The latter measures 13% in both specimens, which is rather short. The well-developed swimming-membrane extends beyond the base of the club. The protective membranes are wide, united at the base of the club. The suckers are arranged in oblique, transverse series of eight; those of the third longitudinal row, counted from the dorsal side, are widest, in the smaller specimen as wide as the armsuckers (0.9%), in the other one slightly wider (1.0%).

The shells show the following measurements (in % of shell-length):

L. in mm	W.	Th.	Str.z.	Spine
120	33.5	10	71	4.2
108	36	11.5	62	4.6

They correspond with the above-described shells, but the median dorsal rib is as wide as in the original figure. The inner cone is dark rose-coloured. In the smaller specimen the ventral sulcus is much deeper and narrower than in the other specimen.

SEPIA BRAGGI VERCO, 1907

(Plate 10, Figs 1-4)

Sepia braggi Verco, J.C., 1907: 213, pl. XXVII, fig. 6

? Hedley, Ch., 1908: 134; 1918: M33

? Gatliff, J.H. & Gabriel, C.J., 1909: 37

? May, W.L., 1910: 307

Chapman, F., 1912: 23, pl. I

Jackson, J.W., 1931: 149

Adam, W. & Rees, W.J., 1966: 79, pl. 19, fig. 121-126

Arctosepia braggi Verco, J.C. & Cotton, B.C., 1928: 127

? Cotton, B.C., 1929: 90; 1931: 41, fig. 9

? MacPherson, J.H. & Chapple, E.H., 1951: 156

Iredale, T., 1954: 74 (? pars)

? Iredale, T. & McMichael, D.F., 1962: 99

? MacPherson, J.H. & Gabriel, C.J., 1962: 409, fig. 479

? *Arctosepia braggi xera* Iredale, T., 1954: 74

Sepia (Arctosepia) braggi Cotton, B.C. & Godfrey, F.K., 1940: 440 (pars),
fig. 428

? *Sepia elongata* Tate, R. & May, W.L., 1901: 351 (*non* d'Orbigny, 1845)

? *Sepia* sp. Meyer, W. Th., 1909: 335, fig. 11

Type localities

Glenelg, South Australia (*S. braggi*); northwestern Tasmania (*S. braggi xera*).

Geographical distribution

Uncertain because of doubtful identifications in the literature; probably South Australia (type loc.) to at least as far north as Cockburn Sound, Western Australia. One badly preserved specimen from off Broome (loc. 2) is tentatively identified as this species which would extend the species range far into the tropical waters of northern Western Australia.

MATERIAL

Spirit specimens

- 1 NE of Rottnest I., W.A., 34 m; September 1965; WAM 437-65: 1 ♀ (Plate 10, Fig. 3).
- 2 NW of Broome, W.A. (17°31.5'S, 121°27'E), 81 m; December 1969; WAM 854-75: 1 ♀ (in bad condition, M.L.d. 36 mm).
- 3 N of Rottnest I., W.A. (from 31°56.8'S, 115°29.4'E to 31°51.8'S, 115°35.3'E), 38 m; February 1972; WAM 855-75: 1 ♂ (Plate 10, Fig. 4).
- 4 Cockburn Sound, W.A.; July 1972; WAM 491-76: 1 ♂, 1 ♀.
- 5 Off Rockingham and Kwinana, Cockburn Sound, W.A.; February 1970; WAM 871-75: 2 ♂, 4 ♀ (Plate 10, Fig. 1).

Dry specimens

- 6 S of Naval Base Groyne, Cockburn Sound, W.A.; November 1965; WAM 501-65: 1 spec. (damaged).

TABLE 13

Measurements of *Sepia braggi*

13a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
3	♂	46.5	80	40	26	22.5	31	90	11	26	32	43	30	97	9.7	1.1	0.9
4	♂	43	84	41	26	21	35	91	9.5	35	46	63	40	116	9.3	0.9	0.9
5	♂	39	85	36	26	28	29	85	7.7	26	38	51	38	102	10.8	1.3	0.8
5	♂	37	89	41	27	27	34	96	8.1	35	46	67	41	—	—	1.1	—
1	♀	58	85	34.5	27.5	17	33	91	10.5	22.5	27.5	26	22.5	86	8.5	1.0	0.7
5	♀	56	87	36	25	22.5	31	89	8.9	27	32	27	30	89	6.2	1.1	0.7
5	♀	56	84	39	27	21.5	30	86	8.9	—	—	32	30	—	—	1.1	—
5	♀	55	87	41	25	25	30	87	9.1	31	40	36	36	—	—	1.1	—
5	♀	52.5	89	36	25	22	29	86	5.7	25	34	29	30	—	—	1.1	—
4	♀	48	83	42	25	23	30	83	8.3	25	33	31 ⁺	31 ⁺	—	—	1.0	—

13b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
3	♂	46	15.7	6.7	63	2.6
4	♂	43	16.3	6.1	—	—
5	♂	39	16.7	6.9	67	—
5	♂	37	16.2	6.2	73	—
1	♀	58	16.9	7.1	—	—
5	♀	56	16.1	6.4	77	—

13c: Literature records

Loc.	L. in mm	W.	Th.	Str.z.	Spine	Author or Coll.
Glenelg, S.A.	60	18.3	7.9	—	4.6	Holotype (Verco)
Adelaide, S.A.	54	16.3	6.9	71	3.7	I.R.Sc.N.B.
Torquay, Vic.	61.4	20	8.1	67	2.4	Adam & Rees, 1966
Torquay, Vic.	56.3	21	8.3	62	2.5	Adam & Rees, 1966
Adelaide, S.A.	56.0	20	8.0	66	3.6	Adam & Rees, 1966
Adelaide, S.A.	38.4	19.5	8.3	76	3.9	Adam & Rees, 1966
Adelaide, S.A.	29.0	21.5	9.0	54	3.4	Adam & Rees, 1966
Semaphore, S.A.	35.5	18.0	7.3	67	4.2	Adam & Rees, 1966
Semaphore, S.A.	32.5	21.5	9.2	63	—	Adam & Rees, 1966

Description

The animal of this species has not been described previously. The mantle is broadly elongate, its dorsal margin broadly acuminate, reaching about halfway the eyes, the ventral margin deeply emarginate around the siphon; the posterior end is bluntly pointed. The fins are rather broad, their anterior ends not reaching the mantle-margin, their posterior ends extending slightly beyond the posterior end of the mantle and dorsally united before the end of the mantle. The head is short and broad, the eyes protruding. The arms of the female are rather short, the dorso-lateral ones slightly longer than the ventro-lateral ones. In the male, the ventro-lateral arms are much longer than the other ones and than those of the female. All the arms of the female are slightly keeled at their outer sides, the ventral ones with a more developed swimming-membrane which descends on the ventral side of the head up to the level of the eye-opening. In the male, the dorsal arms are slightly keeled near their distal tips, but rounded on the greater part of the outer sides. The lateral arms are rounded at their outer sides, without any keels, but the ventral ones do not differ from those of the female. In both sexes, the suckers are quadriserial on the ventral arms; on the other arms they are quadriserial on the basal portions, but biserial on the effiliated tips, especially on the dorso-lateral arms of the female and on the ventro-lateral arms of the male, where they are very small and spaced. Except on the ventral arms, the protective membranes are rather narrow.

The left ventral arm of the male does not show any trace of a hectocotylization.

The tentacles are very long and slender, the clubs short. The swimming-membrane of the tentacular club is well-developed and extends beyond the base of the club. The dorsal protective membrane is wide, devoid of suckers;

at the base of the club the two protective membranes remain widely separated. The suckers seem to be arranged in 5 longitudinal series, 5 or 6 of the middle series being about twice as wide as the other ones. Their chitinous rings, as well as those of the armsuckers, are finely dentate.

The shell is very elongate, broadest in the anterior third, acutely rounded at the anterior end and acuminate posteriorly. The dorsal surface has a distinct, but low and narrow, median rib, vanishing towards the posterior end, which is neatly curved towards the ventral side. The non-calcified marginal portions are very wide: near the anterior end they are even broader than the median rib and extend up to the margins of the rib, only the latter being calcified; towards the middle of the length, the calcified portion extends laterally beyond the rib, but the chitinous margins remain very wide, diminishing towards the posterior end of the shell. The calcareous covering is weakly granulous, with irregular longitudinal lines, not only in the anterior part, but in well-preserved shells also in the posterior part, which is rose-coloured. The spine is slightly constricted at its base, devoid of keels, turned upwards, sometimes slightly curved with its ventral side concave. The ventral surface of the shell shows a distinct, narrow, median groove along its whole length, widening in the anterior part of the last loculus. At each side, the median groove is flanked by a slightly convex rib, which, in the anterior part of the striated area, has an abruptly sloping, flat or concave lateral part, separated from the outer cone by a smoother, narrow, marginal zone, separated from the striated area by the narrow limb of the inner cone. The limbs of the inner cone descend sometimes in the middle of the smooth marginal zones. In the extreme posterior part of the striated area, the transverse striae are slightly convex, but on the greater part of its length, the striae are distinctly convex at each side of the median groove and are incurved, V-shaped, in the groove. The limbs of the inner cone are very narrow, rounded ridges, the posterior part forming a slightly sharper ledge, which surrounds the shallow posterior excavation. The narrow outer cone forms two short posterior wings which surround the posterior part of the inner cone, constituting a cup-like formation, ornamented by tiny, radiating, calcareous keels.

Remarks

According to Jackson (1931: 149) 'Professor W.L. Bragg has presented his collection of South Australian marine mollusca to the Manchester Museum, and contained in this collection is the type-specimen of *Sepia braggi*.' Mr Charles Pettitt has kindly informed me that he could find no trace of the type of *Sepia braggi* in the type collection and in the general

collection of the Manchester Museum. The small collection of South Australian shells presented to the Museum by Prof. Bragg contains six cuttlebones, without any indications of the name or the locality. Of these six shells, which I had the opportunity to examine, four belong to *Sepia apama* Gray, 1849; the two others, one of which is only a small fragment, represent the above-described species. The nearly complete specimen (Plate 10, Fig. 2) has a length of nearly 50 mm (the extreme anterior part is lacking) and cannot be the type which, according to the original description, measured 60 mm.

Up to the present, only two small species of *Sepia* with an elongate shell have been mentioned from Western Australia under the names of *Sepia braggi* and *Sepia rhoda* (see p. 192). As the present collection of the Western Australian Museum contains three different species, two of which seem to be new species (see p. 190 and p. 193), with elongate shells, which are not easy to distinguish at first sight, it is necessary to ascertain if one of the three, and which one, represents *Sepia braggi*. As the type of this species seems to be lost, I consider the above-mentioned specimen as representing *Sepia braggi*; it agrees with the original description and figure and with the specimens described by Adam & Rees (1966: 79, pl. 19, fig. 121-126). Many of the other references of *Sepia braggi* have now become doubtful, especially those of Western Australia. It is noteworthy that only one, very badly preserved, beach collected dry shell in the present collection belongs to *Sepia braggi*; nearly all the other specimens belong to *Sepia cottoni* sp. nov. (p. 193), whereas the third species, *Sepia vercoi* sp. nov., is represented by a single animal and two dry shells (p. 190).

Adam & Rees (1966: 80-81) have discussed the different Australian species described by Iredale (1926; 1954) the animals of which are unknown, although Garrard (1961: 36) mentions the capture of 13 live specimens of '*Arctosepia versuta*' off the coast of New South Wales. As long as the animals of all these species are unknown, it is useless to discuss their status and their relationships.

The shell of *Sepia braggi* can easily be distinguished from that of the two other Western Australian species by its deeper median ventral sulcus and by the outline of the striae of the striated area, which are convex at each side of the sulcus, the dorsal surface differs by the very broad non calcified chitinous margins.

The shell figured on Plate 10, Fig. 3 (loc. 1) shows a curious malformation: at the right side (in the figure) of the ventral sulcus there is a very narrow, rounded rib, which does not reach the anterior end of the striated

area. In his description of *Sepia treba*, Iredale (1954: 75) mentions that 'the median furrow in one specimen' is 'elevated into a rib', whereas in the other specimen it is normal. And *Sepia rhoda* (Iredale, 1954: 75) shows 'instead of a linear groove, a raised rib along the striated area, but the linear groove appears in the last loculus'.

SEPIA VERCOI SP. NOV.

(Plate 10, Figs 5 and 6)

Holotype

- 1 CSIRO Stn 200, W of Shark Bay, W.A. (25°31'S, 112°29'E), 130 m; leg. HMAS *Diamantina*; 0220 hrs, 9 October 1963; WAM 441-65: 1 ♂ in spirit (Plate 10, Fig. 5).

Paratypes

- 2 North shore of Broke Inlet, W.A. on beach; leg. J.K. Porter; 29 August 1974; WAM 770-75: 1 dry shell (incomplete).
- 3 CSIRO Stn 192, NW of Carnarvon, W.A. (24°04'S, 112°59'E), 138 m; leg. HMAS *Diamantina*; 0400 hrs, 8 October 1963; WAM 772-75: 1 dry shell (Plate 10, Fig. 6).

Geographical distribution

Southwestern Australia from Broke Inlet on the south coast to Carnarvon.

TABLE 14

Measurements of *Sepia vercoi*

14a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	St.
1	♂	31	82	49	26	19	37	85	9.5	39	26	26	32	130	11	1.6	0.6

14b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
1	♂	31	23	9	65	—
3	—	50.5	21	8.9	—	6

Description

The single animal in the present collection is a mature male, its penis filled with spermatophores. But as in other Sepiidae the animals may continue their growth after having attained maturity, we do not know if this specimen is full-grown.

The mantle is elongate-oval, its dorsal margin acutely acuminate, surpassing the mid-level of the eyes; the ventral margin is slightly emarginate. The posterior end is bluntly acuminate. The fins are rather narrow but contracted, they do not reach the anterior and posterior ends of the mantle. The rather short arms are united at the base by a low subequal web, which is lacking between the ventral arms. The dorsal arms are slender, effiliated, very slightly keeled at their outer sides, with the suckers biserial along their whole length. The lateral arms are much shorter, stouter, each with a low swimming-membrane and quadriserial suckers. The ventral arms are longer than the lateral ones, but shorter than the dorsal ones; each with a well-developed swimming-membrane, which does not reach beyond the base of the arm. The suckers are quadriserial, those of the right ventral arm diminishing gradually in size from the base to the tip of the arm. The left ventral arm possesses about 6 transverse rows of 4 big suckers on the basal half of the arm; on the distal half they are abruptly much smaller and widely spaced, but closer together near the tip of the arm. On all the arms the protective membranes are well-developed. The arm-suckers are globular with a narrow opening. On the lateral and ventral arms the median suckers are wider than the marginal ones. The chitinous rings are smooth. The tentacles are long and slender. The tentacular club is short and narrow, its swimming-membrane wide and thin, extending slightly beyond the base of the club. The protective membranes remain separated at the base of the club, the dorsal one being wide. The tentacular suckers seem to be arranged in 5 longitudinal series, 5 or 6 suckers of the median series being about twice as wide as the neighbouring ones; their chitinous rings are finely dentate. The largest tentacular suckers are less than half as wide as the biggest arm-suckers. The chromatophores are minute, more crowded on the median part of the dorsal surface of the mantle and above the eyes. Moreover the dorsal sides of the arms each show some larger orange spots, situated on a deeper level, under the small chromatophores.

Unfortunately the shell of the holotype is in rather bad condition and could not be extracted intact; the description is completed with that of the best preserved paratype (3). The shell is elongate, widest in the anterior third and tapering gradually towards the posterior end, which is gently

curved downwards. The dorsal surface is flattened, slightly convex, except near the posterior end, which is more rounded. A very low median rib is weakly indicated. The chitinous, non-calcified margins are very narrow in the posterior half, slightly wider in the anterior third where they each attain about one-sixth of the width of the shell. The greater part of the dorsal surface is calcified, with a reticulate granulous pattern, which forms irregular longitudinal lines on the median rib and near the margins. On the posterior half the calcareous part is separated at each side from the chitinous margin by a stronger calcareous keel. The extreme posterior end is covered by a smooth glaze-like substance, covering also the base of the spine, which is straight, devoid of keels and slightly directed upwards. The ventral surface shows a very shallow, narrow, median sulcus along its whole length. The striae of the striated area are weakly convex, especially in the middle where they are nearly straight. The limbs of the inner cone are very narrow, rounded, shiny ridges, limiting the striated area and vanishing towards the middle of the length of the shell. The posterior part of the inner cone forms a slightly wider ledge, surrounding the weak posterior depression. At each side, a narrow smooth area separates the inner cone from the outer cone. The latter forms a cup-like widening, separating the inner cone from the spine.

Remarks and relationship

As the animals of the Australian species, possessing an elongate shell, have never been described, the animal of *Sepia vercoi*, of which only the male is known, can only be compared with that of *Sepia braggi*, described above (p. 187). The dorsal arms of *Sepia vercoi* possess biserial suckers, whereas in *Sepia braggi* the suckers are quadriserial on the basal part of these arms. The latter species has much longer lateral arms with effiliated tips with biserial suckers and the left ventral arm shows no hectocotylization. Moreover the globular suckers of *Sepia vercoi* are relatively much bigger. *Sepia kiensis* Hoyle, 1885, from the Arafura Sea has quadriserial suckers on all its arms, whereas *Sepia sulcata* Hoyle, 1885, from the Arafura Sea has biserial suckers on the dorsal and dorso-lateral arms but a quite different hectocotylus and a much broader shell.

The shell of *Sepia vercoi* differs from that of *Sepia braggi* by the much shallower ventral median sulcus, by the different outline of the striae of the striated area, and by the much narrower chitinous margins of the dorsal surface.

'*Arctosepia rhoda* Iredale, 1954' (p. 75, pl. IV, fig. 10-12), which is based on a single shell from Point Cloates, mid-western Australia, has a

thicker shell (the thickness measuring 11.6% of the length, which was 52 mm) which shows 'instead of a linear groove, a raised rib along the striated area, but the linear groove appears in the last loculus'.

This new species has been dedicated to the late J.C. Verco, author of *Sepia braggi*.

SEPIA COTTONI SP. NOV.

(Plate 11, Figs 1-6)

Holotype

- 1 CSIRO Stn 46, W of Lancelin, W.A. (31°54'S, 114°55'E), 114-122 m; leg. HMAS *Diamantina*; 1755 hrs, 5 February 1964; WAM 435-65: 1 ♂ in spirit (Plate 11, Fig. 1).

Paratypes — spirit specimens

- 2 CSIRO Stn 34, W of Dirk Hartog I., W.A. (25°54'S, 112°38'E); leg. HMAS *Diamantina*; 1600 hrs, 3 February 1964; WAM 483-76: 1 juv. spec.
- 3 CSIRO Stn 187, SW of Point Cloates, W.A. (23°39'S, 113°11'E), 134 m; leg. HMAS *Diamantina*; 1527 hrs, 7 October 1963; WAM 494-76: 5 ♀ (Plate 11, Fig. 4).
- 4 Armstrong Point, Rottneest I., W.A., deep rock pool open to sea at low tide; 25 March 1958; WAM 484-76: 1 ♀.
- 5 CSIRO Stn 208, NW of Bluff Point, W.A. (27°40'S, 113°20'E), 130 m; leg. HMAS *Diamantina*; 0400 hrs, 10 October 1963; WAM 424-65: 1 ♂, 2 ♀ (Plate 11, Fig. 3).
- 6 WNW of Rottneest I., W.A., 146-164 m; leg. R.W. George on FV *Bluefin*; 14 August 1962; WAM 430-65: 1 ♂.
- 7 CSIRO Stn 40, SW of Bluff Point, W.A. (28°14'S, 113°28'E), 110 m; leg. HMAS *Diamantina*; 1520 hrs, 4 February 1964; WAM 432-65: 1 ♀.
- 8 Stn UMRT 6908-9, NW of Broome, W.A. (17°31.5'S, 121°27'E), 83 m; leg. *Umitaki Maru*; 21 December 1969; WAM 490-76: 1 juv. spec. (M.L.d. 31 mm, shell 31 x 7 mm).

Paratypes — dry specimens

- 9 Cottesloe Beach, Perth, W.A.; leg. L. Glauert; February 1928; WAM 13384: 2 spec. + 2 broken spec.

- 10 Cottesloe Beach, Perth, W.A.; leg. L. Glauert; July 1928; WAM 1292-76: 13 spec. + 4 spec. (damaged).
- 11 Cottesloe Beach, Perth, W.A.; leg. L. Glauert; July 1928; WAM 13595: 1 spec (Plate 11, Fig. 2).
- 12 Cottesloe Beach, Perth, W.A.; leg. L. Glauert; July 1928; WAM 13596/13607: 13 spec. (Plate 11, Figs 5 and 6).
- 13 Calgardup Beach near Margaret River, W.A.; leg. Miss Glauert; October 1938; WAM 1293-76: 15 spec.
- 14 S of Naval Base Groyne, Cockburn Sound, W.A.; leg. S.M. Slack-Smith; 9 November 1965; WAM 502-65: 1 spec.
- 15 Sorrento Beach, Perth, W.A.; leg. S.M. Slack-Smith; 7 November 1965; WAM 508-65: 1 spec. + 3 spec. (broken).
- 16 Ocean Beach, near Augusta, W.A.; leg. B.R. Wilson and S.M. Slack-Smith; 19 March 1975; WAM 768-75: 3 spec. (damaged).
- 17 Flinders Beach near Amity, Stradbroke I., Qld; leg. B.R. Wilson and S.M. Slack-Smith; 16 June 1973; WAM 769-75: 1 spec.
- 18 Cheynes Beach (Hassall Beach), W of Cape Riche, W.A.; leg. S.M. Slack-Smith *et al.*; 3-4 December 1968; WAM 771-75: 1 spec. (incomplete).
- 19 West end, Rottnest I., W.A.; leg. S.M. Slack-Smith; 30 June 1974; WAM 782-75: 2 spec.

Geographical distribution

Western Australia from Hassell Beach on the south coast to Broome. Also recorded from Stradbroke I., Queensland (a single shell specimen) implying a northern Australian distribution.

TABLE 15
Measurements of *Sepia cottoni*

15a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.L.	T.cl.	S.a.	S.t.
5	♂	45.5	80	40	22	13	24	81	—	44	33	31	31	110	11	1.5	0.9
1	♂	43.5	84	32	24	31	26	92	11.5	50	46	50	57	—	—	1.4	—
3	♀	55	69	36	24	—	—	76	7.5	29	24	25	27	—	—	1.3	—
5	♀	42	81	37	23	28	24	79	7	29	29	29	29	120	14	1.7	1.2
5	♀	41	78	35	23	22	27	71	7.5	24	29	29	24	160	12	1.7	1.7
3	♀	41	79	41	22	24	24	83	12	24	27	27	27	120	10	1.7	1.0
4	♀	22.5	84	42	29	27	33	84	6.5	29	22	24	29	—	—	1.3	—

15b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine	Loc.	Sex	L. in mm	W.	Th.	Str.z.	Spine
11	—	64.6	16.2	7.1	70	4.9	10	—	34.1	23.5	9.3	63	5.0
14	—	57.3	18.2	7.5	68	5.2	10	—	33.5	23.3	8.9	61	5.4
10	—	51	17.3	8.4	61	—	6	♂	33	22.5	10.3	63	5.8
15	—	48.3	19.3	7.9	72	5.4	13	—	32.9	23.7	9.4	58	6.7
13	—	47.1	18.3	7.6	70	5.3	10	—	32.8	24.4	10.4	61	6.1
12	—	47.1	19.8	7.4	70	5.5	12	—	31.5	23.8	9.5	67	6.3
12	—	46	19.6	8.0	70	4.8	9	—	31.2	22.1	9.0	64	4.8
19	—	44	21.6	9.1	66	3.4	13	—	31.1	21.9	9.3	58	6.4
17	—	43.8	20.6	8.7	64	4.6	13	—	31.1	22.5	8.7	61	6.4
12	—	43.7	20.4	9.1	64	4.6	8	juv.	31	22.6	—	—	—
1	♂	43.5	19.0	7.4	72	5.7	12	—	27.3	25.6	9.9	59	8.0
5	♀	43	21.5	9.5	63	5.7	10	—	27	27.0	10.8	63	5.5
12	—	42.3	20.3	8.0	68	5.4	13	—	25.9	24.4	9.6	58	3.9
12	—	41.7	20.8	7.9	69	5.3	12	—	24.5	28.6	9.8	57	7.3
3	♀	41	23.0	9.0	59	4.9	10	—	23.7	27.0	10.6	59	7.2
9	—	37.5	20.8	9.9	59	5.3	10	—	23.7	27.5	9.7	59	7.2
13	—	36.3	19.8	8.8	58	5.5	10	—	22.8	27.2	8.8	61	—
10	—	36	23.3	8.3	72	4.2	4	♀	22.5	24.0	9.8	53	4.9
10	—	35.9	23.5	9.5	67	4.7	12	—	21.5	25.6	9.3	56	5.6
10	—	34.8	23.6	10.1	59	5.7	19	—	21.5	25.6	9.3	60	4.6
13	—	34.7	21.0	9.2	55	4.3	12	—	21	27.6	9.5	62	4.3
12	—	34.6	22.2	9.2	66	6.6	10	—	20.8	27.4	10.1	58	6.2
12	—	34.5	24.6	8.7	61	7.2	13	—	20.5	28.3	9.7	62	—
10	—	34.3	24.8	9.3	64	5.8	13	—	19.4	26.8	9.8	59	—
12	—	34.3	21.9	8.1	64	5.8							

Description

The mantle is elongate, more than twice as long as wide, the posterior end acuminate. The dorsal mantle-margin projects strongly forward, the ventral margin is largely emarginate. The fins start behind the lateral mantle-margin and surpass the posterior end of the mantle without being united in front of the spine. The arms show a marked sexual difference. In the female they are subequal, short, rather stout, the dorsal and dorso-lateral ones having an outer membraneous keel, the ventro-lateral and ventral ones possessing a much more developed swimming-membrane. The globular suckers have a small opening and a finely dentate chitinous ring; they are quadriserial on the greater part of the length of each arm, but biserial at the base and at the extreme distal end. The protective membranes are well developed. The arms of the males are quite different. Unfortunately only the holotype is in good condition. First of all, the left ventral arm does not show any trace of a hectocotylization. In the holotype the arms are about twice as long as those of the females. The basal third of these arms bears a few biserial suckers, followed by about 7-8 transverse rows of four globular, rather big suckers, the median ones being larger than the marginal ones. The distal two-thirds become gradually narrower and the last third is threadlike in all the arms, except the ventro-lateral ones. After the basal normal portion of the arms, the suckers diminish rapidly in size, become biserial and disappear on the threadlike tip. The protective membranes are wide on the basal half of each arm, but disappear on the transformed distal half, except on the two ventro-lateral arms, where they show a very curious transformation. On these arms, after the 7th transverse row of 4 suckers, these membranes, especially the dorsal ones, become thicker and wider with very thick transverse ridges, which alternate, each ridge uniting the inner margin of one membrane to the outer margin of the opposite membrane. Each ridge bears two small suckers, an inner one at the base of one protective membrane and its smaller partner near the outer margin of the opposite membrane. On the ventral membrane these outer suckers are situated almost on the margin, but on the much wider dorsal margin they are situated about halfway on the thick ridges. As on the effiliated arms, the suckers diminish rapidly in size, then the inner ones, which alternate on each side with the opposite ridges, disappear, but the smaller minute outer suckers remain for a long distance and disappear finally near the tip of the arm, where the protective membranes persist. On the effiliated other arms, the arrangement of the suckers in alternating pairs, situated on transverse ridges, is principally the same but much less pronounced, and on these arms the protective membranes are not enlarged and disappear. This curious

transformation of the ventro-lateral arms recalls that of the dorsal arms of *Sepia incerta* Smith, 1916, where the ventral protective membrane is wider than the dorsal one (see Adam & Rees, 1966: 68, and Roeleveld, 1972: 213). The latter species also lacks the hectocotylization of the left ventral arm.

The web is shallow between the dorsal, dorso-lateral, ventro-lateral and ventral arms, and absent between the latter ones. The ventral portion of the buccal membrane of the female is ventrally extended and possesses two spermathecae. The tentacles are very long and slender, with relatively small clubs. The swimming-membrane is well-developed and extends slightly beyond the base of the club. The protective membranes are separated at the base of the club, the dorsal one rather broad and devoid of suckers. The tentacular suckers seem to be arranged in 5 longitudinal suckers, about 6 suckers of the middle series being nearly twice as wide as the other ones. In one of the female specimens of locality 5, these big suckers are of the same width as the largest arm-suckers, but in the other specimens they are much smaller; otherwise this specimen does not differ from the other ones. The chitinous rings of the tentacular suckers are finely dentate with distinctly spaced denticles, which are longest at the distal side of the ring.

The shell is very elongate, broadest in the anterior third, acutely rounded at the anterior end and acuminate posteriorly. The shell of the female (Plate 11, Figs 3-4) seems to be slightly wider than that of the male and its lateral margins are very weakly angular between the first and second third of the length, whereas in the male (Plate 11, Fig. 1) these margins are very slightly convex. Unfortunately not enough animals were available to study this character. The dorsal surface has a distinct, but low and narrow, median rib, vanishing towards the posterior end. The surface is weakly granulous, with irregular longitudinal lines, not only in the anterior part but, in well-preserved shells, also in its posterior portion. The granulous calcareous layer covers the greater part of the dorsal surface, but in the anterior half the chitinous lateral margins are rather wide, as in the preceding species. The dorsal surface is more or less rose-coloured and neatly curved towards the ventral side. The spine is slightly constricted at its base, without keels, turned upwards, sometimes slightly curved with its ventral side concave. The ventral surface shows a shallow, narrow, median groove along its whole length. In the anterior part of the striated area, the surface is flattened in the middle, with abruptly sloping, flat or concave lateral parts, separated from the outer cone by smoother, narrow, marginal zones, separated from the striated area by the narrow limbs of the inner cone. These limbs descend sometimes in the middle of the smooth marginal zones. The striae of the striated area are weakly convex, especially in the middle where they are

nearly straight, with a slight incurvation in the median groove. The limbs of the inner cone are very narrow, rounded ridges; the posterior part forming a slightly longer, sharper ledge, which surrounds the posterior excavation. The length of this posterior ledge is rather variable and depends on the size of the shell. The narrow outer cone forms two short posterior wings, which surround the posterior part of the inner cone, constituting a cup-like formation, ornamented with tiny radiating calcareous keels.

Remarks and relationship

As regards the animals, the female of *Sepia cottoni* can only be compared with that of *Sepia braggi*, as the female of *Sepia vercoi* is unknown. The general form and the relative measurements of the first two species do not show any noteworthy differences, except the arm-suckers of *Sepia cottoni* which are bigger. The males show more differences: *Sepia vercoi* possesses a hectocotylus, which is lacking in the two other species. On the other hand *Sepia cottoni* has all the arms much longer than both the other species, and the curious transformation of the ventro-lateral arms. The tentacular clubs are the same in the three species, but judging from the single animal of *Sepia vercoi*, the suckers of this species seem to be relatively smaller.

The shell of *Sepia cottoni* strongly resembles that of *Sepia vercoi* by the narrow, shallow median groove on the ventral surface, by the outline of the striae of the striated area, which are nearly straight in the middle, and by the relatively narrow chitinous margins of the dorsal surface. But the granulation of this surface is less coarse in *Sepia cottoni* and does not show the calcareous keel which, in the posterior part separates the calcareous portion from the chitinous margin.

As to the species described by Iredale, it is very difficult to compare them with the three above-described species, because the descriptions and the figures of the shells do not show enough details. *Sepia rhoda* (Iredale, 1954: 75, pl. IV, fig. 10-12) is much wider than *Sepia braggi*, but has about the same width as *Sepia vercoi* and *Sepia cottoni* of the same size. The thickness of the shell of *Sepia rhoda* is much more than that of the three other species, and the median groove of the ventral surface is lacking along the striated area, which shows a narrow median elevated rib.

Iredale (1926) described two new species from New South Wales: '*Arctosepia limata*' (p. 193, pl. XXIII, fig. 7-8) and '*Arctosepia versuta*' (p. 194, pl. XXIII, fig. 5-6). According to the description, the shell of the former species which measured 36 x 8 mm, is smaller than *Sepia braggi*, proportionately broader, less narrowed posteriorly, different shape, etc.

The shell of the second new species, which measured 33 x 7 mm, is smaller and slightly different. It is not impossible that these two species belong in fact to a single species, the shell of *Sepia versuta* representing a male specimen and that of *Sepia limata* a female. Both strongly resemble male and female shells of *Sepia cottoni* of the same size. It is noteworthy that according to Iredale (1954: 74) hundreds of shells of *Sepia limata* have been collected 'but the majority have been broken, as the bones are brittle, while none exceeding these measurements has been collected in the Sydney district, and specimens have been secured on the north coast of New South Wales, and south Queensland.' If *Sepia limata* was conspecific with *Sepia cottoni*, the shell of which may attain 64.6 mm, it would be very curious that Iredale only collected small specimens.

As to *Sepia versuta*, Iredale (1954: 75) states: 'In southern Australia large shells (for the group) occur with the name *braggi*, and it would appear that these small New South Wales shells are degenerate representatives of the larger ones. Thus, Whitley collected a series of *braggi*-like bones in northwestern Tasmania, and while most of these are obviously of the true *braggi* style, some others are of the *versuta* form, and appear to be far larger relatives.' 'The northern *versuta* was separated from *limata* as being "smaller, the growth lines more closely packed, the posterior end much less rapidly tapering, the anterior ventral more swollen, less excavate posteriorly, and with more numerous striae". The Tasmanian specimens measure 51 by 10 mm and 48 by 10 mm, and are elongate and narrow, the width never increasing rapidly, the ventral surface elevated, the median furrow in one specimen elevated into a rib, in the other normal, the striae rather coarse, the hood small, the spine short and thickened, the dorsal area smoothish, the median rib scarcely indicated. This may have been confused elsewhere with *braggi*, passing as the male or immature, but it is here named *Arctosepia treba* sp. nov., from Stanley, northwestern Tasmania.' This new species has not been figured.

In order not to increase the already existing confusion among this group of species, I prefer to consider *Sepia cottoni* as a separate species, characterized by the male which lacks a hectocotylus, but has both its ventro-lateral arms transformed, and by the shell with a weak median groove on its ventral surface, slightly convex or even straight striae in the middle of the striated area, a weakly granulous dorsal surface and rather wide chitinous margins in the anterior half of the shell. This new species has been dedicated to the late B.C. Cotton.

Judging by the numerous dry shells in the present collection, this species seems to be the most common of the elongate species on the Western

Australian coast. Several of the references given with a question mark under *Sepia braggi* (p. 185) probably apply to our new species.

SEPIA REESI SP. NOV.

(Plate 4, Fig. 3)

Holotype

- 1 Salmon Bay, Rottnest I., W.A.; leg. L. Glauert; September 1931; WAM 497-76: 1 dry shell (Plate 4, Fig. 3)

Paratypes

- 2 Salmon Bay, Rottnest I., W.A.; leg. L. Glauert; September 1931; (a) WAM 498-76: 1 dry shell.
- 3 Salmon Bay, Rottnest I., W.A.; leg. L. Glauert; September 1931; (b) WAM 499-76: 1 dry shell.

Geographical distribution

Unknown beyond the type locality.

TABLE 16
Measurements of *Sepia reesi*

Specimen	L. in mm	W.	Th.	Str.z.	Spine
Holotype 1	45.2	25	7.3	71	4.9
Paratype 2	45+	27.5	8.4	78	-
Paratype 3	42.4	28.5	8.3	73	3.1

Description

Shell elongate, sharply rounded anteriorly, broadly rounded posteriorly. Dorsal surface salmon-coloured, the holotype with a distinct median rib, limited by very narrow grooves, the paratypes with a less distinct rib, without limiting grooves. The dorsal surface is nearly smooth near the anterior end, weakly granulous on the remaining part, the granules forming a reticulate pattern near the posterior end and at each side, at the bases of the lateral parts of the outer cone, an irregular, keel-like longitudinal ridge, separated from the median part of the surface by an indistinct groove.

The ventral surface shows a narrow median groove (sulcus) along the whole striated zone and on the greater part of the last loculus. The striae

are nearly straight transverse in the posterior portion, more and more reversed V-shaped in the anterior part of the striated zone. The latter is flanked at each side by a rather broad, nearly smooth area, which is flat or weakly concave and which descends abruptly towards the outer cone. At each side this smooth zone, which shows in fact very weak growthlines, forms a rounded angle with the nearly flat median part of the striated zone. In the posterior half of the shell the limbs of the inner cone separate the striated area from the lateral smooth zones.

The inner cone has very narrow, rounded limbs and is bluntly rounded posteriorly, surrounding a shallow depression; the limbs disappear gradually towards the middle of the striated area. The outer cone is narrow, slightly enlarged in the posterior part as two wings, which are continuous between the spine and the inner cone. The spine is rounded and distinctly turned upwards, but not curved. The posterior end of the shell is regularly curved towards the ventral side.

Remarks and relationship

These three specimens, the holotype representing perhaps a male and the paratypes the female, resemble *Sepia mira* (Cotton, 1932: 546, fig. 7-9) from Queensland (North-West Islet, Capricorn Group), for which the author created a new genus, *Tenuisepia*, characterized by: 'Sepion small, elongate, narrow, five times as long as broad; inner cone much reduced; no ventral sulcus; dorsum without ribs; spine medium, stout, rounded'. But *Sepia mira*, of which only one specimen is known, has a narrower shell, more elongate posterior wings at the outer cone, no dorsal keel, no ventral sulcus, a less rounded posterior portion of the inner cone and of the outer cone, a spine which is not turned upwards, and the posterior end of the shell less curved towards the ventral side.

On the other hand, the shell of our new species resembles the female shell of *Sepia chirotrema*, which has been described as *Sepia hendryae* (see p. 125), but the latter is much broader and the limbs of the inner cone and the ventral sulcus are also much wider; the sculpture of the dorsal surface is about the same.

I dedicate this species to the late Dr W.J. Rees, a dear friend and colleague with whom I published the review of the Sepiidae in 1966.

SEPIA (METASEPIA) PFEFFERI HOYLE, 1885

(Plate 12, Fig. 6; Plate 13, Figs 2-3)

Sepia (Metasepia) pfefferi Hoyle, W.E., 1885: 199; 1885a: 304; 1886: 145, pl. XXI, figs 1-10

- Brazier, J., 1892: 13
 Adam, W. & Rees, W.J., 1966: 114, pl. 43, fig. 256
Metasepia pfefferi Iredale, T., 1954: 78
 ?*Metasepia pfefferi laxior* Iredale, T., 1926a: 240, pl. XXXV, figs 9-10;
 1954: 78
 ?*Metasepia pfefferi wanda* Iredale, T., 1954: 78, pl. V, figs 9-11

Type locality

Challenger Sta. 188, 9°59'S, 139°42'E, south of Papua, Arafura Sea, 28 fms [green mud], 19-IX-1874.

Geographical distribution

Northern Australia; southwards to Mandurah in Western Australia and to the Capricorn Group, Queensland, on the east coast.

MATERIAL

Spirit specimens

- 1 Shark Bay, W.A.; September 1963; WAM 466-65: 1 ♀ (Plate 12, Fig. 6).
- 2 SW of Jurien Bay, W.A. (30°38'S, 114°47'E), 110 m; December 1970; WAM 856-75: 1 ♀ (Plate 13, Fig. 2).
- 3 W of Mandurah, W.A. (32°33'S, 115°04'E), 110 m; November 1970; WAM 859-75: 1 ♀ (Plate 13, Fig. 3).
- 4 Shark Bay, W.A.; early 1966; WAM 492-76: 1 ♀.
- 5 Shark Bay, W.A.; August 1962; WAM 431-65: 1 ♀ (M.L.d. 32 mm).

TABLE 17

Measurements of *Sepia (Metasepia) pfefferi*

17a: Animal (in % of dorsal mantle-length)

Loc.	Sex	M.L.d. in mm	M.L.v.	M.W.	M.Th.	H.L.	H.W.	F.L.	F.W.	A.L.I	A.L.II	A.L.III	A.L.IV	T.cl.	S.a.	S.t.
4	♀	57	84	68	56	42	58	100	14	32	46	49	47	17.5	3.2	—
1	♀	44	82	77	55	34	66	100	18	48	50	57	50	22.5	2.7	3.2
3	♀	27	78	85	41	59	67	96	7.4	59	70	74	63	14	2.6	3.7
2	♀	16	87	93	62	56	94	100	12.5	56	69	81	69	22	3.7	5.6
Type	♀	52	94	—	—	48	63	96	11.5	38	52	58	58	11.5	2.3	3.3

17b: Shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.
4	♀	42	55	—	—
1	♀	35	53	15	63
3	♀	22.5	58	18	53
2	♀	14	64	14	46
Type	♀	42	55	16	71

17c: Literature records

Subspecies	L. in mm	W. (%)	Author
<i>laxior</i>	51	63	(Iredale, 1926a: 240)
<i>laxior</i>	36	67	(Iredale, 1926a: 240)
<i>laxior</i>	27	59	(Iredale, 1926a: 240)
<i>wanda</i>	43	63	(Iredale, 1954: 78)
<i>wanda</i>	38	61	(Iredale, 1954: 78)
<i>wanda</i>	20	62	(Iredale, 1954: 78)

Description

The mantle is broadly oval and very thick; its dorsal margin slightly angular, the ventral margin broadly emarginate around the funnel. In the larger specimens the dorsal surface is dark purple with irregular lighter coloured patches, especially on the base of the fins, the latter having a wide uncoloured border. The two small specimens are light reddish brown. The flat ventral surface of the mantle is greyish, bordered by a dark V-shaped ridge, separating it from the sides of the mantle which are darker coloured with, at the base of each fin, a series of big roundish lighter patches. In the two small specimens, the V-shaped ridge is very dark in contrast with the ventral and lateral sides; the same dark-purplish colour is seen on the arms as irregular patches along the swimming-membrane and on the distal portion of the arms.

The fins start at a short distance behind the mantle-margin and are distinctly separated at the blunt posterior end of the mantle; they are wide and on both ventral and dorsal surfaces pigmented only on the inner half of their width.

The head is short, the eyes are not very prominent.

The arms are short and very stout in their basal half, acuminate in their distal half. The dorsal arms and in a lesser degree, the dorso-lateral and

ventro-lateral ones have filiform tips with only a few minute suckers. The basal half of each arm bears rather large suckers, disposed in transverse rows of four, the median ones somewhat wider than the marginal ones. On the dorsal arms there are 6 transverse rows of big suckers, on the lateral arms 8-10 rows and on the ventral ones 7-8 rows. On the remaining portion of each arm the suckers are much smaller, becoming minute and biserial near the tip. The protective membranes are rather wide covering completely the distal suckers. Each membrane has very prominent, transverse, greyish-white or darker coloured thickenings, alternating with the suckers. These thickenings have an irregularly folded or wrinkled surface, which may be partly due to contraction during fixation. The chitinous rings of the arm-suckers show numerous fine denticles. All the arms are laterally compressed with an outer swimming-membrane along their whole length. The distal parts of these membranes bear sometimes a few papillae on their outer borders, as in *Sepia papuensis*.

The tentacles are very long and slender with rather short clubs. The exact arrangement of the tentacular suckers is difficult to ascertain, their total number attains about 40. Probably there are 5 or 6 longitudinal series. Four median suckers are much larger than the other ones, long-stalked and each situated in a deep pit; two of them may attain 5.6% of the mantle-length in the smallest specimen. At the dorsal side of each big sucker are two minute suckers, at the ventral side two or three bigger ones, the largest of which attains about one-third of the diameter of the big median suckers. In the small specimens the chitinous rings are finely dentate, but in the bigger ones the rings of the big suckers are smooth. The swimming-membrane is very wide along the tentacular club, but becomes gradually narrower along the tentacular stem; its whole length is about twice that of the club. The protective membranes are thin and narrow, separated at their bases and continuing on the inner surface of the stem beyond the swimming-membrane. The dorsal membrane is separated from the stem of the club by a deep groove, but there are no fenestrae opposite the big suckers as in *Sepia chirotrema*.

Even the smallest of these four female specimens has well-developed nidamentary glands; unfortunately the male is unknown.

The shell does not differ from that of the holotype. In well-preserved specimens the posterior end is more acuminate; it shows at its ventral surface the radiating calcareous streaks which pass from the rounded angle of the inner cone outwards on the horny termination. This is probably the calcification which according to Iredale (1926a: 240) suggests a spine formation in the largest specimen of his sub-species *laxior*.

Remarks

According to Hoyle (1886: 148) 'In *Sepia pfefferi* the pits at the base of the funnel for articulation with the mantle are deepest in the middle, not at the anterior end as in *Sepia tullbergi*.' In the small specimens these pits are in fact situated about in the middle of the funnel cartilages, but in the larger specimens they are in front of the middle.

Iredale (1926a: 240, pl. XXXV, figs 9, 10) described a sub-species *laxior* for a broader shell, found in the Capricorn Group at the southern end of the Great Barrier Reef. In 1954 (p. 78) he mentioned this sub-species from other localities along the Queensland coast and stated that Whitley collected specimens of a different form at Denham, Shark Bay, Western Australia. For the Shark Bay form, Iredale (1954: 78, pl. V, figs 9, 10, 11) introduced the sub-species name *wanda*. These sub-species are only based on the shells, the animals have not been described. According to Iredale (1954, p. 78) the western form shows little calcification of the inner limbs, while in the eastern form the inner limbs are well calcified. In well-preserved shells both the anterior and posterior ends are rather acuminate, but these chitinous portions may be easily worn or damaged in beach-collected shells or in shells extracted from the animals, which changes the relative width. The inner limbs of the above-described specimens are normally calcified. Consequently I do not see any reason to separate the specimens described by Iredale as a western and an eastern sub-species.

SUPPLEMENTARY NOTE

Included in the Western Australian Museum collections sent to me for study were specimens of three species from non-Western Australian localities but which are worth reporting.

SEPIA MESTUS GRAY, 1849

(Plate 9, Fig. 3)

Sepia mestus Gray, J.E., 1849: 108

Tryon, G.W., 1879: 197

Hoyle, W.E., 1886: 135, fig. 5

Brazier, J., 1892: 12

- Tate, R. & May, W.L., 1901: 351
 ?Chapman, F., 1912: 25
 Hedley, Ch., 1918: M.33
 Adam, W., 1939: 52, 86
 Adam, W. & Rees, W.J., 1966: 45, pl. 13, fig. 74-75; pl. 14, fig. 76-79;
 pl. 15, fig. 80-83; pl. 46, fig. 274
Ascarosepion verreauxi Rochebrune, A.T. de, 1884: 98, pl. V, fig. 2
 Adam, W., 1944: 229
Solitosepia liliana Iredale, T., 1926: 188, pl. XXI, fig. 1-3; 1954: 64
 Iredale, T. & McMichael, D.F., 1962: 98

Type localities

Australia (*S. mestus*); Sydney (*S. verreauxi*); Manly Beach, N.S.W. (*S. liliana*).

Geographical distribution

Southern Queensland and New South Wales, eastern Australia.

MATERIAL

Dry specimens

- 1 Flinders Beach, near Amity, Stradbroke I., Qld; June 1973; WAM 810-75: 2 spec. (Plate 9, Fig. 3).

TABLE 18
 Measurements of *Sepia mestus*

Shell (in % of shell-length)					
Loc.	L. in mm	W.	Th.	Str.z.	Spine
1	74	44	8.1	69	5.1
1	68.2	41	9.8	65	5.8

Description

The shell is oval, broadest in its posterior half, slightly acuminate at the anterior end and with a strong, ventrally keeled, posterior spine, which is slightly directed upwards. The dorsal surface is convex with a faint indication of an indistinct median rib. Nearly the whole dorsal surface is reticulate

granulous, this granulation being strongest near the posterior end and on the outer cone. The ventral surface is rather flat with a very narrow, shallow, median groove in the striated area; this groove being slightly wider on the last loculus. The striae are regularly convex and very close together. The limbs of the inner cone are very large in their posterior half and are completely fused to the outer cone. The lateral parts of the outer cone are broad and continuous behind the inner cone as a narrow margin. The spine has a high wedge-like ventral keel.

Remarks

As mentioned by Adam & Rees (1966: 46), the animal of this species is not known for certain. They described a badly preserved female specimen from Northern China which seems to belong to this species.

The specimens described and figured by Iredale (1926: 189, pl. XXI, fig. 4-5) as '*Solitosepia mestus*' do not seem to belong at all to this species. On the other hand I do not doubt that '*Solitosepia liliana* Iredale, 1926' is synonymous with the true *Sepia mestus* Gray.

SEPIA PLANGON GRAY, 1849

(Plate 6, Fig. 2)

Sepia plangon Gray, J.E., 1849: 104

Tryon, G.W., 1879: 194

Hoyle, W.E., 1886: 128

Brazier, J., 1892: 11

Hedley, C., 1918: M.33

Adam, W. & Rees, W.J., 1966: 42, pl. 13, fig. 70-73; pl. 44, fig. 267

Acanthosepion plangon Rochebrune, A.T. de, 1884: 105

Adam, W., 1944: 231

Solitosepion plangon Iredale, T., 1926: 190, pl. XXIII, fig. 3-4; 1954: 66

Iredale, T. & McMichael, D.F., 1962: 98

Solitosepia plangon adhaesa Iredale, T., 1926a: 238

?*Sepia cultrata* Hedley, Ch., 1918: M.33 (non Hoyle, 1886)

?*Sepia polynesica* Pfeffer, G., 1884: 11, fig. 14, 14a

Type localities

Port Jackson, Australia (*Sepia plangon*); North-West I., Capricorn Group (*S. plangon adhaesa*).

Geographical distribution

Eastern Australia (southern Queensland, New South Wales, Lord Howe Island).

MATERIAL

Dry specimens

- 1 Flinders Beach near Amity, Stradbroke I., Qld; June 1973; WAM 802-75: 2 spec. (Plate 6, Fig. 2)

TABLE 19

Measurements of *Sepia plangon*

Shell (in % of shell-length)					
Loc.	L. in mm	W.	Th.	Str.z.	Spine
1	95.5	31	7.7	73	4.7
1	63.4	28.5	8.6	66	4.7

Description

Both shells are rather worn but they certainly belong to this species. In each the spine possesses a ventral keel and is distinctly curved upwards. See Adam & Rees (1966: 42-43) for a full description of this species.

SEPIA BANDENSIS ADAM, 1939

Sepia bandensis Adam, W., 1939: 1, fig. 1-4; 1939a: 53, pl. III, fig. 4-5
Adam, W. & Rees, W.J., 1966: 104, pl. 26, fig. 165-168; pl. 44, fig. 266

Type locality

Banda Neira.

Geographical distribution

Central Indo-West Pacific.

MATERIAL

Spirit specimen

- 1 Little Lagoon, Sibutu, Sulu Arch., Philippines (4°31'N, 119°22'E), on reef sand flats at low tide at night; February 1964; WAM 468-65: 1 ♂. 1 ♀.

TABLE 20
Measurements of *Sepia bandensis*, shell (in % of shell-length)

Loc.	Sex	L. in mm	W.	Th.	Str.z.
1	♂	43.5	44.5	9.2	64
1	♀	42	51.5	10.5	66.5

Description

The poor preservation of the animals does not permit a detailed description and exact measurements, but there does not seem to exist any noteworthy difference with the type material. The shells show exactly the same characters.

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