

# Designation of a Neotype for the Dwarf Sea Hare *Aplysia concava* G. B. Sowerby I, 1833, and a Review of the Status of *Aplysia norfolkensis* G. B. Sowerby II, 1869 (Mollusca: Heterobranchia)

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**ABSTRACT.** A recent revision of the globally distributed dwarf sea hare *Aplysia parvula sensu lato* split that species into 10 separate taxa. As Australian specimens were not included in this revision, further study using material from the south west Pacific was warranted. At least one described species, *Aplysia concava*, was found to occur in southeastern Australia, New Zealand and New Caledonia. A redescription of this species was published by Nimbs & Wilson (2021) even though the holotype was deemed lost—the difficulty, in 2020–2021, to access important and relevant museum specimens, prevented the designation of an appropriate neotype at that time. The present study is an annexure to the published redescription for the purpose of designating a neotype for *Aplysia concava* and provides a discussion on the taxonomic status of another dwarf sea hare species, *Aplysia norfolkensis*, which is herein regarded as a junior synonym of *A. concava*.

## Introduction

The sea hare genus *Aplysia* Linnaeus, 1767 is the most speciose genus in the marine mollusc family Aplysiidae Lamarck, 1809 (Nimbs *et al.*, 2017a,b). The dwarf sea hare, *Aplysia parvula* Mörch, 1863 *sensu lato*, was once thought to be a globally distributed taxon, but a recent study by Golestani *et al.* (2019) divided it into 10 species, many of which are cryptic. In that study, Australian animals were not examined and, consequently, Australian *Aplysia parvula s. l.* warranted further study. Given the presence of cryptic species complexes among Indo-Pacific *A. parvula s. l.*, molecular data from Australian specimens were analysed in an attempt to identify any unknown or previously unrecognized species (Nimbs & Wilson, 2021).

Among Australian specimens of dwarf sea hares, only *Aplysia concava* G. B. Sowerby I, 1833, was found (Nimbs & Wilson, 2021). Golestani *et al.* (2019) reported the *A. concava* holotype lost and, as the original description was based solely on a shell, they could not differentiate it from any of the other species examined in their study. Consequently, they considered *Aplysia concava* to be a *taxon inquirendum* (Golestani *et al.*, 2019).

Recently collected specimens from the Australian east coast and some museum-material conformed to the original description of *A. concava* by G. B. Sowerby I and, with additional molecular data, a redescription was published by Nimbs & Wilson (2021). During their study in 2020 additional museum specimens of Australian *Aplysia parvula*

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**Table 1.** Details of specimens studied (after Nimbs & Wilson, 2021: table 1). Localities, except Hunter Island<sup>a</sup>, in New South Wales, Australia.

voucher	locality	date	collected by	length (mm)	COI	16S	H3
AMS C.481313	Smoky Cape	30 Feb 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	9	—	—	—
AMS C.481398	Hastings Point	27 Feb 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	7	MT107263	MT108945	MW854246
AMS C.481399	Hastings Point	27 Feb 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	19	MT107259	MT108948	MW854247
AMS C.481400	Hastings Point	27 Feb 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	16	MT107267	MT108950	MW854248
AMS C.481462	Tweed Heads	28 Feb 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	7	MT107262	MT108947	MW854249
AMS C.481573	Tweed Heads	28 Feb 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	12	MT107265	MT108951	MW854250
AMS C.481686	Kingscliff	03 Mar 2014	J.H. Waterhouse, A.C. Miller, F. Noss, D. Holmes	14	MT107264	MT108944	MW854251
AMS C.546630	Lord Howe Island	04 Apr 2017	K. Layton, A. Reid (Reid <i>et al.</i> , 2017)	9	MT107268	MT108943	MW854252
AMS C.572080	Hunter Island <sup>a</sup>	04 Aug 2017	S. Hannam, A. Reid, E.K. Kupriyanova, L. Vogel, I. Middleton	16	MT107261	MT108949	MW854253
AMS C.574818	Sandy Beach	04 Mar 2016	S. D. A. Smith	7	MT107260	MT108946	MW854254
AMS C.574821	Sandy Beach	06 Apr 2016	M. Nimbs	8	MT107266	MT108953	MW854255
AMS C.574820 <sup>c</sup>	Newcastle	14 Dec 2016	S. D. A. Smith	14	—	—	—
AMS C.574826	Sandy Beach	08 Jan 2019	M. Nimbs	7	MT107269	MT108942	MW854256
WAM S.29698	Coffs Harbour <sup>b</sup>	24 May 2019	M. Nimbs	12	—	—	—

<sup>a</sup> Hunter Island, 22.396°S 172.085°E, east of New Caledonia, south of Vanuatu.

<sup>b</sup> Korff's Islet, Coffs Harbour.

<sup>c</sup> AMS C.574820, neotype of *Aplysia concava* G. B. Sowerby I, 1833.

*s. l.* could not be accessed for loan due to museum closures. As a result, a neotype for *Aplysia concava* was not then designated. Furthermore, examination of museum material of another potential Australian *A. parvula s. l.* species, *Aplysia norfolkensis* G. B. Sowerby I, 1869 (synonymized with *A. parvula* by Eales (1960) was needed to clarify its taxonomic status. *Aplysia norfolkensis* was not examined by Golestani *et al.* (2019).

The purpose of the present study is to further affirm that the *A. concava* holotype is indeed lost and to designate an appropriate neotype to replace it. Once the available names are connected to available specimens we then explore the taxonomic status of *A. norfolkensis*.

## Methods

Thirteen specimens from eastern Australian and one from Hunter Island (east of New Caledonia) were examined. These consisted of nine specimens sourced from the Australian Museum, Sydney (AMS), and four whole specimens collected from various localities in northern New South Wales (NSW) (Table 1 after Nimbs & Wilson, 2021: table 1). Material was examined and photographed using an Olympus S2×7 binocular microscope with an Olympus DP26 overhead-mounted digital camera. Living specimens were photographed using an Olympus TG6 camera.

## Systematics

### Family Aplysiidae Lamarck, 1809

#### Genus *Aplysia* Linnaeus, 1767

#### *Aplysia concava* G. B. Sowerby I, 1833

Fig. 1

Sowerby I (1833) described *Aplysia concava* based on a shell from an unknown location. The type specimen could not be found at the UK Natural History Museum and is likely lost (A. Salvador pers. comm., cited in Golestani *et al.*, 2019; Nimbs & Wilson, 2021).

In accordance with Article 75.3 of The Code (ICZN 1999), specimen AMS C.574820 collected from Newcastle, NSW, on 14 December 2016 by Stephen D. A. Smith is here designated as neotype for *Aplysia concava* G. B. Sowerby I, 1833 for the purpose of clarifying the taxonomic status of the species (Fig. 1). Characters that define the neotype and differentiate it from other taxa in the *Aplysia parvula s. l.* species complex are listed in Nimbs & Wilson (2021).

Although the type locality for *Aplysia concava* was not specified by Sowerby I, it was listed as “Australia” by Sowerby II in 1869. Given the broad geographic scope associated with this putative original type locality, a specimen collected from Newcastle, NSW on the central east Australian coast was selected as a reasonable neotype. The neotype has been lodged with the Australian Museum, Sydney, Australia (AMS C.574820).



**Figure 1.** Photograph of living neotype of *Aplysia concava*, specimen AMS C.574820, Newcastle, NSW, Australia, collected 14 December 2016, by Stephen D. A. Smith. Photograph: M. Nimbs.

### *Aplysia norfolkensis* G. B. Sowerby II, 1869

G. B. Sowerby II, 1869, p. 216, pl. 10, fig. 42A–B; type locality “Norfolk Island, New South Wales” [but later determined to be Port Jackson (= Sydney Harbour), see text];—Pilsbry, 1895, vol. 16, p. 100.

*Tethys norfolkensis*.—Hedley, 1906, p. 536, pl. XXXIII, figs 33, 34;—Singleton, 1937, p. 296.

Although Sowerby II lists the type locality for *A. norfolkensis* as “Norfolk Island, New South Wales”, later authors assert that the type specimen was collected by John Brazier (Australian Museum) who then supplied the shell to Sowerby (Burn, 2019; Hedley, 1906). According to Hedley (1906), Brazier’s specimens were collected from Sydney Harbour, NSW.

Sowerby’s original description, as with many 19th century sea hare descriptions, was based solely on a shell. The shell illustrated by Sowerby (Fig. 2), was described as exhibiting an “... auricle produced by the reflected dorsal margin

[which] is more expanded in *Aplysia concava* than in this similarly shaped but differently coloured shell” (Sowerby II, 1869, p. 216). Later, however, Pilsbry (1895) suggested that *A. norfolkensis* was probably synonymous with *A. concava*. Hedley described and figured a living specimen of *A. norfolkensis* (Hedley, 1906; pl. xxxiii, figs 33, 34) and provided a description and drawings of the mantle characteristics which are consistent with those found in *A. concava* (Nimbs & Wilson, 2021).

A single shell of *A. norfolkensis* collected by Brazier, from Bradleys Head, Port Jackson, Sydney, NSW, Australia on 25 June 1892 was examined and photographed as part of the present study (Fig. 3A, B). The morphology of this shell agrees with Sowerby’s original painting of *A. norfolkensis*. Additionally, this distinctive, concave shell is consistent with that found in *A. concava* (Nimbs & Wilson, 2021). Consequently, *Aplysia norfolkensis* G. B. Sowerby II, 1869, is herein regarded as a **junior synonym** of *Aplysia concava* G. B. Sowerby I, 1833.

Species 24. (Fig. a, b, Mus. Sowerby.)

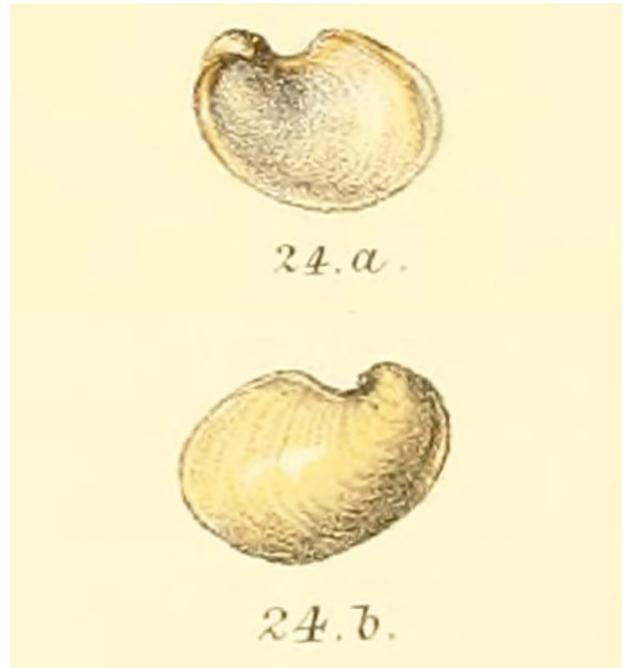
APLYSIA CONCAVA. *Apl. testâ parvâ, stramineâ, tenui, ventricosâ, transversâ, levigatâ, intus albâ; apice parvâ, rotundâ, validè incurvâ, utrinque subauriculatâ; margine superiori concavâ, brevi, ad terminum elevatâ; labio externo anticè obliquè producto; margine dorsali reflexo, elevato, obliquè versùs labium externum declivi.*

THE CONCAVE APLYSIA. Shell small, straw-coloured, thin, ventricose, transverse, smooth, white within; apex small, rounded, strongly incurved, subauriculated on both sides, upper side concave, short, dorsal margin reflected, elevated, oblique sloped towards the outer lip.

SOWERBY. Genera of Shells.

*Hab.* Australia.

*Aplysia anguilla* is more transverse, and *Aplysia rosea* more triangular than this species, although they nearly resemble it; the apex is auriculated, and the reflected lateral margins near it.



Species 42. (Mus. Sowerby.)

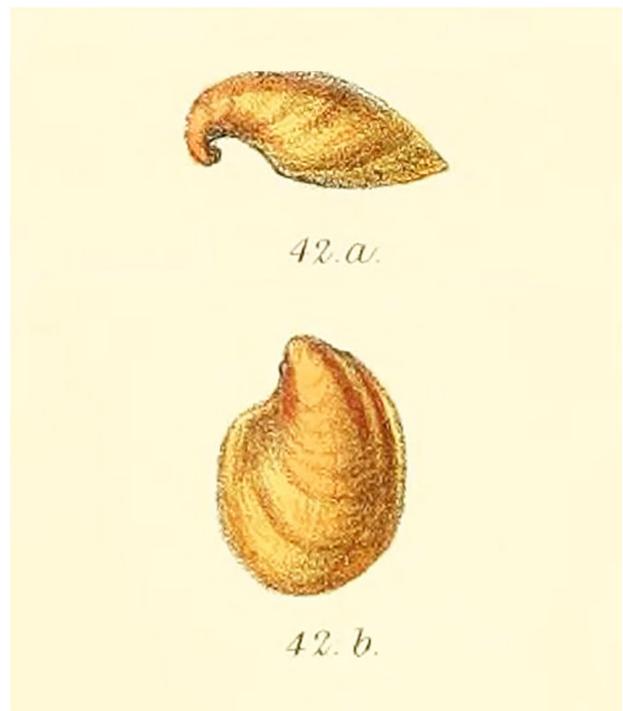
APLYSIA NORFOLKENSIS. *Apl. testâ corneâ, fuscâ, arcuatâ, ventricosâ, obliquè subovatâ, tenui, levigatâ; apice elevato, rotundo, dorso auriculato; margine superiori declivi, excavato; labio externo convexiusculo; margine inferiori rotundo; margine dorsali arcuato, rotundo, prope apicem tenuiter reflexo, versùs terminum inferiorem obliquè inclinato.*

THE NORFOLK ISLAND APLYSIA. Shell horny, brown, arched, ventricose, obliquely subovate, thin, smooth; apex elevated, round, auriculated at the back; upper margin sloped, excavated; outer lip rather convex; lower margin rounded, dorsal margin arched; rounded, thinly reflected near the apex, obliquely inclined towards the lower end.

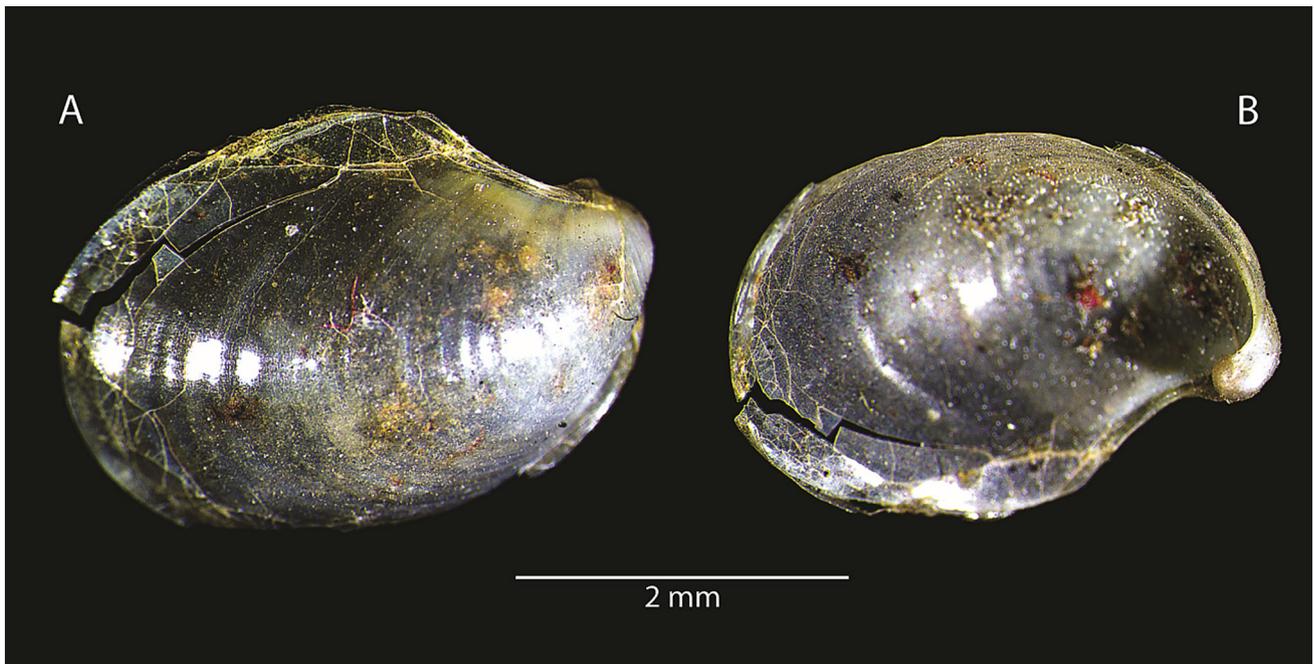
SOWERBY.

*Hab.* Norfolk Island, New South Wales.

The auricle produced by the reflected dorsal margin is more expanded in *Aplysia concava* than in this similarly shaped but differently coloured shell.



**Figure 2.** Original descriptions and figure illustrations of shells for *Aplysia concava* G. B. Sowerby I, 1833: vol. 2, p. 243, pl. 235, figs 24a,b; and *Aplysia norfolkensis* G. B. Sowerby II, 1869: vol. 17, p. 216, pl. 10, figs 42a,b. Sourced from Biodiversity Heritage Library, (see Sowerby I, 1833; Sowerby II, 1869).



**Figure 3.** Light microscope image of *Aplysia norfolkensis* shell, (a) dorsal view, (b) ventral view, specimen AMS C.55733, collected by Brazier, J., 25 June 1892, Bradleys Head, Port Jackson, Sydney, NSW, Australia. Photograph: M. Nimbs.

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