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**On the identity of *Nerita undulata* Gmelin, 1791,
previously known as *Nerita grayana* Récluz, 1843
(Gastropoda: Neritidae)**

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Abstract: *Nerita undulata* Gmelin, 1791 is found to be a valid taxon. As a consequence *Nerita flammulata* Récluz, 1841 and *Nerita grayana* Récluz, 1843 turn out to be junior synonyms. It was also found that the sample of the type-material of *Nerita trifasciata* Le Guillou, 1841 in MNHN, Paris consists of three species. One specimen is the true *N. trifasciata* Le Guillou, 1841 and hereby designated as lectotype of *N. trifasciata*; all other specimens are *N. undulata*. These latter specimens should be separated from the lectotype of *N. trifasciata*. All the type-material of *N. trifasciata* in MHNG, Genève are *N. undulata*; these specimens are no longer type-material of *N. trifasciata*.

Introduction: In previous articles nearly all species of the genus *Nerita* were discussed (Krijnen et al, 1995, 1997, 1999, 2001). We noticed that a lot of confusion about the true identity of *Nerita undata* Linné, 1758 arose during the previous two centuries. This taxon was therefore stabilized by assigning a neotype (Krijnen et al, 2006). In the present article and future ones we will discuss the species that are related to the so-called *N. undata*-complex. In this first contribution *Nerita undulata* Gmelin, 1791 and its synonyms are discussed.

Figures 2-11 in the text are illustrated in colour on Plate 2.

Abbreviations:

UZMC University Zoological Museum, Copenhagen
MHNG Muséum d'Histoire Naturelle, Genève
MNHN Muséum National d'Histoire Naturelle, Paris
ZMA Zoological Museum, Amsterdam

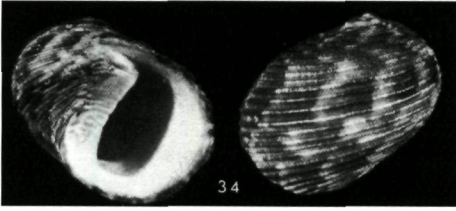
Discussion of holotype:*Nerita undulata* Gmelin, 1791.

Fig. 1. (from Cernohorsky, 1974 :
fig. 34)

Original description. - Gmelin, 1791.
Syst. Nat. XIII: 3678, sp. 36
(Chemn. tab. 191, figs. 1970-1971).
Type material.- "21.7 x 24.0 mm"
(Cernohorsky, 1974: 166).
Type locality. - "India" (Gmelin).
Type depository. - UZMC.

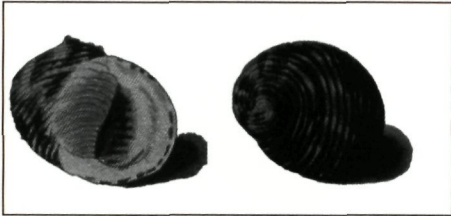


Fig. 2. (from Chemnitz, 1781: tab. 191,
figs. 1970-1971)

Characteristics: Elongated shell with moderately developed spire. Juvenile specimens are significantly more globose. On the ochre-brown background all kinds of black coloured oblong spots are formed, not always forming an axial wavy pattern, but often forming three bands. Densely ribbed (approx. 30 in number); ribs rounded and finely grooved by axial striae. Secondary ribs may appear mainly in the upper half of the final whorl and in adult specimens only. Flat to slightly concave parietal shield: creamy white to yellow (in adult specimens); wrinkles behind the columellar teeth are small but obvious; on the upper half of the parietal shield the wrinkles extend towards the cubed tooth while on the lower half they shorten and become obscure. On the columella there are two, sometimes three, centered teeth with a cubed tooth above them. Inside the outer lip one rather distinct tooth in the upper part and 15 – 18 crenations.

Operculum flat to slightly convex, densely granulated and brownish. No pustulous callosity on the base of the apophysis inside the operculum.

This species belongs to the subgenus *Cymostyla* Von Martens, 1887.

Habitat: Often found on roots and branches of mangrove-trees or at nearby locations. Occurs with *Nerita planospira* Anton, 1839.

Synonyms: *Nerita flammulata* Récluz, 1841. Tsuchiya (2000: 103) mentioned *N. flammulata* as a synonym of *Nerita undulata* Gmelin, 1791 and confirmed the mangrove habitat. After examination of specimens of several large samples including growth series (Siboko peninsula, West Sumatra, Indonesia; Bunaken, North Sulawesi; Tanjung Karang, west coast of Prov. Central Sulawesi; Bira, South Sulawesi; Paso, Ambon, Indonesia), we believe that these specimens sufficiently match the type-material of *N. undulata* shown by Cernohorsky (1994: 166) as well as with the specimens of *N. flammulata* figured by Tsuchiya. For further comments see discussion of synonyms.

Nerita grayana Récluz, 1843. Most features in Récluz' description of *N. grayana* correspond well with the appearance of *N. undulata* i.e. the habitus of the shell, the number of primary ribs alternating with secondary ones, the teeth on the columella (although worn in *N. undulata*), viz. one cubed tooth followed by two equal-sized centered teeth and the columellar area that is strongly inclined into the aperture. For further comments see discussion of synonyms.

Studied material: Up to 33 x 42 mm. (h x w).

Distribution: Andaman and Nicobar Isl. (as *N. grayana*, Subba Rao, 2003: 110); Siboko peninsula, West Sumatra, Indonesia (coll. B. Gras and coll. W. Regter); Bunaken, North Sulawesi; Tanjung Karang, west coast of Prov. Central Sulawesi; Bira, South Sulawesi; Paso, Ambon, Indonesia (Rumphius expedition, 1990); Philippines; Okinawa Isl., South Japan (coll. Y. Kano); Waigeo, Irian Jaya.

Discussion: In the description of '*Die feinere und leichtere gewässerte Nerite*' (= *N. undulata* Gmelin, 1791) Chemnitz (1781: 301-302) mentioned that his figs 1970-1971 were made according to specimens in the Spengler collection ('*Ex museo Spengleriano*'). In the overview of type specimens of mollusca in UZMC, Cernohorsky (1974: 147) used the following criterium to select a holotype: "*Provided that only a single specimen of the species illustrated and cited by Gmelin is present in the Spengler-Moltke collection, this specimen should be regarded as the holotype.*". We regard the selected specimen as the holotype.

Cernohorsky (1994: 166) stated that *N. undulata* is a synonym of *Nerita chamaeleon*

Linné, 1758. At first, we agreed with Cernohorsky (Krijnen et al., 2006: 72). However, after a careful examination of several hundreds of specimens we concluded that this is not correct and that *N. undulata* is in fact to be regarded as a valid species.

In the past several other authors also regarded *N. undulata* as a valid species: Dillwyn (1817: 1005) compared *N. undulata* with *N. undata* Linné, 1758; the former species "...is said to be thinner, with the ribs much narrower, and the summit not pointed;...". Récluz (1842: 179) stated the relationship of *N. undulata* with *N. leguillonana* thereby indirectly accepting *N. undulata* as a valid species (see also Récluz, 1850: 283). Others, however, did not accept *N. undulata* as a valid species: Von Martens (1887: 34) synonymized *N. undulata* with *N. undata* and stated twice that *N. undulata* is a juvenile species (p. 34, p. 125). He even noted (p. 125) that the juvenile type-material cannot be identified properly due to the lack of important features of teeth and crenulations in the aperture. Tryon (1888) followed Von Martens' opinion that *N. undulata* is a form of *N. undata*.

Remark: In our study growth series significantly contributed to our conclusion that *N. undulata* is to be regarded as a valid species. We noticed important differences in features between juvenile and adult specimens (see Figs 3-4). We agree with Von Martens that the type-material is a juvenile specimen. Adult specimens were identified as *Nerita flammulata* Récluz, 1841 by Von Martens (1887: 46-47).

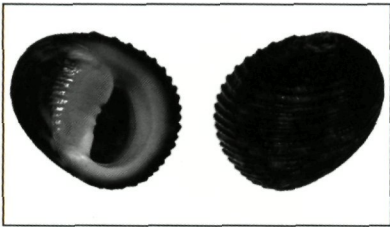


Fig. 3. (juvenile spec. from Siboko peninsula, West Sumatra prov., Sumatra, Indonesia. h x w: 16.0 x 16.5 mm. Leg. B. Gras)

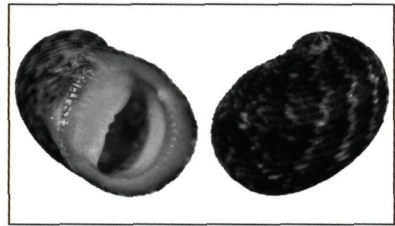


Fig. 4. (adult spec. from Siboko peninsula, West Sumatra prov., Sumatra, Indonesia. h x w: 30.2 x 33.1 mm. Leg. B. Gras)

Recently Japanese authors re-introduced *N. undulata* as a valid species. Tsuchiya (2000: 103) discussed *N. undulata* Gmelin, 1791 and confirmed the mangrove habitat. He also figured *N. undulata* (2000: pl. 51, sp. 6). Kano (pers. comm., 2009) confirmed the use of the name *N. undulata* and identified two of the three syntypes of *N. trifasciata* Le Guillou, 1841, deposited in MNHN, as *N. undulata*.

N. undulata differs from *N. undata* Linné, 1758 by the rough body-whorl, caused by fine axial striae, the broader cubed tooth, and the folds in the upper part of the parietal shield

that extend towards this cubed tooth, a feature already noticed by Von Martens (1887: 47, discussion of *N. flammulata* Récluz, 1841 (= synonym)).

Unfortunately the type-material cannot be found in UZMC at the moment (pers. comm. H. Dekker, Sept. 2009).

Discussion of synonymy:

Nerita flammulata Récluz, 1841.

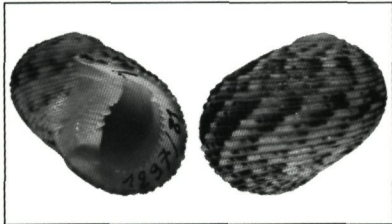


Fig. 5 (syntype 1. Pictures by Y. Finet, MHNG)

Original description. - Récluz, 1841.

Revue Zool.: 180-181, sp. 22.

Type material. - "24 x 19-20 mm"

(Kabat & Finet, 1992: 234).

Type locality. - "Les îles de la mer du Sud, les Moluques?".

Type depository. - MHNG

1297/81 (2 questionable syntypes).

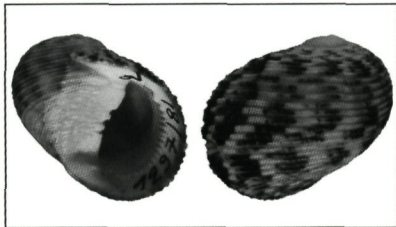


Fig. 6 (syntype 2. Pictures by Y. Finet, MHNG)

Récluz (p. 180-181) described the species as follows: "*Elle a trente à trente-trois côtes striées longitudinalement, légèrement rudes au toucher; sa spire peu saillante est presque lisse et d'un beau jaune; sa columelle est plane, jaunâtre, très-inclinée en-dedans et pourvue de deux petites dents dans le centre. Le fond de son ouverture est d'un jaune soufré; le labre finement strié à l'extérieur, ride obliquement en-dedans, à une dent obtuse et peu prononcée au sommet de la range des rides.*". (This nerite has 30 to 33 ribs, a little coarsely to touch, the spire slightly developed, yellowish and nearly smooth; the parietal area is flat, yellowish, deeply inward inclined with two small centered teeth on the columella. The base of the aperture is sulfurous yellow; the edge of the outer lip finely

jagged by ribs, inner side of outer lip obviously crenulated with one mediocre pronounced tooth above the crenulations.)

In the original description Récluz (p. 181) mentioned four differences with *N. undulata*, but he was not sure whether *N. flammulata* is a valid species: “*Celle-ci serait-elle une variété de la Ner. ondulée?*”. The four differences are: *N. flammulata* has a less developed spire than *N. undulata*; has more conspicuous teeth on the columella; has a jagged edge at the outer lip and inside the outer lip, crenulations with a tooth above it. Apart from the first difference, the other three differences can be attributed to the worn out conditions of the holotype of *N. undulata*. Therefore, we support Récluz’ doubt and synonymise *N. flammulata* with *N. undulata*.

N. flammulata was one of the few *Nerita*-species that was figured by Récluz in 1850. However, some of Récluz’ references (15th of August, 1850: 282-287) to the pictured species were incorrect. The plate of Récluz (15th of November, 1850: III), with the required corrections included in the legend, is shown at the end of this article (see Plate 1).

Schepman (1908: 6) identified specimens from the Siboga-expedition as *N. flammulata*. Dekker (pers. comm., April, 2009) confirmed this identification. Much later this species was again correctly distinguished from *Nerita undata* Linné, 1758 by Mienis (pers. comm., 06-03-2000) and Subba Rao (2003: 110) who called it *Nerita grayana* Récluz, 1843. Japanese authors re-introduced *N. flammulata* as a valid species. Tsuchiya (2000: 103) mentioned *N. flammulata* as a synonym of *N. undulata* Gmelin, 1791. Masuda & Hayase (2000: 309) also confirmed the mangrove-habitat. In Masuda & Uchiyama (2004) pictures show *N. flammulata* in situ on the stem of a mangrove-tree.

Nerita grayana Récluz, 1843

Original description: Récluz, 1843. Proceedings of the Zoological Society of London, part XI: 200, sp. 7. London.

Type material: “Long. 21-25 mill.; larg. 30 mill.; convex. 21 mill. *Ouverture extér.*: long. 22 mill.; larg. 20 à 21 mill. *Spire*, haut. 9 mill.”(Récluz).

Type locality: “Port Curimao, province of North Ilocos, isle of Luzon; on the rocks at low water. H. Cuming.” (Récluz)..

Type depository: Unknown.

Discussion: The type-material of *N. grayana* Récluz is unknown. Figures can be found in Reeve (1855: pl. VII, sp. 33a-b), Sowerby (1883: pl. V, fig. 91), Von Martens (1887: pl. 7, fig. 8-10) and Tryon (1888: pl. 6, fig. 2-3). See Figs 7a-d below. These figures all show the same species. Récluz described this species as follows: "*Ner. testá ovato-globosá, dorso-obliquè conoïded, transversim sulcatá; sulcis costis latioribus, striis longitudinalibus creberrimis sulcatá; anfractibus sordidè nigro-violaceis, obsolete albo maculatis; spirá prominulá, conico-depressá, acutá; aperturá pallidè fuscescente; labio planulato, margine tridentato, supra rugis confertis valdè impresso; labro intùs regulariter sulcato, supernè unidentato.*" (Ner. body whorl elongately spherical, dorsal-oblique conical, transversely grooved by striae; with interstices broader than ribs, the latter with conspicuous striae; body whorl greyish black-purple with light-coloured spots; moderately developed spire, sharp but depressed; aperture pale ochrous; flat parietal shield, three teeth on columella, in the upper part densely folded; inside outer lip regularly crenated, in the upper part one tooth). All these characteristics correspond to the description of *N. undulata* Gmelin, 1791. Subba Rao (2003: 110) correctly used the taxon *N. grayana* to identify the figured specimen but was not aware of its synonymy with *N. undulata*.

Note that the description of *N. grayana* in GloriaMaris (1997: 5) is not correct. The involved species is a species belonging to the *undata*-complex and will be discussed elsewhere.

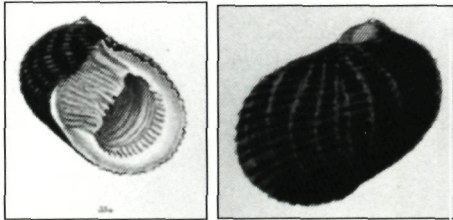


Fig. 7a Reeve, 1855: pl. VII, sp. 33a (left) and sp. 33b (right)

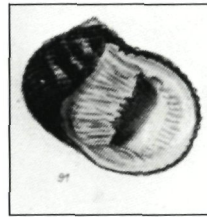


Fig. 7b Sowerby, 1883: pl. V, fig. 91

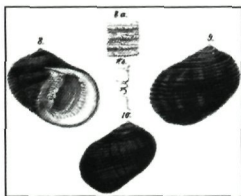


Fig. 7c Von Martens, 1887: pl. 7, fig. 8-10

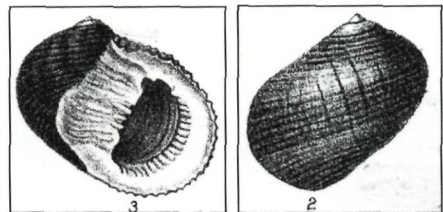


Fig. 7d Tryon, 1888: pl. 6, fig. 2 (right) and fig. 3 (left)

Note: Below we discuss *Nerita trifasciata* Le Guillou, 1841. It proves to be a separate species (belonging to the *undata*-complex) and not a synonym of *N. undulata*. It is discussed here because we found that several syntypes labelled as *N. trifasciata* in MNHN and MHNG are in fact specimens of *N. undulata*.

Nerita trifasciata Le Guillou, 1841



Original description.- Le Guillou, 1841. *Revue Zool.*: 343-344, sp. 1.
 Type material.- "Long. 26 m., larg., 17 m." (Le Guillou).
 Type locality.- "Triton-Bay (Nouvelle-Guinée)." (Le Guillou).
 Type depository. - MNHN (3 syntypes).

Fig. 8. (syntype 1 *N. trifasciata*, MNHN. Pictures by Y. Kano)

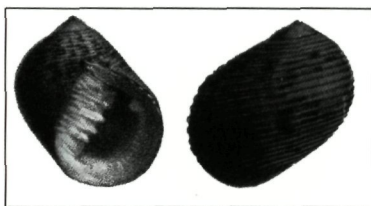


Fig. 9. (*N. trifasciata*, from Récluz, 1850: pl. 11, figs. 5, 8)

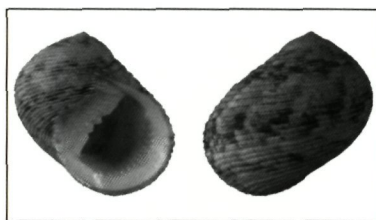


Fig. 10. (syntype 2, MNHN. Pictures by Y. Kano): in fact a specimen of *N. undulata*.

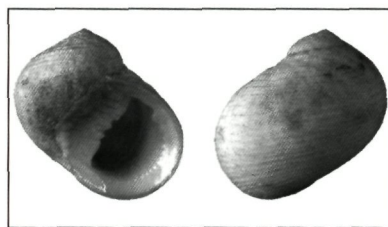
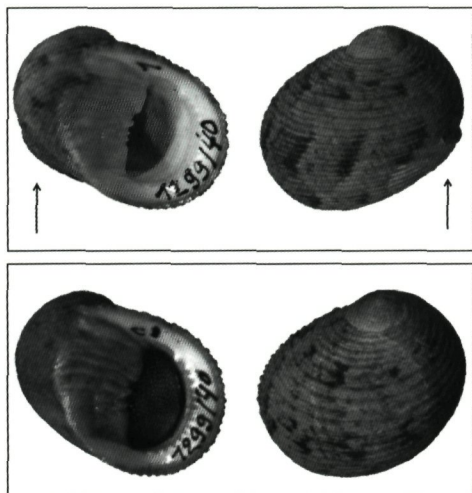


Fig. 11. (syntype 3 'Var. A. Alba.', MNHN. Pictures by Y. Kano): in fact a specimen of *N. undulata*.



Type depository. - MHNG 1299/40 (2 syntypes).

Upper left and right (1299/40 (1)): h x w: 22,2 x 23,0 mm. Specimen with small oyster mangrove habitat!

Bottom left and right (1299/40 (2)): h x w: 19,8 x 21,7 mm.

Fig. 12. (so-called syntypes of *N. trifasciata*, MHNG. Pictures by H. Dekker): in fact specimens of *N. undulata*.

Discussion: Le Guillou (1841: 343-344) described this species as follows: “*Testa ovata subglobata transversim sulcata sulcis 30-33 angustis, profundis; albido-viridescente, nigro trifasciata et sub flammulata; spira brevi, laterali, su acuta; labio plano, rugoso et granuloso, margine tridentato, dentibus medianis parvulis; labro intus incrassato, breve, sulcato, unidentato.*” (Body whorl elongated, half spherical with 30-33 ribs with small but clear interstices; greenish white, with three black bands of elongated stains; short spire, sharp; flat parietal area, folded and granulated, columella with three teeth, middle tooth very small; inside outer lip swollen, small, crenulated, with one tooth).

The syntypes (Figs 8, 10 and 11) in MNHN are in fact two different species. The description of *N. trifasciata* of Le Guillou (1850: 343-344) matches syntype 1 deposited in MNHN (Fig. 8) as well as the figures in Récluz (1850, see our Fig. 9). We therefore select this specimen in MNHN as the lectotype of *N. trifasciata*. Syntypes 2 and 3 (the latter being ‘Var. A. Alba’, see Figs 10 and 11) correspond with the syntypes in the MHNG (Fig. 12). All these syntypes are in fact *N. undulata* Gmelin, 1791. Dekker (pers. comm., 2006) pointed to one syntype (in MHNG, upper right Fig. 12) with a small oyster (see arrow), typical of a mangrove-species, as is *N. undulata*.

The designated lectotype of *N. trifasciata* clearly represents a different species than *N. undulata*, but it still belongs to the *undata*-complex. Thus, *N. trifasciata* Le Guillou, 1841 is not a synonym of *N. undulata*.

The other syntypes in MNHN are *N. undulata* and should therefore be separated from the type-material of *N. trifasciata*. The syntypes in MHNG must be renamed to *Nerita undulata* Gmelin, 1791. They are no longer syntypes of *N. trifasciata*.

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- Dekker, H.**, 16-09-2009. About presence *N. undulata* in UZMC, confirmation holotype missing (O.S. Tendal, 14-09-2009).
- Kano, Y.**, 27-10-2009. About the determination of syntypes of *N. trifasciata* in MNHN.

PLATE 1: Plate 11 of Récluz (1850) with corrected references

Original legend:

1-2. *Nerita scabricosta* Lamarck, 1822

3. *Nerita atropurpurea* Récluz, 1841

4. *Nerita longii* Récluz, 1842

5-8. *Nerita trifasciata* Le Guillou, 1841

6. *Nerita flammulata* Récluz, 1841

7. *Nerita patula* Récluz, 1841

9. *Nerita essingtoni* Récluz, 1842

10. *Nerita georgina* Récluz, 1841

11. *Nerita aurantia* Récluz, 1842

12-14. Not applicable

References to Figs on plate 11 by Récluz (1850: 283-285, 287):

N. scabricosta, ref. correct (p. 287);

N. scabricostata (sic), ref. correct, wrong name (p. 284);

N. atropurpura, ref. correct (p. 285);

N. longii, ref. correct (p. 286);

N. trifasciata, ref. not correct (p. 284): fig. 6 ⊗ Fig. 5-8;

N. flammulata, ref. not correct (p. 284): fig. 7 ⊗ Fig. 6;

N. patula, ref. not correct (p. 285): f. 8 ⊗ Fig. 7;

N. essingtoni, ref. correct (p. 284);

N. pacifica, ref. correct (p. 283);

N. aurantia, ref. not correct (p. 283): f. 5 ⊗ Fig. 11;

Fig. 12-14. Not applicable.

Remarks:

N. atropurpura is a synonym of *N. planospira* Anton, 1839.

N. georgina is a synonym of *N. insculpta* Récluz, 1841.

N. pacifica is a valid species according to Récluz (as bracket and text lay-out suggest on p. 283). But in legend Récluz changed taxon to *N. georgina*.

N. essingtoni and *N. aurantia* are species belonging to the *undata*-complex. These taxa are under revision. Will be published elsewhere.

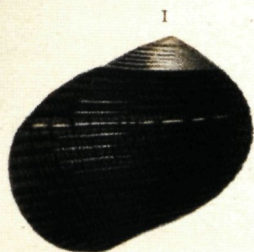


PLATE 2: Colour photographs of text figures

1a-b. from Chemnitz, 1781: tab. 191, figs. 1970-1971.

2a-b. juvenile spec. of *N. undulata* from Siboko peninsula, West Sumatra prov., Sumatra, Indonesia. h x w: 16.0 x 16.5 mm. Leg. B. Gras.

3a-d. adult spec. of *N. undulata* with operculum from Siboko peninsula, West Sumatra prov., Sumatra, Indonesia. h x w: 30.2 x 33.1 mm. Leg. B. Gras.

4a-b. syntype 1 *N. flammulata*, MHNG.

5a-b. syntype 2 *N. flammulata*, MHNG.

6. syntype 1 *N. trifasciata*, MNHN. Picture by Y. Kano.

7a-b. *N. trifasciata*, from Récluz, 1850: pl. 11, figs. 5, 8.

8a-b. syntype 2, MNHN. Pictures by Y. Kano: in fact a specimen of *N. undulata*.

9a-b. syntype 3 'Var. A. Alba.', MNHN. Pictures by Y. Kano: in fact a specimen of *N. undulata*.

10a-b. syntype 1 of *N. trifasciata*, MHNG. Pictures by H. Dekker): in fact a specimen of *N. undulata*.

11a-b. syntype 2 of *N. trifasciata*, MHNG. Pictures by H. Dekker): in fact a specimen of *N. undulata*.

PLATE 3: various specimens of *N. undulata* Gmelin, 1791

1a-d. Chinen, Okinawa, Japan. Hab.: Taken on rocks at low tide. Size: 20.9 x 20.5 mm. (h x w). Juvenile specimen. Collected by local people. June, 2003. Coll. B. Gras.

2a-d. Paso, Ambon Bay, Ambon, Indonesia. Hab.: Mangrove forest, on -0.5 m., in mud, littoral. Size: 22.0 x 23.5 mm. (h x w). From: Rumphius Biohistorical Expedition 1990, Sta. 14. 13/14-09-1990. Coll. Naturalis, Leiden.

3a-d. Prince John Dive Resort, Tanjung Karang, Central Sulawesi province, Sulawesi, Indonesia. Size: 28.6 x 28.4 mm. (h x w). 06-01-2009. Leg. B. Gras.

4a-d. Prince John Dive Resort, Tanjung Karang, Central Sulawesi province, Sulawesi, Indonesia. Size: 32.7 x 30.9 mm. (h x w). 06-01-2009. Leg. B. Gras.

5a-d. Prince John Dive Resort, Tanjung Karang, Central Sulawesi province, Sulawesi, Indonesia. Size: 35.3 x 34.1 mm. (h x w). 06-01-2009. Leg. B. Gras.

PLATE 2



1a



1b



2a



2b



3a



3b



3c



3d



4a



4b



5a



5b



6



7a



7b



8a



8b



9a



9b



10a



10b



11a



11b

PLATE 3



1a



1b



1c



1d



2a



2b



2c



2d



3a



3b



3c



3d



4a



4b



4c



4d



5a



5b



5c



5d