CRIBRARIA FISCHERI VAYSSIERE, 1910, A SYNONYM OF *CRIBRARULA CRIBRARIA* (LINNAEUS, 1758): ITS NOMENCLATURAL HISTORY AND A COMPARATIVE STUDY OF SHELL CHARACTERS

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Abstract: *Cribraria fischeri* was described as a species. It is shown in the current work that the description of this taxon is based on three shells from different areas of the Indian and Pacific Oceans. This type material is not homogeneous and the details of the data labels were interpreted differently by students of cowries. The Schilders treated *fischeri* first as a form, later as a subspecies of *C. gaskoini*, and finally as a valid species. This happened because they apparently ignored one of the criteria of subspecies: all shells of a subspecies should share the main diagnostic shell character of the species. The Schilders did not prove that *fischeri* shares the main diagnostic characters of *gaskoini* and this approach turned out to be problematic and resulted in a taxonomic confusion of long standing. Subsequent students of cowries mostly followed the Schilders' approach with only a small deviation.

The zigzag nomenclatural history of *C. fischeri* is traced in this work; one can see how the Schilders and other students of cowries have had difficulty trying to determine the taxonomic identity of the taxon when not using clear taxonomic definitions and criteria for species and subspecies, not comparing shell characters of the relevant taxa, and not considering intraspecific variation; conclusions were based on their opinions, not on the facts.

Shell characters of *C. fischeri* and related taxa are analyzed below based on the definitions and criteria accepted and tested in the project "Intraspecific variation in living cowries." There does not appear to be any recent reports on a living population of *C. fischeri* hence shell characters for the comparative study were taken from its original description and accepted malacological practice; a total of 43 shell characters, which can be treated as forms, are compared and illustrated.

This study shows that there is no diagnostic shell character of *fischeri*, which cannot be found in *Cribrarula cribraria* (Linnaeus, 1758) hence a conclusion is drawn that *C. fischeri* is a synonym of the latter.

Key words: Mollusca, Gastropoda, Cypraeidae, *Cribrarula, cribraria*, *esontropia*, *fischeri*, *gaskoini*, nomenclature, intraspecific variation, taxonomy.

CONTENTS

1. INTRODUCTION

Cypraea fischeri Vaysiere, 1910 has a hundred-years-long nomenclatural history and its taxonomic identity needs clarification. An attempt to do that is made in this work.

1.1. Problems with conchological definitions and criteria

Describing and diagnosing living cowry species using shell characters is a scientific method of long standing. This conchological method is based on the assumption that shells belonging to different species differ from shells of other species by certain substantial characters without intermediates; more detailed instructions and criteria were not developed. This is important because not all shell characters can be used for separating cowry species. When a description of a taxon is based on certain shell character, we must confirm that this character is of a specific level.

There are no definitions and criteria of species and subspecies in Schilder & Schilder (1938b)—the Prodrome. This deficiency caused serious problems for students of cowries since publication of the Prodrome. After all, using shell characters in order to describe or diagnose molluscs should be a scientific method and it is unthinkable to do such work without initial definitions, criteria, and methodology. Regarding subspecies the Schilders then wrote that these "can be recognized at least by the sum of several variable characters of the adult shells and by the fact that each race usually has its own centre of distribution where it is relatively more frequent than at the periphery." This approach is too general and very difficult to use in practice.

Students of cowries who came after the Schilders used the terms species and subspecies very loosely, and often did not considered intraspecific variation. With time I became convinced that the taxonomic identity of the cowry taxa mentioned in the Prodrome as well as those that were described after the Schilders work, should be checked again paying special attention to the intraspecific variation in cowry populations. For that purpose the project "Intraspecific variation in living cowries" ('the Project') was initiated in 2000.

The first problem of the Project was to define the term "species," the basic rank of zoological nomenclature. Schilder (1960) suggested the following practical definition, which he developed while working on Cypraeidae: "groups of similar shells should be treated as different species if they can be separated by at least one well-recognizable character showing no intermediates even in extreme specimens." This definition stresses that **all** normal individuals (aberrant excluded) of a species differ from individuals of other species by at least one well-recognizable diagnostic shell character; it is adopted below.

Even today some authors have not adhered to this definition or perhaps did not apply it in its strict sense.

When an author describes a new species using occasional shell characters or diagnostic characters not existing in **all** individuals of the new taxon, this can only cause confusion and increasing lists of synonyms.

The second problem was defining the term 'subspecies' that would be suitable for practical use. Such a definition is worked out by the present author based on the works by Schilder (1960, 1963b, 1966b) and Mayr (2000); it presupposes that subspecies of marine molluscs are geographically separated populations, which can be:

⇒ Originally described only by statistical shell characteristics obtained by studying sufficiently large batches of shells representing the new subspecies.

⇒ Diagnosed in the conchological practice by studying relatively small batches of shells ('selective test').

1.2. Definitions and criteria accepted in the Project and in this work

Shell character—a natural quality of an individual shell (shape, profile, color, pattern, teeth and so forth).

Main diagnostic shell character (MDSC)—the most prominent well-recognizable diagnostic shell character that is found in all individuals of the species (abnormalities excluded). The MDSC allows the separation of one species from others. This term was first introduced in the Project.

Shell characteristic—the result of measurements or/and counting for a substantially large batch of shells (several dozens or more; the more the better) representing a group of populations. For example, the average shell length; the average width to length ratio; the average number of normalized teeth in the aperture of cowry shells; a number of shells in the studied batch sharing a certain shell character, and so forth.

Taxon—a taxonomic unit, whether named or not (according to the ICZN, 1999), in this case populations of cowries.
Species—a taxon the shells of which can be separated from shells of all other cowry taxa by at least one well-recognizable diagnostic character (MDSC) showing no intermediates even in extreme specimens.
Subspecies—a group of populations conforming to the criteria explained below in section **1.3**.
Taxon, which is not separable conchologically (nsc)—a taxon, which cannot be diagnosed conchologically because its main diagnostic shell characters are not known at the moment.

1.3. **Conchological criteria**

The main criterion for diagnosing cowry **species**—the existence or absence of at least one well-recognizable diagnostic shell character (MDSC)—here and below all underlined words are by the present author. This definition does not allow for intermediate forms.
Criteria for diagnosing **subspecies.** Subspecies should conform to the following criteria:
a. ⇒ geographical separation from all other populations of the same species;
b. ⇒ the majority (70% or more) of shells of the batch representing subspecies differs by at least one shell character from shells of other batches representing other populations of the same species; in other words subspecies should differ from the other populations of the species by at least one shell characteristic;
c. ⇒ all shells of a subspecies should share the main diagnostic shell character of the species—MDSC.
In other words, it is assumed that all individuals of a subspecies share the MDSC of that species but a considerable proportion of them differ by having other additional diagnostic characters, which are generally not found in shells belonging to other subspecies of the same species.
In the Project and below, cowry populations are recognized as **subspecies** only if scientific data confirm that their distribution range and main diagnostic characteristics differ from those of other subspecies of the same species.

Note that the average data or data on the majority of individuals of a population are not relevant for diagnosing species and cannot be considered a "good" diagnostic shell character because they do not cover **all** the individuals in the population.

1.4. Principle of the scientific evidence

In the Project and in this work the author stipulates that the taxonomic identity of each cowry taxon must be proved by the scientific evidence: the MDSC must be given for species, the main diagnostic shell characteristics must be given for subspecies, the studied batches of shells must be large and unbiased, and so forth. All these elementary standards will ensure recurrence of the results of conchological studies in the future and stability of the cowry nomenclature.

Taking all this into consideration it is interesting to trace the nomenclatural history of *C. fischeri.*

2. NOMENCLATURAL HISTORY OF *CYPRAEA FISCHERI* VAYSSIERE, 1910

2.1.The original description of *Cribraria fischeri* Vayssiere, 1910 is based on three shells; at least two of them are from the Dautzenberg Collection and pictured by Vayssière on Plate 13 of the description—see a copy of the description translated into English in the Appendix, section A1.
Later all species of the genus *Cribraria* were moved into the genus *Cribrarula* and below they are noted as the members of this genus.

Vayssière's description is detailed and he is perhaps one of the first cowry students who suggested comparing cowry taxa using a table of diagnostic shell characters; he suggested also a special combination of the four shell characters: the shell length, its maximal width, and the number of labial and columellar teeth—as an integral shell characteristic of cowry species. Later the Schilders improved on that idea and transformed it into their 'formula' consisting of the same shell characters, but each of these characters was represented as an average for that batch of shells, in addition to which the teeth count was normalized (see Heiman 2009c).

Unfortunately, the main diagnostic shell characters given by Vayssière and intended for separating *C. fischeri* from other related taxa, were not sufficiently convincing (at that stage students of cowries only had a vague idea of intraspecific variation).
Besides, as it will be shown below, there seems to be a problem with interpretation of the type material of *C. fischeri*. As a result, this taxon was rather problematic and confused students of cowries for a long time. During the last hundred years *C. fischeri* was treated as a valid species; as a form and later a subspecies of *Cribrarula gaskoini* (Reeve, 1846)—*C. gaskoini fischeri*; again as a valid species in 1967-1971; and once more as a subspecies of *gaskoini* since 1971—see 2.11. Summary of Section 2 below.

2.2. Schilder checked the description by Vayssière as a valid species in Schilder (1930) where he discussed the type specimens of Cypraeidae.

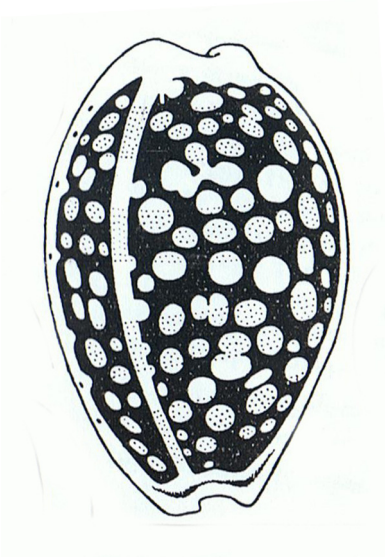
"I have seen only a metatype, determined by Vayssière himself, in coll. Dautzenberg: 11.3(61) 17:15, collected at Maui, Sandwich Isl. *C. fischeri* evidently is a good species, allied to *cumingii* (Sow.), and not to *cribellum* (Gask.). The dorsal markings are less definite than in other *Cribraria*."

Here Schilder had ignored the fact that the description of *fischeri* is based on three shells (syntypes) and interpreted information on the data label of one shell in his own way considering that the shell in question is from the Hawaiian Islands and not from Mauritius. At that stage it still was possible to ask Dautzenberg about the exact locality of the shell, at least to cite his opinion; but the Schilder's text is unequivocal.
As we will see later, this is the first step leading to a very long confusion.

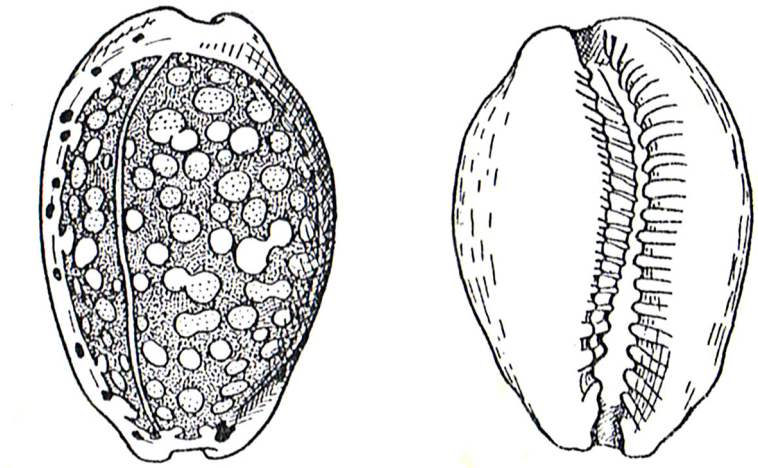
2.3. *C. fischeri* is next mentioned in Schilder (1933) as a valid species found in the waters bordering Neu-Pommern i.e. New Britain (Papua New Guinea, the Bismarck Archipelago)—Fig. 2.1, the next page.
Schilder mentioned that he then had known only two specimens of *fischeri*—the type from Upolu (13 mm, in Vayssière's collection) and another specimen 15 mm from New Hebrides in Sullioti's collection (in the Museum of Genoa).
Schilder wrote that the metatype of *C. fischeri* mentioned in his previous work—Schilder (1930) above, section 2.1.—is in fact a small shell of *C. gaskoini* (Reeve, 1846).
Schilder mentioned several shell characters of the specimen (including the fossula): brown-gold dorsum with four brown-red bands, which can be seen in Fig. 2.1 as the dotted bands; the light numerous, regular lacunae with a hardly visible darkening at their periphery but not exactly as distinctly round as in *cumingii* (Sow.)!; the clearly defined dorsal line at about ¾ of the dorsum height; the sparse small dark spots at the left of the right margin spreading onto the white base.

There is no comparison 'one-to-one' of shell characters of *C. gaskoini* and *C. fischeri*, just the Schilder's opinion to which he adhered to, to the end of his scientific activity.

In Schilder & Schilder (1938a) the authors described a new species *Cribrarula catholicorum*–Fig. 2.2-2.3 from the same area (New Britain). They mentioned that this new species "formerly has been confounded with *fischeri* Vayssiere, the type of which is a dwarf variety of *C.* (*C.*) *gaskoini* Reeve; it differs, however, in the lateral spots being scarce and never extending onto the base…"
In this approach, it is presumed that *gaskoini* is not endemic to the Hawaiian Islands but distributed also in other areas of the Pacific Ocean.
It should be also mentioned that according to Schilder (1933) and Schilder & Schilder (1938a) two closely related forms of *Cribrarula* taxa are know from an area of New Britain (Figs. 2.1 and 2.2-2.3); they differ only by the presence or absence of the small dark spots on the base; in other words a single small spot on the base makes the difference; such an approach, in my opinion, does not make sense.

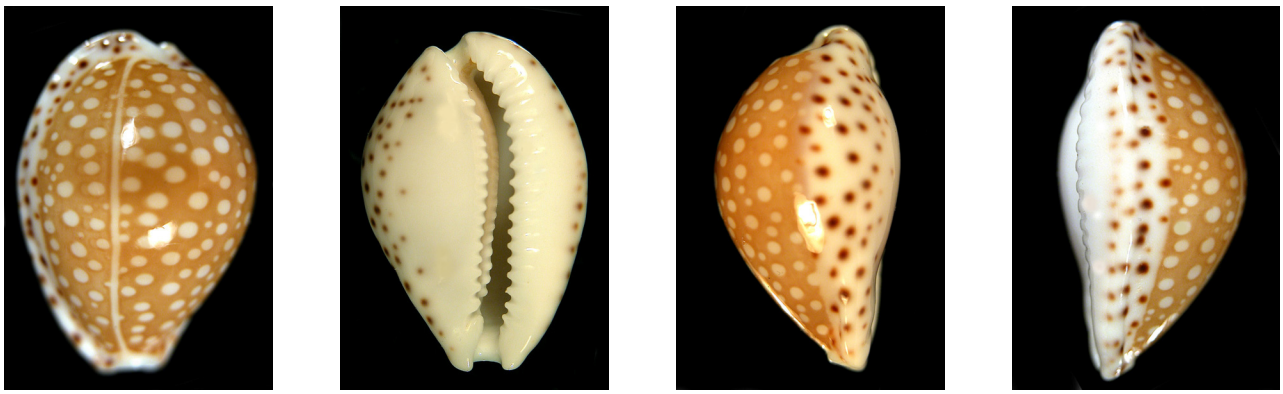


2.1.*C. fischeri* pictured in a work by Schilder (1933)



2.2-2.3. *C. catholicorum* pictured in a work by the Schilders (1938a)

2.4. In the Prodrome—Schilder & Schilder (1938b) the Schilders treated *fischeri* as a small shell (variety, a synonym) of *C. gaskoini*—see Appendix section A4



2.4-2.7. *C. gaskoini*, the Hawaiian Islands

The original description of *C. gaskoini* can be seen in Appendix section A5 its further description in the Prodrome (where additional diagnostic shell characters of *gaskoini* are mentioned) can be seen in Appendix section A6
The type locality of *gaskoini* is not mentioned in Reeve (1846) or in Sowerby (1870). The Schilders did not explained why they considered *C. fischeri* a synonym of *C. gaskoini* hence their statement seems to be simply an opinion, but an opinion is not a fact so it cannot be a diagnostic character and it cannot be accepted as scientific evidence.

2.5. Later, after the Schilders studied cowries in the Dautzenberg collection, their approach changed: in Schilder & Schilder (1952)—Appendix, section A8 they treated *fischeri* as a subspecies *C. gaskoini fischeri* (Vayssiere, 1910).
The Schilders based this opinion on their interpretation of the type material of *C. fischeri* in Dautzenberg's collection, especially the data on the labels attached to the two small shells used by Vayssière.

One of those shells was, according to its label, from Melanesia and the Schilders diagnosed it as *C. fischeri*.
The Schilders decided that there was a mistake or misunderstanding of the text of the label of the second shell: the shell, they supposed, was from the Hawaiian Islands and not from Mauritius, as is written on the label. They diagnosed this second shell also as *C. fischeri* from the Hawaiian Islands but did not explain why, apparently following the previous works by Schilder mentioned above.
They concluded that *C. gaskoini* consists of two subspecies: *C. gaskoini gaskoini* from the Hawaiian Islands and *C. gaskoini fischeri* from Melanesia to Samoa.
This conclusion was based on two shells only, each representing different subspecies that cannot be accepted because subspecies should be described based on large batches of shells.

2.6. Cernohorsky (1965) reported finding in Fiji live cowry he diagnosed as *C. gaskoini* -Appendix section A9.
He did not explain why the shell pictured in Fig. A9-1 is diagnosed as *C. gaskoini*.

Here we run into important questions:
a) Each species of cowries should differ from all the other species by at least one conchological diagnostic character without intermediates. Subspecies should share these main diagnostic characters according to a simple, obvious logic.
If one, for example, looks at shells of *Erosaria lamarckii* (Gray, 1825), from any locality in the world, one first should be sure that the shell in question is *E. lamarckii* i.e. it has the main diagnostic characters of *lamarckii*. If one is interested to find out which subspecies of *lamarckii* this specimen belongs to, one can continue examining other diagnostic characters of the shell; but first–the species must be defined—see Heiman (2009b).

b) Shell characters of many species of molluscs are variable and separating of subspecies cannot be based on a single shell; it only can be based on statistical shell characteristics obtained by examining substantially large batches of shell.

Later Burgess (1993) considered that this shell is in fact a new species and described it as *C. taitae*.

2.7. In Schilder & Cernohorsky (1967)—Appendix section A10—the authors shortly discussed the nomenclatural history of *fischeri*, a range of distribution of which, in their opinion, is from New Hebrides to Polynesia, and conclude that "*Cribraria fischeri* should therefore be regarded as a real species in some respects connecting *gaskoini* with *cumingii*."
Later Burgess (1993) considered that shells in figs. 2-3 of the latter work are in fact *C. taitae*.

2.8. Two shells from Melanesia (New Hebrides) are treated in Debant (1969)—Appendix section A11,
Fig. A11-1—as *C. fischeri* (two different forms).
Later Burgess (1993) considered that shells in figs. 1a-1b of the latter work are in fact *C. taitae*.

2.9. In Schilder (1971a, b) *fischeri* is also treated as a valid species from New Hebrides, Fiji, Samoa, and New Caledonia and its subspecies *Cribrarula fischeri astaryi* from Marquez's Islands is described—Appendix section A12.

2.10. In Schilder & Schilder (1971) *fischeri* is listed as a subspecies of *gaskoini* again; but the taxon *astaryi* is not mention.

2.11. *C. fischeri* is mentioned in Burgess (1985) as a synonym of *C. gaskoini* although the diagnostic characters of both taxa are not compared in detail.
C. astaryi Schilder, 1971 is recognized as a valid species—Appendix section A15. Burgess wrote:
C. astaryi "differs most obviously from *gaskoini* in the lateral spotting which, in *astaryi*, is confined to the extreme lateral margin (in *gaskoini*, the spotting covers a portion of the dorsum)."

Another passage from Burgess (1985) may be useful for understanding the complexity of *fischeri* nomenclature: "Through the kindness of Mr. Georges Richard of the National Museum of Natural History, Paris, I have been able to examine the holotype of *Cypraea fischeri*. Without question (and Dr. Richard agrees with me on this) it is a dwarf specimen of *Cypraea gaskoini* Reeve, 1846. This holotype is without locality data."

2.12. Burgess (1993) described a new species *C. taitae* and compared it with *C. astaryi*-Appendix, section A 16.

2.13. Summary of the nomenclatural history of *Cypraea fischeri* discussed in Section 2.

Table 2.1.

Works by students of cowries	Taxonomic level of *C. fischeri*
Vayssière (1910)	species
Schilder (1930)	species
Schilder (1933)	species
Schilder & Schilder (1938b)	form of *C. gaskoini*
Schilder & Schilder (1952)	subspecies of *C. gaskoini*
Schilder & Cernohorsky (1967)	species
Debant (1969)	species
Schilder (1971a, b)	species
Schilder & Schilder (1971)	subspecies of *C. gaskoini*
Salvat & Rives (1975, 1980))	not mentioned
Burgess (1970, 1985)	synonym of *C. gaskoini*
Richard & Hunon (1991)	subspecies of *C. gaskoini*
Lorenz & Hubert (1993)	synonym of *C. gaskoini*
Lorenz & Hubert (2000)	synonym of *C. esontropia*
Hunon (2000)	subspecies of *C. gaskoini*
Lorenz (2002)	synonym of *C. esontropia*
this study	synonym of *C. cribraria*

3. PROBLEMS WITH THE TYPE MATERIAL AND ITS INTERPRETATION

3.1. Shells size and teeth count.
Three shells of *C. fischeri* are mentioned in Table 1 of the original description as follows (the Vayssière formula—see Heiman (2009c)):

13/8—17+16; 12/7—15+13; 12.5/7—16+14.

Two shells are pictured on Plate 13 of the description; for one of them the dorsal and basal views are given and only the basal view is given for the second shell.
In note 1 to the description (Appendix) Vayssière mentioned two shells from the Dautzenberg's collection; "in one of the two Dautzenberg's specimens (Fig. 1, 2) there are 16 labial and 14 columellar teeth; in the other one, there are 15 teeth on both sides."
I have received from MNHN (Paris) very clear photos of one of the two shells in question and what I see does not fit Vayssière's written description. Perhaps the shells were switched at some stage.
One can count 16 columellar teeth in Fig. 2; suppose this is a mistake made when the shell was drawn. One can assume that the shell depicted as Figs. 1-2 of the description is actually the specimen measuring 12.5 mm.

One can count 17 labial and 16 columellar teeth in Fig. 3 (the second specimen pictured); this could be the shell that measures 13 mm.
Vayssière had written in the text of the description: "on the type-specimen, there are 17 labial and 16 columellar teeth, but on other shells I counted 15-16 labial and 13-14 columellar teeth". This text contradicts the previous one (even without my remarks regarding the teeth count); besides, here the type is mentioned, which perhaps is the third shell, not pictured by Vayssière.
Maybe it is the shell pictured in Appendix A10, Fig. A10-1, one can count in this shell 16 labial and 15 (or 17 if the double teeth are counted as single ones) columellar teeth. Its size is 12 mm; perhaps it is the type sensu Vayssière.
We can assume that Schilder apparently reasoned this in a similar way.

Summarizing identification of the shells studied by Vayssière and their size:
Figs. 1-2—12.5 mm; Fig 3—13 mm; the shell not pictured (Fig. A10-1)—12 mm.

3.2. The type locality.
This is the most difficult question regarding *C. fischeri* because the original data labels may be based on erroneous information, they may be lost, replaced by exact or not exact copies, and so forth. The Schilders opinion regarding this question can be seen above.

Hence below I try to use diagnostic shell characters in order to clarify which localities are probable.

3.2.1. As it is cited in section 2.2 above the formula for the type of *fischeri* sensu Schilder (1930) is 11.3(61) 17:15; these data do not correspond the original description. We do not have explanations for this fact.

3.2.2. The shell Figs. 1-2 (12.5 mm) of the original description differs from *C. gaskoini* because it:
a) has the relatively large and dense dorsal lacunae instead of small and sparse;
b) has the wide, not clearly defined dorsal line instead of narrow, well defined one;
c) does not have the dark rings bordering the lacunae and narrow dark lines bordering the dorsal lines.
These are shell characters of a specific level according to the description of *C. gaskoini* hence the shell pictured on Figs. 1-2 cannot be related to *gaskoini*. It is similar to *C. esontropia* (Duclos, 1833) and its type locality may be Mauritius Island.

3.2.3. The type locality of the shell Fig. 3 of the description is Upolu, Samoa.

3.2.4. The type locality of the third shell pictured in Appendix (section A 5) was determined Lifu Island near New Caledonia.

3.4. Summary of Section 3.
The description of *C. fischeri* was based on three shells (syntypes): one is apparently from Mauritius Island, the second from Samoa, and the third from New Caledonia.

The diagnostic characters given by Vayssière for *C. fischeri* and the related taxa are mostly not of a specific level and do not allow their separation.

Certain vagueness with the non homogeneous type material, especially relating to the data labels, induced the Schilders to designate (apparently groundlessly), the Hawaiian Islands as the type locality of *C. fischeri* and consider it to be a subspecies or form of *C. gaskoini.*

The Schilders and subsequent authors did not publish information regarding a comparative study of shell characters of *C. fischeri* and the related taxa, that is by using conchological methods; they only expressed their opinions regarding the taxonomic identity of this taxon.

A comparative study is conducted below.

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4. COMPARING SHELL CHARACTERS

Shells characters of *fischeri* are cited from its original description because there is no information on living populations of this taxon.

Notes to Table 4.1:
1. Data cited from the Prodrome and other works by the Schilders designated by the sign 1.
2. Certain shells in different populations may have a rare subcylindrical shape. Such shells, found in an area near Mauritius and Reunion islands, were named *Cribrarula cribellum* (Gaskoin, 1849). It is shown in Heiman (2004) and Jay (2003) that 'cribellum' is a form of *C. esontropia*. The latter taxon is treated in Heiman (2007a, b) as a subspecies of *C. cribraria* (Linnaeus, 1758).
3. Certain characters are present in all shells of the species whereas other characters may be present mostly in its subspecies or forms.
4. A shell character may be visible in fresh collected large specimens. With time and in dead collected shells it may no longer be visible. Sometimes a special lighting and an angle of view are needed in order to see and photograph these shell characters.
5. In not fully formed shells the base may be tinged tan and the fossula may look flat and regularly toothed.
6. The data below are cited from the original descriptions and obtained examining several specimens in the author's collection.
7. It is difficult to understand a shell character by looking at a picture of the type material in the Appendix section A12, Fig. A12-1.
8. This is the only shell character separating *C. taitae* from *C. cribraria* but its specific or subspecific level is not proven by the scientific evidence (a comparative statistical study of large batches of shells and so forth); it may be only a form of *C. cribraria.*
9. Each of the shell characters compared in Table 4.1 represents in fact a different form, which can be found in populations of the compared taxa i.e. a form with an elliptical to elongate-elliptical shape, oval shape, humped dorsum, and so forth.

Table 4.1.

The presence of a character in all shells is designated by the sign '**V**' printed in bold; its presence in a substantial quantity of shells is designated by the sign 'V', and sporadic reports of a character are designated by the sign 'v'; 'ni' indicates the absence of information.

			1	2	3	4	5	6	7	8	9	notes
taxa → shell characters ↓			*cribraria cribraria*	*cribraria esontropia*	*fischeri*	*cribraria orientalis*	*gaskoini*	*catholicorum*	*cumingii*	*astaryi*	*taitae*	
the formula[1]			23.57.19.18	26.61.17.16	12.56.22.21	22.57.20.19	20.62.21.20	14.63.21.20	**11.54.40.34**	17.56.24.24	14.56.19.25	
shape	elliptical to subcylindrical	Figs. 4.1,4. 9.	**V**	**V**	**V**	**V**	**V**	**V**	**V**	V	V	2, 3
	oval	Fig. 4.2, 4.8.	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	ni	2, 3
profile	flat to slightly convex	Fig. 4. 3.	**V**	**V**	-	**V**	**V**	**V**	ni	ni	ni	
	convex	Fig. 4.4.	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	ni	
	humped	Fig. 4.18.	v	**V**	ni	ni	**V**	ni	**V**	ni	**V**	

Shell characters		taxa									notes
		c. cribraria	*c. esontropia*	*fischeri*	*c. orientalis*	*gaskoini*	*catholicorum*	*cumingii*	*astaryi*	*taitae*	
left side	round Fig. 4.6	**V**	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	
	round, thickened, rarely slightly edged Fig. 4.6.	-	**V**	ni	**V**	**V**	-	-	ni	ni	
right side	callused, edged Fig. 4.6.	**V**	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	
	adorned with small spots Fig. 4.7.	v	**V**	**V**	**v**	**V**	**V**	**V**	ni	ni	
spire	depressed Figs. 4.8-4.9.	**V**	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	
dorsum	fulvous to ochraceous Figs. 4.9-4.10.	v	**V**	**V**	v	**V**	**V**	**V**	ni	ni	
	light brown to dark brown Fig. 4.11.	**V**	v	**V**	**V**	**V**	**V**	ni	ni	**V**	
dorsal lacunae	whitish, round lacunae, not crowded Fig. 4.2.	**V**	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	
	of different size, crowded Figs. 4.3, 4.4	**V**	v	ni	**V**	-	**V**	ni	ni	ni	
	encircled with pale brown rings Fig. 4.12.	v	-	ni	v	v	ni	**V**	V	ni	4
	numerous small Fig. 4.11.	v	ni	ni	v	**V**	ni	ni	ni	ni	
dorsal line	absent, indistinct, or confused Fig. 4.14.	**V**	V	v	**V**	v	ni	ni	**V**	ni	
	definite Figs. 4.15-4.16.	**V**	v	ni	v	**V**	**V**	**V**	ni	**V**	
	narrow, near the middle or on the right of the dorsum Figs. 4.15-4.16.	v	-	**V**	v	v	ni	ni	ni	ni	
	narrow, bordered by 2 deeper colored lines 4.17.	v	v	-	v	v	ni	**V**	ni	ni	4
lateral spots	many chestnut to dark brown Figs. 4.7, 4.9, 4.18.	V	V	**V**	**V**	**V**	ni	**V**	**V**	**V**	
	few small orange-brown spots present	**V**	V	ni	ni	V	**V**	ni	ni	ni	
	scarce, not extending onto the base	V	V	ni	ni	V	**V**	ni	ni	ni	
	not spotted Fig. 4.6.	**V**	v	ni	**V**	ni	ni	ni	ni	ni	
dorsal zones	absent/indistinct or very pale fulvous Fig. 4.2.	**V**	v	**V**	**V**	ni	ni	**V**	ni	ni	
	one or three greyish visible Figs. 4.8, 4.18.	**V**	V	ni	ni	ni	ni	ni	ni	ni	
	4 distant narrow pale ochraceous Fig, 2.1.	ni	ni	ni	ni	ni	**V**	ni	ni	ni	
base	convex, white, not spotted Fig. 4.19.	**V**	v	**V**	**V**	ni	**V**	ni	ni	ni	
	may be spotted with brown Fig. 4.20.	v	V	v	v	**V**	ni	**V**	ni	ni	
	flattened Fig. 4.3.	v	v	ni	v	**ni**	**V**	ni	ni	ni	
aperture wide enough so the fossula can be seen Figs. 4.5, 13.		**V**	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	
labial teeth	equally produced to about ½ lip	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	ni	
	less produced or reduced	v	ni	ni	ni	ni	**V**	ni	ni	ni	
colum. teeth	fine, short; several teeth stronger anteriorly Figs. 4.5, 4.20.	**V**	**V**	**V**	**V**	**V**	**V**	**V**	ni	ni	
"the anterior extremity is produced to the point where it is directed upward" Fig. A 16-1.		ni	ni	ni	ni	ni	ni	ni	ni	V	8
anterior extremity is barely visible and mostly blends smoothly with the curve of the dorsum Figs. 2.1-2.3.		ni	ni	ni	ni	ni	ni	ni	V	ni	7
extremities broad, slightly produced Fig. A-9.1.		**V**	**V**	**V**	ni	ni	**V**	ni	ni	ni	
extremities distinctly produced Fig. 4.8, 4.10, 4.21		**V**	ni	ni	ni	**V**	ni	**V**	ni	V	
fossula	broad, concave, denticulate	ni	ni	ni	ni	ni	ni	ni	ni	ni	
	broad, flat, regularly toothed	**V**	**V**	ni	**V**	**V**	**V**	ni	ni	ni	5
	shallow, ribbed, broad as the columellar sulcus	ni	ni	ni	ni	ni	**V**	ni	ni	ni	
	2 rows of teeth, narrower than the columellar sulcus	ni	ni	ni	V	ni	ni	ni	ni	ni	
	flat, crossed by coarse cuneiform ribs	**V**	**V**	ni	**V**	**V**	ni	**V**	ni	ni	5
shell characters ↑ taxa →		1	2	3	4	5	6	7	8	9	notes


4.1. *C. cribraria orientalis*, Philippines


4.2. *C. cribraria orientalis*, Philippines


4.3. *C. cribraria*, form 'cribellum', Reunion


4.4. *C. cribraria orientalis*, Philippines


4.5. *C. cribraria orientalis*, Philippines


4.6. *C. cribraria orientalis*, Philippines


4.7. *C. cribraria esontropia*, Reunion

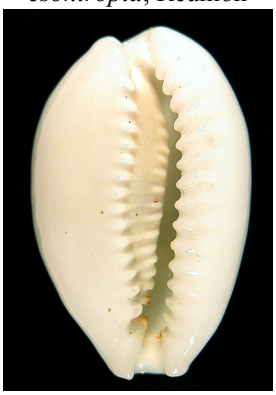

4.8. *C. cribraria esontropia*, Reunion


4.9. *C. cribraria esontropia*, Reunion


4.10. *C. cribraria*, Kwajalein


4.11. *C. cribraria*, W. Australia


4.12. *C. cribraria orientalis*, Philippines


4.13. *C. cribraria*, Australia


4.14. *C. cribraria orientalis*, Philippines


4.15. *C. cribraria comma*, Madgascar


4.16. *C. cribraria orientalis*, Philippines

4.17.*C. cribraria*, Queensland, Australia

4.18. *C. cribraria esontropia*, Reunion

4.19. *C. cribraria*, Kwajalein

4.20. *C. cribraria esontropia*, Reunion

4.21-4.23. *C. cumingii*, Polynesia

4.24. *C. catholicorum*, Solomon Is.

4.25-4.27. *C. astaryi*

4.1. The original description of *C. cribraria* is short:
"C. testa umbilicata marginata lutea: punctis rotundata albis."
According to Dodge (1953) "The synonymy is, with the exception of one figure, correct." Interestingly, several old authors cited by Linnaeus, pictured in their works shells of the species with marginal spots, for example, a picture in Martini (1769), which "was added to the synonymy in the "revised twelfth edition" Plate 31.
According to Linnaeus's definition, all other taxa in Table 4.1 can also be treated as *C. cribraria*.

4.2. It follows from Table 4.1 that *C. fischeri* cannot be separated from *C. cribraria* at the specific level; it cannot be treated also as a subspecies of *C. cribraria* because there are no published reports confirming the existence of separated populations of *C. fischeri* in the tropical/subtropical areas of the Indo-Pacific region. Besides, the type material of *C. fischeri* cannot be used for separating this taxon at a subspecific level because there are only three shells.

4.3. It follows from Table 4.1 that *C. fischeri* is not separable from *C. gaskoini*. Shells of the former are similar to small shells of *gaskoini* to such a degree that the Schilders once treated 'fischeri' as a form of *gaskoini*.

4.4. Diagnostic characters of *C. fischeri* and *C. cribraria esontropia* are practically the same except several shell characters that are not mentioned in the original description of *fischeri*. So, one can understand why students of cowries sometimes treated *fischeri* as a synonym of *esontropia*.

4.5. *C. fischeri* differs from *C. cumingii* by several shell characters; the difference in teeth seems to be of a specific level.

4.6. *C. fischeri* differs from *C. catholicorum* by the more numerous lateral spots, the convex rather than flattened base, and more produced extremities. To decide whether this difference is of a specific level would only be possible after studying of large batches of shells of both taxa.

4.7. *C. astaryi* is described as a Polynesian species. Not many diagnostic characters are given in its original description and they are not sufficient to establishing the true taxonomic identity of this taxon. I treat it here as *C. cribraria* in a broad sense.

4.8. *C. taitae* is treated here as a form of *C. cribraria* until the scientific evidence clarifying its taxonomic level will be available.

5. DISCUSSION

5.1. Mistakes in early works

The Prodrome records that *fischeri* belongs to *C. gaskoini* but I feel that this is a mistake. This approach was not based on, and was not confirmed by a comparative study of diagnostic shell characters of these taxa; it apparently was an opinion based on the first decision on how to interpret the data slips of the type material. Then Schilder did not discuss with Dautzenberg and other malacologists the identity of the type material; the decision seems to be his only. The shell pictured in Figs. 1-2 of the description is so close to shells of *C. esontropia* that it easily can be treated as a synonym of *C. esontropia*. It is so different from shells of *gaskoini* that it is strange that the Schilders did not compare diagnostic characters of these two taxa and also did not pay attention to the fact that treating *fischeri* as a form or a subspecies of *gaskoini* is de facto violating one of criteria of subspecies—all shells of a subspecies should share the main diagnostic shell character of the species.

Later, in 1952 the Schilders studied the type material of *fischeri* in the Dautzenberg's collection again; they did not accept the locality mentioned for one of the types and continued to believe that this shell is from the Hawaiian Islands and not from Mauritius. They confirmed that this shell of *fischeri* is a subspecies of *C. gaskoini* known from the Hawaiian Islands. Then it was already too late to ask Professor P. Dautzenberg (1849-1935) regarding the identity of the original type material and the relevant labels.

The two other shells belonging to the type material of *fischeri* also differ from shells of *gaskoini.*

5.2. Other options

C. fischeri was described as a species; it is possible for a species to be represented by shells from different localities: from Mauritius, New Caledonia, and from Samoa if they share the main diagnostic character, which is absent in all other species. But the fact that these shells are from different localities cannot be taken as the evidence that they represent different species.

5.3. *Cribrarula cribraria* is widely distributed in the Indo-Pacific region; in the West it is known from Elat in the Gulf of Aqaba to South Africa; in the East it is reported in Polynesia and Easter Island; it is known in Japan, Australia, and New Caledonia.

Many forms of the species may arise throughout this vast range of distribution; some of them take root, others arise sporadically and later may disappear.

Several forms of *C. cribraria* from an area of the Pacific Ocean are described as species or subspecies based on small lots of shells, without publishing data regarding a comparative conchological study; their descriptions are sometimes short and not convincing, for example, *C. catholicorum* Schilder & Schilder, 1938, *C. astaryi* Schilder, 1971, *C. taitae* Burgess, 1993 mentioned in this work.

An additional attention paid to the taxonomic identity of *C. gaskoini* and several other *Cribrarula* taxa of the Pacific Ocean is a by-product of the current study. It turned out that the specific level of *C. gaskoini* cannot be taken for granted, that it is in fact one of forms of *C. cribraria*, which perhaps can be treated as a subspecies—see a more detailed discussion of this problem in Heiman (2009a).

Several other taxa—*C. catholicorum*, *C. astaryi*, *C. taitae*—are currently under a conchological study; their true taxonomic identity will be clarified in the future.

6. CONCLUSION: *C. FISCHERI* IS A SYNONYM OF *C. CRIBRARIA*

The taxonomic practices used during the past hundred years indicates that diagnostic shell characters given in the original description of *C. fischeri* and its type material do not allow contemporary students of cowries to clarify its taxonomic identity deep enough. One cannot treat '*fischeri'* as a species or as a subspecies of another species. Neither can '*fischeri'* be treated as a form because there is no information regarding a living population of the taxon. Shells with characters similar to these of '*fischeri'* can sometimes be found in populations of *C. cribraria* hence it seems to be logical to treat '*fischeri'* as a synonym of the latter.

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APPENDIX

A1. The original description of *C. fischeri* translated by Mr. Olivier Caro (Rennes, France).

"*Cypraea fischeri* nov. sp. [1])
Shell oval, globose, of very small size, with opaque dorsum. Dorsal color is strong yellow-ochre, with lacunae of the same color but very pale, rather numerous, some being clustered in groups of two or three. There are many small spots on the sides, rather large, and of a deep dark brown color; the ventral side is opaque and white.
There is a dorsal longitudinal line, almost in the middle, very visible and wide.
The aperture is rather wide and slightly curved; on the type-specimen, there are 17 labial and 16 columellar teeth, but on other shells I counted 15-16 labial and 13-14 columellar teeth.[2])
Dimensions of the larger specimen: length 13 mm, maximal width 8 mm.
Habitat—According to F. Ancey, the shores of Mauritius; on another label, there was written "Upolu", one of the Samoa's.

In a description of this new *Cypraea* I'll take advantage to correctly specify its conchological characters in a table, and to compare them with these of all the species of the *cribaria* group; thus one will be able to better note the distinctive characteristics of these shells.
For an easier reading, I'll write dimensions as a fraction, with the shell length being numerator and its width being denominator; teeth numbers will follow, first the labial teeth followed by the columellar ones, separated by the sign "+". For example, for our larger specimen of *Cypraea cribaria*, which is 41 mm long & 23 mm in its max width, which has 21 labial and 23 columellar teeth, the data will be written: 41mm/23mm, 21+23. When one will mention the max height of the shell, one could write it in the denominator, after the width, with a separator "+" [3]).
Examination of the table will lead us to notice that, in the same species of *Cypraea*, teeth numbers are not fixed, but may vary with the size of the shell, and even vary between two specimens of the same size. This character having nothing absolutely constant may be useful only in comparison of numerous shells of neighboring species as we have been noticed in a certain number.
As the table obviously shows, species of *cribaria* group can be recognized by their ornamentation that always consists of the presence of numerous white lacunae on the dorsum, the background of which varies from pale yellow-ochre to some more or less dark brown-yellow.
Apart from this common feature, we notice some characteristics, more or less pronounced, which allow to separating of these seven species.

In *Cypræa cribaria* only the common characters can be found: lacunae on yellow to brownish background, with a shape oblong, typical.
C. esontropia Reeve has the same shape as *cribaria*, but with some brown spots on sides.
Esontropia Duclos is oval, with gibbous dorsum and fat margins, clearly visible transversal bands, and many small lateral spots. It appears that the type of *esontropia* Reeve is an intermediate form between *cribaria* and the true *esontropia* described by Duclos.
Regarding *peasei,* it can be almost considered as an albinotic form of *esontropia* Ducl., but this form may have a habitat reduced to localities in which some species are always pale, as it can be seen on Mauritius, where live *C. stolida* var. *diauges* and some pale forms of other species like *hirundo*, etc.
C. cribellum is elongate like *C. cribaria,* with the lateral spotting of *esontropia* Reeve; but, because of its flattened dorsum, its elliptic shape with sides almost parallel, and because of its flat base, this species cannot be confused with a young *esontropia*.
The hyaline *gaskoini* could be confused with some globose *C. peasei*, but its teeth are slightly smaller, and there is always a white longitudinal line on the right side of the dorsum, which never appears in the other species.

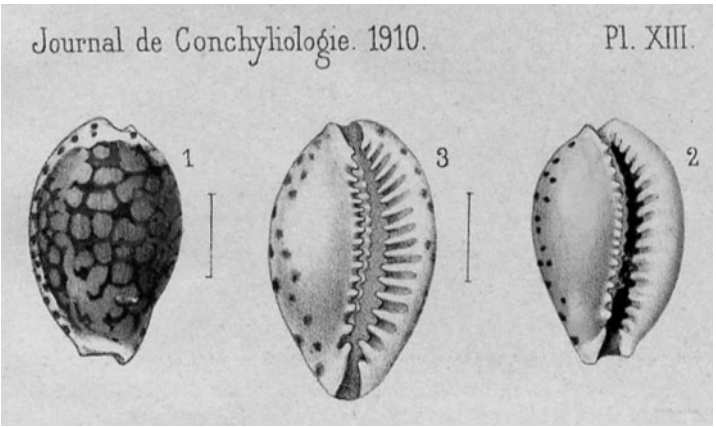
Our new type, *fischeri*, with its opaque dorsum, comes closer to *esontropia* Duclos, but its size is always very small, its general coloring tends to the reddish yellow, and the shell displays a very wide longitudinal dorsal line near to the middle of the dorsum.

Finally there is *cumingii*, with its dorsal line placed laterally, and a special dentition; on both sides of the aperture, teeth are very small, and more numerous than in any other member of the group. Regarding *C. coxeni* Cox, *beckii* Gaskoin and *macandrewi* Sowerby, they don't belong to *cribaria* group. *Coxeni* shows some analogy with *errones*, by its shape and the dorsal ornamentation that reminds the brown blotches of some examples of this last species, but the teeth look more like those of *stolida*. *Beckii* and *macandrewi* must be placed near *punctata* L. (*atomaria* Kiener, *stercus-muscarum* Lamk.) in a distinct group, similar to *cribaria."*

Notes
1. In one of the two Dautzenberg's specimens (Fig. 1, 2) there are 16 labial and 14 columellar teeth; in the other one, there are 15 teeth on both sides.
2. In Fig.3 copied after author's drawing, the inside of the aperture was not darkened in order to let the teeth be more visible.—A note of the French Editor.
3. Vayssière did not use a shell height in this description.—Translator's note.

Table of diagnostic shell characters

shell characters	species			
	C. cribaria L.	*C. esontropia* Ducl.	*C. peasei* Sow.	*C. gaskoini* Rve.
general shape	oblong-oval	oval, rather globose, sides often spotted laterally	oval, rather globose	oval, globose
color of the dorsum	shell opaque, from pale to dark yellow-ochre, with white lacunae	shell opaque, from pale to dark yellow-ochre, white lacunae, and brown lateral spots on lower parts of sides	shell rather translucent; background pale ochre, with lacunae of a hyaline white, lateral spots pale brown	bright coloring, but of a very pale yellow; test translucent; lacunae hyaline-white, lateral spots of a rather deep reddish brown
color of the base	opaque porcelain-white	opaque porcelain-white	porcelain-white, slightly translucent	porcelain-white, slightly translucent
dorsal pattern	numerous lacunae, sometimes very numerous, most of them of a same diameter, some smaller; no dorsal line, even if one is often noticeable; rectilinear interruption of the drawing, on external side, followed by an irregular reappearance of the pattern	same ornamentation as in *cribaria*, but here one often distinguishes the three pale brown juvenile bands, even in the most adult shells; lateral spots dark brown on the shell sides	same ornamentation as in *esontropia* (lacunae, lateral spots, transversal juvenile banding), but all is paler, and more or less translucent	same ornamentation as in the two previous shells, but paler than in *peasi*; lacunae might be usually less nume-rous; the three juvenile bands are not visible; there is a dorsal longitudinal line, 0,5-0,6mm wide, arranged laterally on external side
aperture	rather wide, a bit curved	rather wide, a bit curved	rather wide, a bit curved	rather wide a bit curved; strong teeth, with large & deep interstices on the marginal side
dimensions & dentition lenghth/width marg+coll	41/23—21+23 39/21—20+22 28/16—18+19 19/10—18+21 15/9.5—17+18	30/18.5—17+20 26/15—19+20 20.5/14—17+18 17/10—17+16 14.5/9—14+14	30/20.5—19+17 27/15.5—17+20 26/14.5—17+18 22.5/13—15+19	27/16.5—21+23 24/14—18+21
habitat	Pacific Ocean: New Caledonia, Vanuatu, Marianas, Samoa, Western Australia, Philippines, China, Japan. Indian Ocean: Natal, Réunion, Mauritius, Mozambique, Red Sea, Hindustan, Maldives, Sri Lanka	Pacific Ocean: New Caledonia, Hawaii, Cook, Pomotu, Australia, Philippines. Indian Ocean: Mauritius.	Pacific Ocean: New Caledonia, Hawaii, Cook, Pomotu, Australia, Philippines. Indian Ocean: Mauritius.	Pacific Ocean: Hawaii, Samoa.



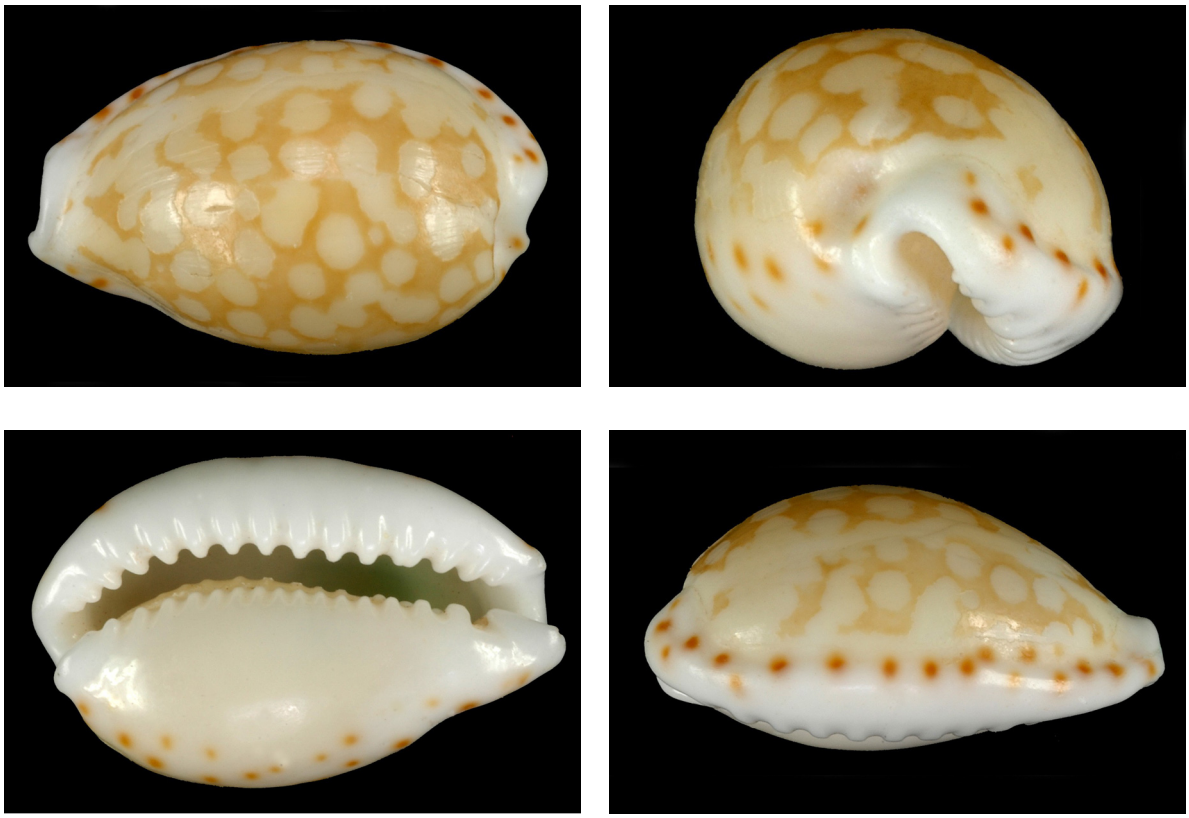
A1-1. Type material pictured in the original description of *C. fischeri.*

Shell 1 is pictured in Richard & Hunon (1991 photos 17-18) as the holotype *C. gaskoini fischeri* in the collection of the MNHN, Paris.

Table of diagnostic shell characters (continuation)

shell characters	species		
	C. *cribellum* Gask.	*C. fischeri* Vayss.	*C. cumingii* Gray.
general shape	oblong-oval, with flattened dorsum	globose, oval	very oval and oblong
color of the dorsum	shell opaque, from pale to sometimes dark yellow-ochre; lacunae whitish; colored lateral spots relatively large	shell opaque, of a strong yellow-ochre; lacunae yellowish white; lateral spots of a rather dark brown	shell opaque, from a pale to a pronounced yellow ochre; lacunae white, encircled with a dark yellow line; lateral spots large and dark brown
color of the base	opaque porcelain-white	opaque porcelain-white	opaque porcelain-white
dorsal pattern	same ornamentation as in *esontropia* (lacunae, lateral spots, and sometimes also the juvenile banding), but there is no dorsal line as in *gaskoini*	same ornamentation as in *esontropia* (few lacunae, large dark lateral spots), no juvenile bands; longitudinal dorsal line almost in the middle	lacunae white, encircled with a dark yellow line, on a paler yellow-ochre background; lateral spots large and dark brown; dorsal line clearly distinct, less median than in *fischeri*
aperture	very wide aperture, almost straight	rather wide, a bit curved; strong teeth, with deep interstices	a bit narrow; very numerous teeth, small and confined to the aperture
dimensions & dentition lenghth/width marg+coll	16/9—15+15 16/9—16+16 13.5/7.5—14+15 13.75/7.5—15+17 12/7—14+15 12/6.5—14+14	13/8—17+16 12/7—15+13 12.5/7—16+14	21/11.5—25+30 11/6—30+26 10/5.5—29+28
habitat	Pacific Ocean: New Caledonia. Indian Ocean: Mauritius, Reunion.	Pacific Ocean: Samoa (Upolu)	Pacific Ocean: Tahiti, Pomotu, Kingsmill, Jarvis.

A2. A syntype of *C. fischeri* in the Malacological Collection of the MNHN, Paris



A2-1-A2-4. A syntype of *C. fischeri* preserved in the collection of the MNHN, Paris.
The pictures by P. Maestrati (MNHN); courtesi of the MNHN.

The dorsum of this shell is profusely spotted by the relatively large lacunae touching and even covering the dorsal line.

This shell is the same as in the original description, pictures #1 and # 3, but has 15 labial and 15 columellar teeth (instead of 13 mentioned by Vayssière)

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A3. *C. fischeri* in Schilder (1930)-see section 2.2 above.

"I have seen only a metatype, determined by Vayssière himself, in coll. Dautzenberg: 11.3(61) 17:15, collected at Maui, Sandwich Isl. *C. fischeri* evidently is a good species, allied to *cumingii* (Sow.), and not to *cribellum* (Gask.). The dorsal markings are less definite than in other *Cribraria*."

No photos of this shell seem to be published until now.

A4. *C. peasei* and *C. fischeri* according to the Prodrome.

"We think that *gaskoini* and *peasei* are ecological variety of one single species [*gaskoini*]…*peasei* is larger than *gaskoini*, more solid though pellucid, with the outer lip more declivous in front and externally bordered by a callous carina, which projects from the basal level in the anterior third; *fischeri* represents the more common small variety of the non-pellucid *gaskoini* (size: mean of *fischeri*=13mm, type of *gaskoini* =23mm, mean of *peasei* =24 mm)."

There seems to be a consensus among students of cowries that *C. peasei* is a sub-fossil form of *C. gaskoini* sporadically found in the Hawaiian waters.

An example of shells treated by Hawaiian collectors as *C. peasei* (Sowerby, 1870) can be seen in Figs. A4-1-A4-3.

A4-1-A4-3.

A5. Description of *C. gaskoini* in Reeve (1846:Plate 22).

"Gaskoin's cowrey. Shell somewhat shortly ovate, rather solid, sides thickened, margined, teeth rather strong; back yellowish straw-colour, sparingly ornamented with rather small white eyes, encircled with pale brown rings, sides dotted with chestnut, base white."
"The sides are stoutly thickened and spotted as the *C. esontropia* and the back is covered with the same kind of small clear ringed eyes as the *C. cumingii*."

A5-1. One of the syntypes of *C. gaskoini.* Courtesi of the British Museum of Natural History, London.

This description is short and mentions the following main diagnostic shell characters of the taxon:

-oval shape;
-thickened, angled margins;
-dorsum sparingly ornamented with white dorsal lacunae;
-sides dotted with chestnut.
-
-the dorsal lacunae encircled with pale brown rings;
-spotted sides
-strong teeth;
-base white;

A6 *C. gaskoini* in the Prodrome.

"The Hawaiian *gaskoini* (20.62.21.20) approaches *cumingii* in the acuminate though much shorter extremities and in the outer lip declivous at the extremities, though both characters are less developed; it differs by the less numerous teeth [ ] , the labial teeth equally produced, the less broad fossula, and the finer lateral spots; all these characters are to be found also in *catholicorum* (14.63.21.20), which differs from *gaskoini* by the scarce lateral spots restricted to the right side and not extending to the base, by the broad instead of constricted extremities, and by the fossula which is concave and about as broad as the columellar sulcus, whereas in *gaskoini* the fossula consists of two rows of teeth rather approaching each other and so becomes much narrower than the declivous columellar sulcus."
The last sentence underlined by the present author is an additional diagnostic shell character not mentioned in section A3.

A7. Diagnostic shell characters of *C. gaskoini*—summary and comments.
The main diagnostic shell characters of *C. gaskoini* can be summarized as follows:

a. oval shell shape
b. mostly humped dorsum;
c. thickened, margined (edged) sides;
d. the dorsal pattern consisting of small white lacunae, encircled with pale brown rings;
e. sides and partly base are spotted with chestnut;
f. the fossula consists of two rows of teeth rather approaching each other and so becomes much narrower than the declivous columellar sulcus;
g. narrow clear dorsal line tinged light brown at its sides.

A8. Schilder & Schilder, 1952, section 119 p. 174 —on *C. gaskoini* Reeve, 1846 and *fischeri*.
The authors considered that *C. gaskoini* consists of two subspecies: *C. gaskoini gaskoini* from the Hawaiian Islands and *C. gaskoini fischeri* from Melanesia to Samoa. They explained this approach as follows:

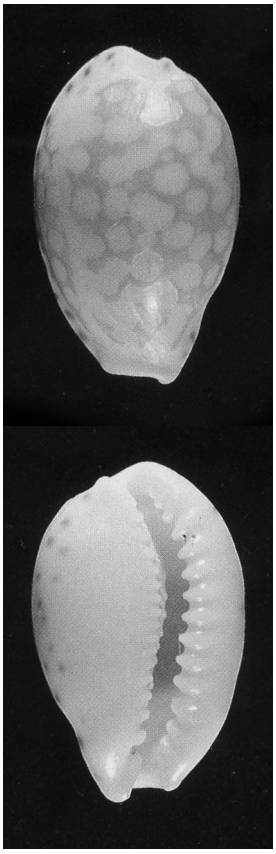
"Dautzenberg's shells prove that the species *gaskoini* is not restricted to the Hawaiian Is.; in Eastern Melanesia there is a slightly different race, described as *fischeri*, the holotype of which came from Upolu. The distribution and the relative size of the two races of *gaskoini* (*fischeri* and *gaskoini*) correspond to those of *rashleighana* (*rashleighana* and *eunota*); they are closely allied morphologically, but well separated geographically, whereas *fischeri* and *catholicorum* are well separated morphologically, but live in adjacent regions. The former is more pyriform than *catholicorum*, with the right margin more sharply edged, the aperture abruptly curved behind, the outer lip more declivous in front, the inner lip bent to the left behind, the fossula steep and much narrower than the declivous and shallow columellar sulcus, and the lateral spots more distinct and numerous. The specimen from Lifou is an oblong variety of *fischeri*."

A picture of that specimen made by F.A. Schilder personally and published later in Schilder & Cernohorsky (1967) can be seen in Fig. A5-2.
The authors added in section "Dautzenberg's type specimens" p. 234:

"3. The following shells must be regarded as type specimens of cowries described by other writers:….
(119) *Cribraria gaskoini fischer*i: the small shell from Haiku (Baldwin) is a paratype of *fischeri* Vaissière (Journ. de Conchyl., 58, p.302, 1910)."
This was based on the certain observations important to us for understanding a nomenclatural history of *C. fischeri***.** The Schilders reported two shells in the Dautzenberg's collection, which they treated as *fischeri* from known localities:

"1 ex.= *fischeri*: 12(57)20:20" from Lifou (or Lifu), Melanesia [it can be seen in Fig. A2.1-A2.4 above].
"1. ex. F. = *fischeri*: 11(61)22:19, slightly worn, lateral spots larger and less numerous than in the larger specimen from Haiku.
The small shell is labeled "cotype" of "*fischeri*", figured by Vayssière as figures 1-2 on plate 13 of his paper originally describing *fischeri* (J. de Conchyl., 58, 1910) [Figs. above]; therefore it cannot be regarded as a metatype only, as we suggested before[...], but it is a real paratype. The specimen preserved in Vayssière's collection and figured by him as figure 3 should be regarded as holotype, because its dimentions—13(61)21:18—correspond to those indicated in Vayssière's diagnosis on page 302 and in the table on page 307

of his paper. The two other "cotypes," the dimentions of which have been published on page 307, are worn *Erosaria labrolineata*[…] Therefore Dautzenberg's specimen from Haiku has been figured by Vayssière, but not mentioned in the text of his paper; it is possible, however, that the type locality "Ile Maurice" mentioned in the description but not in the table, is a misunderstanding of Dautzenberg's label "Côte de Haiku, Maui."
This locality, however, fits to the large shell only, the small shell has erroneously been put into the same box by Dautzenberg or by Ancey, we suppose, for the shell agrees with the Melanesian *fischeri* , and not with small specimens of *gaskoini* found in the Hawaiian Islands."



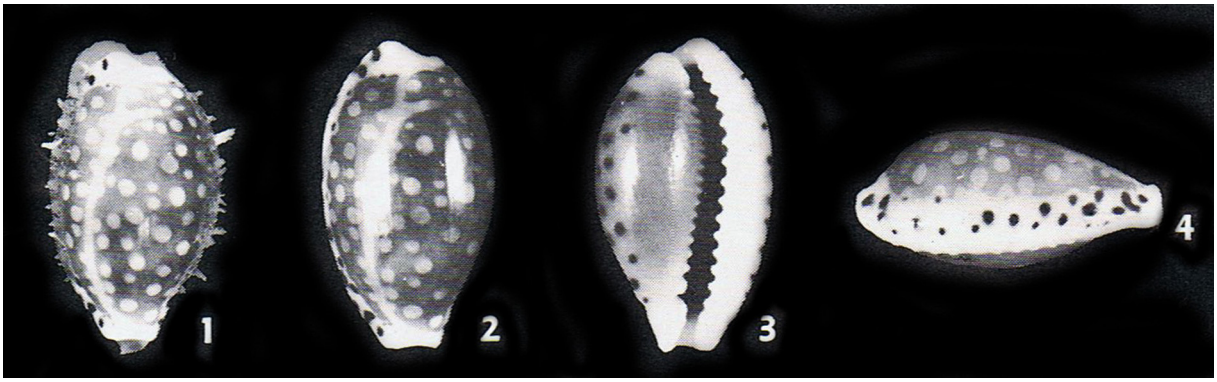
A8.1-A8.2.

The shell pictured in the original description of *C. fischeri* in Figs. 1-3 on Plate 13 is published later in Richard & Hunon (1991:Photos 17-18) as the holotype of *C. gaskoini fischeri* from French Polynesia.
Currently, this specimen is preserved in the MNHN. Paris, as a syntype of *C. fischeri* # 3545—Figs. A8.1-A8-2 and A2.1-A.2.4 above.

Two small shells 12 mm and 12.5 mm are mentioned by Vayssière (in a table); a number of teeth are correspondingly 15+13 and 16+14.
Vayssière mentioned in Note 1 to the description:
"In one of the two Dautzenberg's specimens (Fig. 1, 2) there are 16 labial and 14 columellar teeth; in the other one, there are 15 teeth on both sides."

As can be seen in section A10 below, the smallest shell 12 mm is from an area near New Caledonia; its teeth count seems to be: 16+15 (or 17, if one counts double teeth). Vayssière's and Schilder's data are not in harmony.

A9. *C. gaskoini* from Fiji is reported in Cernohorsky (1965)—Fig. A9-1. This fact can be used as a confirmation of an old idea that this species can be found outside the Hawaiian Islands, although the important shell characters is not mentioned in this report: that the white lacunae are encircled with pale brown rings and the narrow dorsal line is bordered with brown.

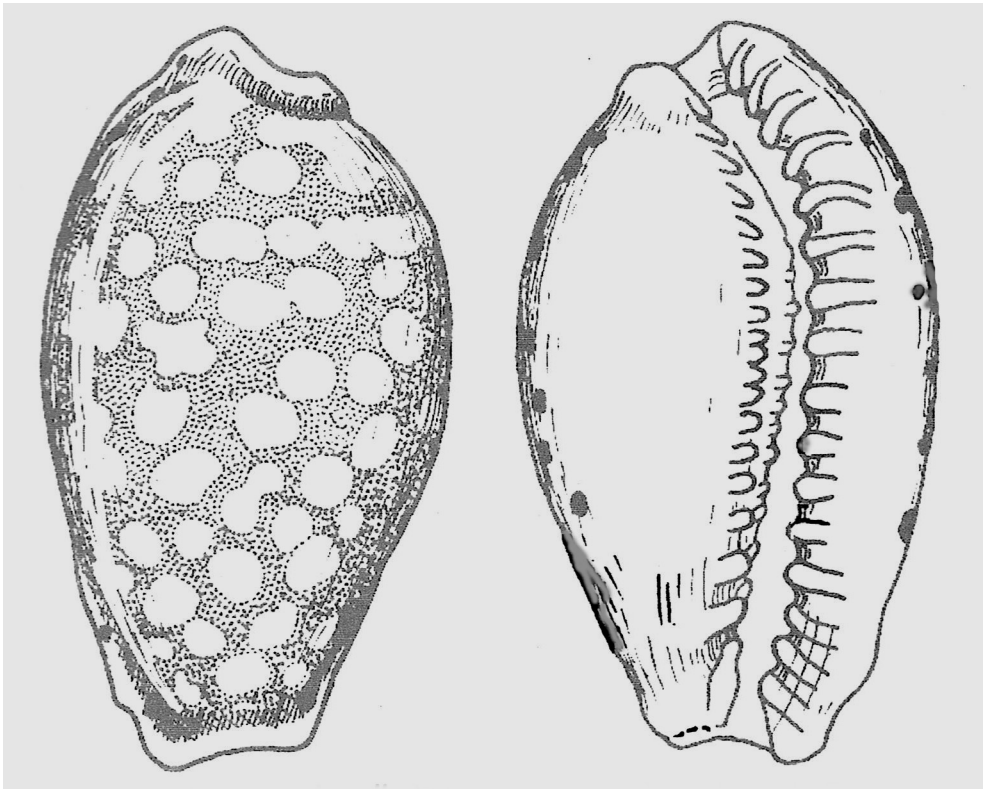


A9-1. *C. gaskoini* collected on the main Suva reef; 11.4x6.3 mm; 23:22 normalized teeth.
Three left pictures are published in Cernohorsky (1967:105) too.

Later Burgess (1993) considered that Fig. A9-1 above represents in fact *C. taitae* although in the same article Burgess mentioned that the dorsal line is absent in *C. taitae*!

Only two of the seven diagnostic characters of *gaskoini* mentioned above can be recognized in Fig. A9-1: the slightly humped dorsum and the spotted sides and base.

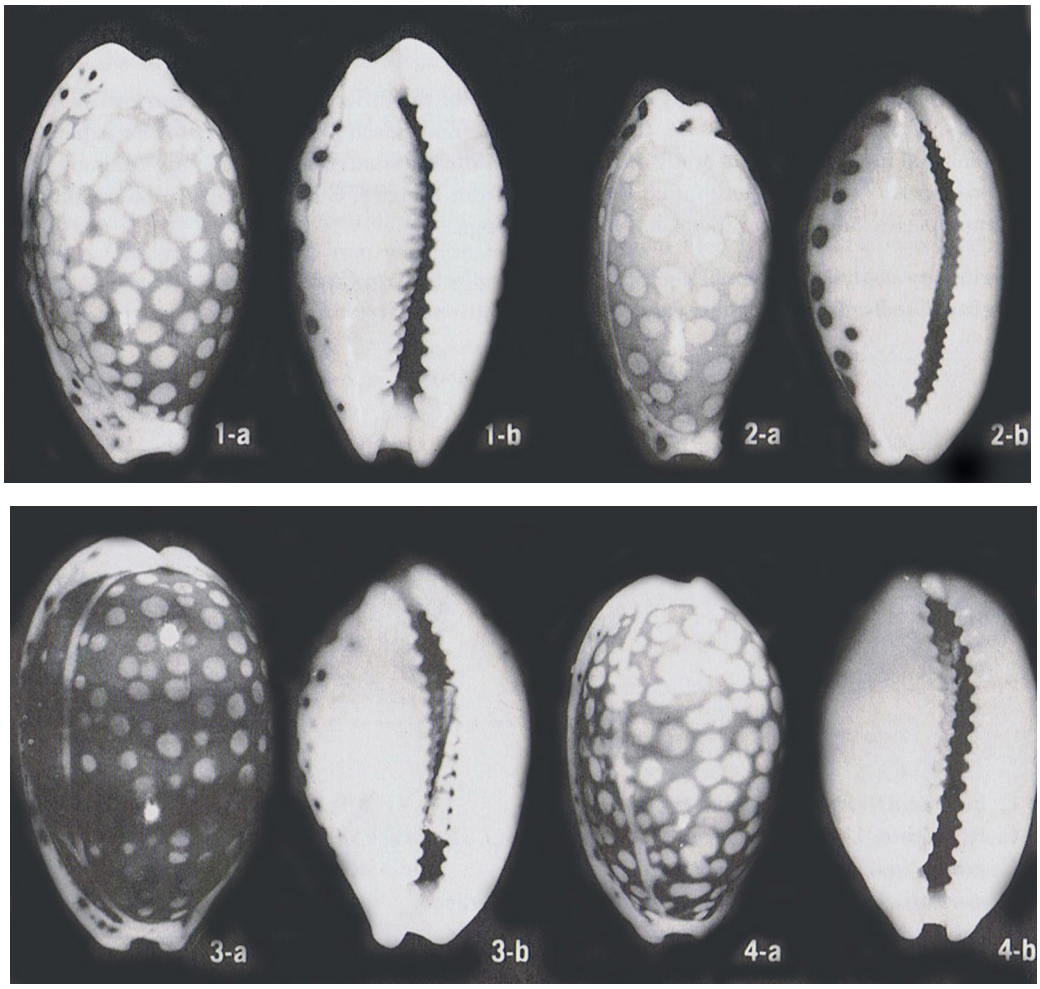
A10. In Schilder & Cernohorsky (1967) the authors report "re-discovery" of *C. fischeri* in New Hebrides (Efate, westward from Fiji) and suggested to treat *fischeri* as a valid species.



A10-1. *C. fischeri*, 12 mm, collected at Efate, westward of Fiji. Pictured in Schilder & Cernohorsky, (1967)

This shell is treated in Burgess (1993) as *C. taitae*.

A11. In Debant (1969) the author already treats *fischeri* as a valid species from New Hebrides and reports finding shells of this taxon belonging to two different forms: in one form shells are very close to *C. cumingii* Sowerby, 1832 but have a substantially lesser number of teeth; in the second form shells are very close to *C. catholicorum*.
Later these shells were mentioned in Burgess (1993) as *C. taitae*.

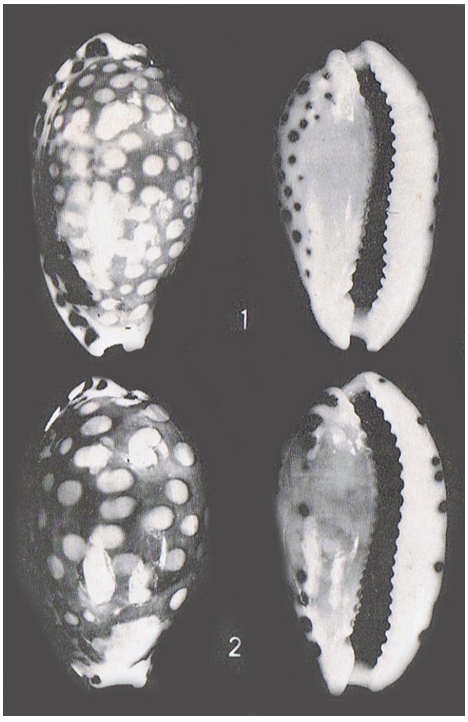


A11-1.Two forms of *C. fischeri* sensu Debant (1969):1-2-a form close to *C. cumingii*; 3-4-a form close to *C. catholocorum*

A12. In Schilder (1971a, b) *fischeri* is also treated as a valid species from New Hebrides, Fiji, Samoa, and New Caledonia and its subspecies *Cribrarula fischeri astaryi* from Marquez's Islands is described—Fig. A12-1.

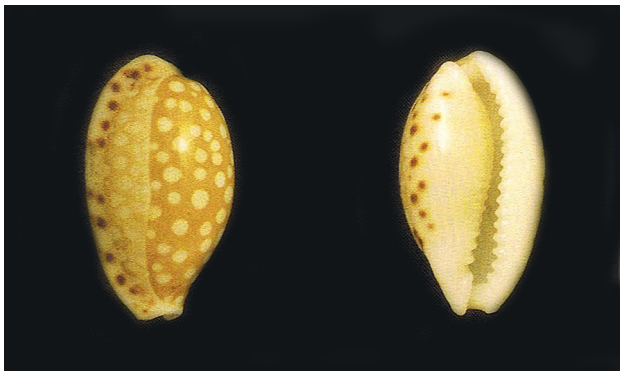
A13. In Schilder & Schilder (1971) *fischeri* is listed as a subspecies of *gaskoini* again; a taxon *astaryi* is not mentioned.

A14. Salvat & Rives (1975) pictured the following *Cribrarula* species from French Polynesia:
cribraria (Linnaeus, 1758) from Tahiti; *esontropia* (Duclos, 1833) from Tahiti and Marquez's; *gaskoini* (Reeve, 1846) from Tahuata (Marquez's), and *cumingii* (Sowerby, 1832) from Tahiti. To comment with pictures
In Salvat & Rives (1980) the authors pictured the following *Cribrarula* of Tahiti: *gaskoini* (Reeve, 1846), *cribraria* (Linnaeus, 1758), *astaryi* (Schilder & Schilder, 1971), and *cumingii* (Sowerby, 1832
→



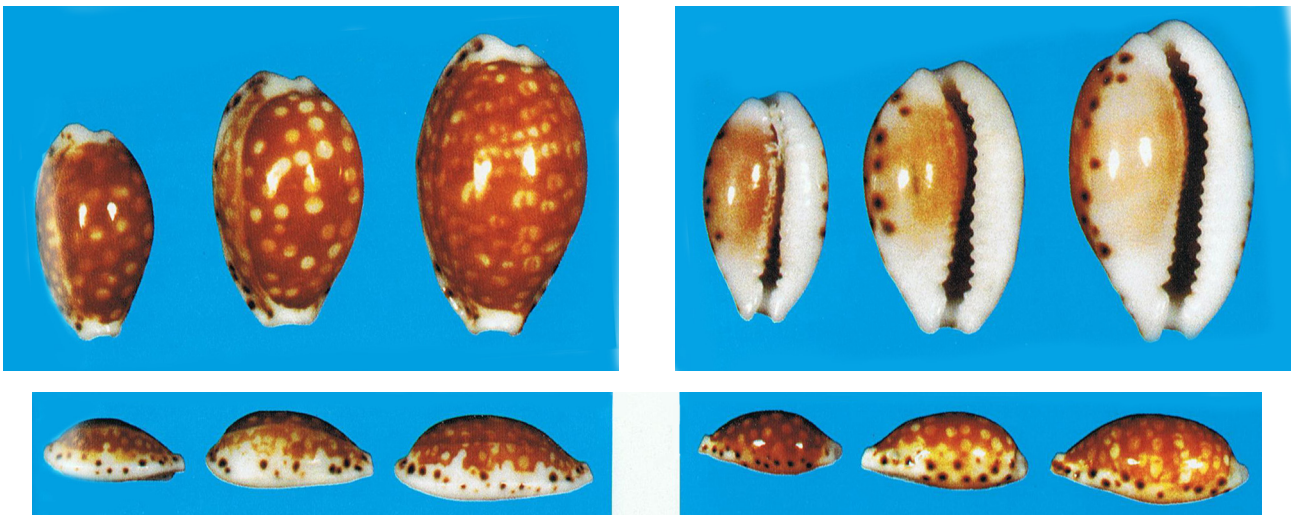
A12-1. *C. fischeri astaryi*, the holotype (1a-1b) and a paratype (2a-2b) from the Marquez's Islands.

A15. *C. fischeri* is mentioned in Burgess (1985) as a synonym of *C. gaskoini* and the following species of the genus are recognized: *astaryi* Schilder, 1971 (picture at right), *catholicorum* (Schilder & Schilder, 1938); *cribraria* (Linnaeus, 1758); *cumingii* (Sowerby, 1832); *esontropia* (Duclos, 1833); *cribellum* (Gaskoin, 1849), and *haddnightae* (Trenberth, 1973). Later, in Burgess (1993) the author wrote: "Burgess (1985) was not aware that his Samoan *Cypraea* [*Cribrarula*] species was specifically different from *C. astaryi* and the illustrations of the dorsal and ventral views of what then thought to represent that species are those of *C. taitae*…"



A15-1. A specimen pictured in Burgess (1985) as *C. astaryi*, which he latter treated as *C. taitae*.

A16. Burgess (1993) described a new species *C. taitae* and compared it with *C. astaryi*.



A16-1. *C. taitae*; after Lorenz (1995)

A17. In Lorenz (1995) three shells determined as *C. taitae* from Apia, Western Samoa are pictured and certain of their characters are compared with these of *gaskoini*, *catholicorum*, and *cumingii astaryi.* The latter can be easily separated by the more numerous teeth, but a specific difference between *taitae* and *catholicorum* is not convincing. *C. gaskoini* looks differently from *taitae.*

A18. In Lorenz & Hubert (2000:486) the authors recognized *C. taitae* as a valid species considering that "for decades the name '*fischeri*' was used for the type of shells now accepted with this new name" [*taitae*] and that *fischeri* "has to be treated as a synonym of *esontropia* and is not available for *taitae*."

A19. L.M. Raybaudi added a short note to Lorenz (1995) work on p.79 picturing 7 shells of *C. cribraria* from Apia (Samoa). These pictures are of a special interest: they can be treated as *C. cribraria* indeed!—see pictures next page.
This is an interesting fact confirming that at least two forms of *C. cribraria* live in Samoa: the typical form and a *taitae*-like form. The shells of the latter seem to be differing by the presence of a rather confused dorsal line and small dark spots on the shell sides and base. It is not known, the shells of which form prevail in Samoa and what is the taxonomic identity of the Samoan populations.

A19-1-A19-2. *C. cribraria* from Samoa; after Raybaudi (1995)