Typification and nomenclature of four species names with links to *Cryptonemia* (*Halymeniaceae, Rhodophyta*): *Fucus palmetta* S.G.Gmelin, *Delesseria gmelinii* J.V.Lamouroux, *Fucus lomation* Bertoloni, and *Sphaerococcus lactuca* C.Agardh

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This analysis concerns the typification and species nomenclature of *Fucus palmetta* S.G.Gmelin (1768: 183), *Delesseria gmelinii* J.V.Lamouroux (1813a: 124), *Fucus lomation* Bertoloni (1818: 289), and *Sphaerococcus lactuca* C.Agardh (1822: 231). All four names pertain to a single species currently placed in *Cryptonemia* J.Agardh (Halymeniaceae, Rhodophyta). Two of the names have not been typified to date, and name priorities require reconsideration.

Our analysis is based on the current ICN [International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code)] (Turland *et al*. 2018), whose provisions are retroactive unless expressly limited. Nomenclatural terminology follows that used in the ICN. Interpreting 18th and 19th century nomenclatural actions (which can be cryptic) in the context of 21st century rules requires care to ensure correct application of the scientific names. Because the application of scientific names to species is determined by means of nomenclatural types (ICN Principle II; Art. 7.1), various past nomenclatural judgements have lacked underpinning evidence essential for nomenclatural stability. Herbarium abbreviations are those in the online database *Index Herbariorum*. References to both the journal and the independently paginated offprint versions of several publications are included because of citations of the latter by some authors. Dates of publication have been determined in accordance with ICN Art. 31.1. The use of double quotation marks (e.g. "*Palmetta marina"*) to indicate binary designations that are not validly published names follows Turland *et al*. (2018: 205).

Fucus palmetta S.G.Gmelin. Gmelin (1768: 183, pl. XXII, fig. 3; pl. XXIII) based *F. palmetta* on an unknown number of specimens from unnamed localities of the '*littora Oceani septentrionalis et marin mediterranei*' [seashores of the North Ocean and the Mediterranean], and he illustrated one individual at two different magnifications. Gmelin also mentioned that "*Palmetta marina*" (Ginanni 1757: 20, pl. XIX: fig. 37) from the Adriatic Sea was the same as his species or did not differ much from it. "*Palmetta marina*", however, is not a validly published name because it appeared in a publication in which phrase names predominate [see ICN Art. 23.6*(a)* and the associated *Ex. 13*].

Gmelin (1768) did not indicate a nomenclatural type (Art. 7.2). To our knowledge, a lectotype (Art. 9.3) has not been formally designated to date; and apparently, there are no known surviving algal specimens of Ginanni (Stafleu & Cowan 1976: 947) or of Gmelin (Dixon & Irvine 1970: 482). Thus, in accord with ICN Art. 9.12, we **designate here** the protologue illustration in Gmelin (1768: pl. XXIII) as lectotype of *Fucus palmetta* S.G.Gmelin. The designated lectotype is reproduced here as Fig. 1. To remove any ambiguity (Art. 9.9) for purposes of the precise application of the name *Fucus palmetta* S.G.Gmelin, we also **designate here** PC0474619 as the epitype (Fig. 2). The epitype (Art. 9.9), with the handwriting "*Cryptonemia lomation* J. Ag. sp." (referring to J. Agardh 1851) and "*Cryptonemia lactuca* J.Ag. alg. Med." (referring to J. Agardh 1842), was collected at

Trieste, Italy (Adriatic Sea) and is conserved in **PC** (Herbier Montagne within Herbier Cryptogamique, Dépt. Systématique et Évolution, Muséum National d'Histoire Naturelle, Paris, France).

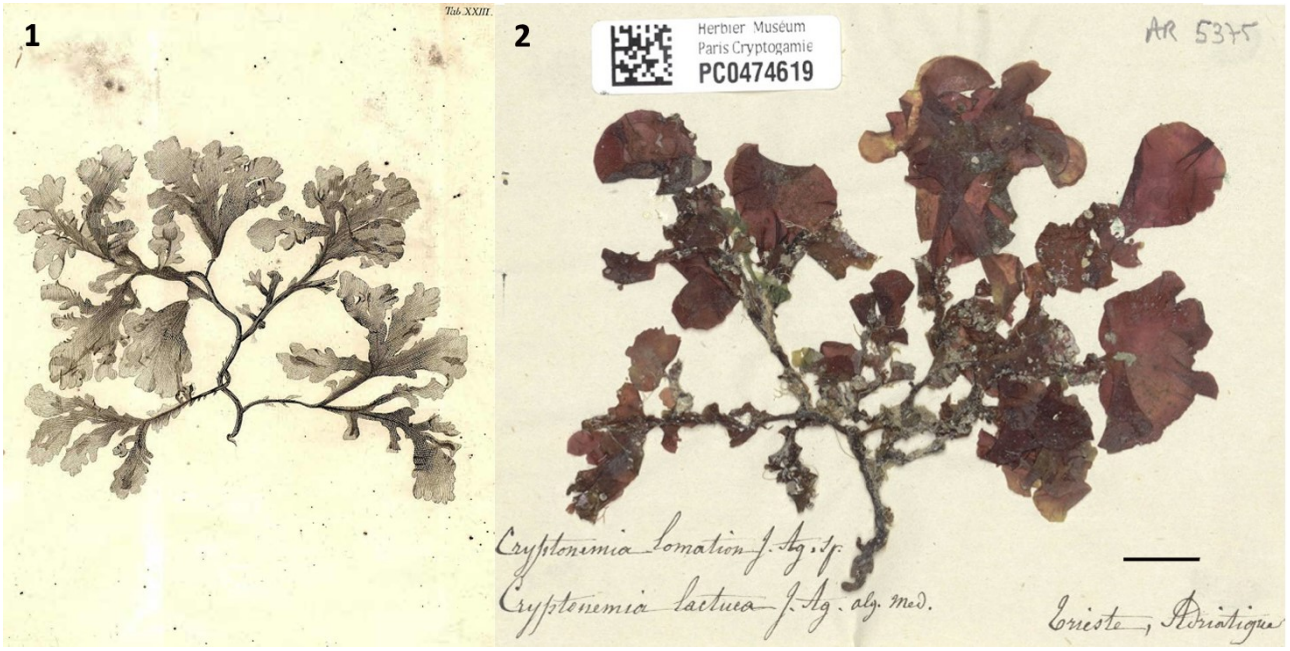

Fig. 1. Designated lectotype of *Fucus palmetta* S.G.Gmelin, illustration, reproduced from Gmelin 1768, pl. XXIII. Size data not indicated by Gmelin. **Fig. 2.** Designated epitype of *Fucus palmetta* S.G.Gmelin: PC0474619. Collector and date not indicated. Names and locality data written by Montagne. Scale bar = 10 mm.

It is important to differentiate between the legitimate name *Fucus palmetta* S.G.Gmelin (1768) and the later illegitimate homonym (Art. 53.1) *Fucus palmetta* Stackhouse (1801: 102, pl. XVI, *F. palmetta*) to understand the subsequent rather complex nomenclatural history of the Gmelin name. Stackhouse (1801: 102) created the illegitimate homonym by explicitly excluding (Art. 48.1) "*F. palmetta* of Gmelin" from his account (also see Turner 1802: 21, 23). Because *Fucus palmetta* Stackhouse (1801) is illegitimate, it cannot function as a basionym for a new combination (Art. 6.10). Subsequently, however, Stackhouse (1809: 76) validly published *Membranifolia palmetta* Stackhouse as a legitimate replacement name (Art. 6.11-6.13; 7.4-7.5) for *F. palmetta* Stackhouse, citing the earlier Stackhouse illustration (1801: 102, pl. XVI) and the earlier description of *F. palmetta* Stackhouse in Turner (1802: 21) as the basis for the new name.

Delesseria gmelinii J.V.Lamouroux. As explained in ICN Art. 7, *Ex.2*, Lamouroux (1813a: 124, 125; 1813b: 36, 37) transferred both the Gmelin and the Stackhouse entities into *Delesseria*, establishing *D. gmelinii* J.V.Lamouroux as a legitimate replacement name for *Fucus palmetta* S.G.Gmelin, and publishing the legitimate new combination (Art. 6.10) *D. palmetta* (Stackhouse) J.V.Lamouroux based on the legitimate *Membranifolia palmetta* Stackhouse (1809).

Four years later, C.Agardh (1817: XVI) transferred effectively the Stackhouse name into *Sphaerococcus* with the cryptic reference "T. t. 73" (= Turner 1809: pl. 73). Turner (1809) explicitly cited both the illustration and the description upon which Stackhouse based *Membranifolia palmetta*, and thus, although not mentioned by C.Agardh (1817: XVI), the correct authorship of the name in *Sphaerococcus* is *S. palmetta* (Stackhouse) C.Agardh, not *S. palmetta*

C.Agardh, as indicated by some authors (e.g. Mirbel 1825: 96. Leman 1827: 177. Drouet 1866a: 141; 1866b: 221).

Sphaerococcus lactuca C.Agardh. C.Agardh (1822: 231) subsequently also placed *Fucus palmetta* S.G.Gmelin in *Sphaerococcus* using a new epithet, *S. lactuca* C.Agardh, possibly to avoid creating a later homonym for *S. palmetta* (Stackhouse) C.Agardh.

C. Agardh, however, also cited "*Fucus palmetta* Gmel. Fuc. p. 183. t. 22. f. 3. & t. 23." (Gmelin 1768) in the synonymy of *S. lactuca*, and thus definitely included the type of the Gmelin name and therefore of the homotypic *Delesseria gmelinii* J.V.Lamouroux (1813a: 124). As a result, C.Agardh should have adopted the legitimate, available 1813 epithet "*gmelinii*" to avoid homonymy (Art 11.4 (c)) and not created the new 1822 epithet "*lactuca*", which, in the context of the current ICN (Art 52.1), is nomenclaturally superfluous and illegitimate and must be rejected. Moreover, under Art. 7.5, *S. lactuca* is automatically typified by the type of *Delesseria gmelinii* J.V.Lamouroux (1813a, b), the name whose epithet ("*gmelinii*") should have been adopted, and itself a homotypic synonym of *Fucus palmetta* Gmelin.

Fucus lomation Bertoloni. C. Agardh (1822: 231) also cited the validly published (ICN glossary) and legitimate name *Fucus lomation* Bertoloni (1818: 289, pl. X: fig. 3) in the synonymy of *Sphaerococcus lactuca*. Bertoloni (1818: 289) based *F. lomation* on specimens from 'Portus Lunae', currently known as the Gulf of La Spezia (Liguria, Tyrrhenian Sea, Italy). Bertoloni (1818: 289), like Gmelin (1768: 183), cited "*Palmetta marina*" (Ginanni 1757: 20, tav. XIX, fig. 37) in his protologue. In addition, Bertoloni cited p. 239 & pl. 51, fig. 6 in a then unpublished manuscript of [Giovanni] Targioni Tozzetti (1712-1783), and he also cited the 'Herb. Michel.' (Pier Antonio Micheli; herbarium now in **FI**). No nomenclatural type was indicated by Bertoloni, and a lectotype apparently has not been formally designated previously.

We are aware of three specimens identified and labelled *Fucus lomation* by Bertoloni that qualify as original material (Art. 9.4). Two unnumbered specimens are conserved in Bertoloni's herbarium in **BOLO** (Orto Botanico ed Erbario, Sistema Museale di Ateneo. Università di Bologna, Bologna, Italy); and one specimen numbered 22972 is conserved in **LD** (Herbarium, Botanical Museum, Lund University, Lund, Sweden) and was sent by Bertoloni to C. Agardh. All three include Bertoloni annotations referring to 'tab. 4, fig. 3' in Bertoloni (1819); the same figure appears in Bertoloni (1818) as pl. X: fig. 3 (mislabelled as pl. IV on the journal plate).

However, only one **BOLO** specimen (Fig. 3) comes from Portus Lunae, the only location cited in the protologue by Bertoloni (1818: 289). It is not a holotype because at least two other Bertoloni original specimens predating the 1818 protologue exist. The Portus Lunae specimen, depicted below in Fig. 3, is **designated here** as lectotype of *Fucus lomation* Bertoloni. Bertoloni annotated the packet containing the designated lectotype to indicate that the specimen was collected in 1804 from "Lunae Portu a S. Terenzo" (a locality in the Gulf of La Spezia).

Fucus lomation is based on a different nomenclatural type from that of *F. palmetta* S.G.Gmelin (and *Delesseria gemlinii* J.V.Lamouroux), and thus, in the context of the current ICN, C. Agardh (1822: 231) treated them as heterotypic synonyms. Based on detailed studies of the second and third authors (GF, MC) of photos of herbarium sheets containing numerous specimens from various localities, we conclude here that this species is highly variable morphologically and thus confirm that C. Agardh's conclusion of heterotypic synonymy is justified.

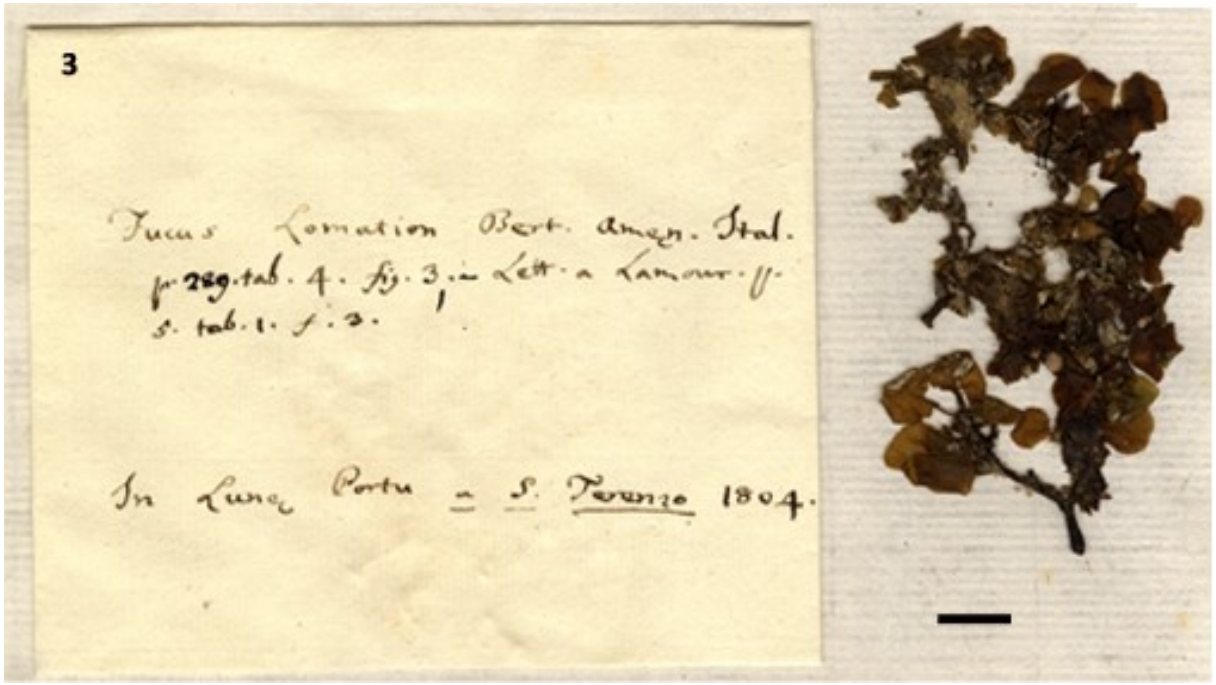

Fig. 3. Designated lectotype of *Fucus lomation* Bertoloni with accompanying packet. Specimen (unnumbered) conserved in **BOLO**. Scale bar = 20 mm.

Our analysis has led to the following outcomes:

1. Past judgements concerning the nomenclatural legitimacy, priority and application of *Fucus palmetta* S.G.Gmelin, *Delesseria gmelinii* J.V.Lamouroux, *Fucus lomation* Bertoloni and *Sphaerococcus lactuca* C.Agardh were made without proper knowledge of relevant nomenclatural types and thus were not properly based on ICN Principle II and Art. 7.1 which state that "the application of names is determined by nomenclatural types".
2. In the absence of any known original specimens, *Fucus palmetta* S.G.Gmelin (1768) has been lectotypified here with a protologue illustration, and to remove any possible ambiguity, a specimen conserved in **PC** has been designated here as epitype. Care is required to differentiate between the nomenclaturally legitimate name *Fucus palmetta* S.G.Gmelin (1768: 183) and the nomenclaturally illegitimate later homonym *Fucus palmetta* Stackhouse (1801: 102).
3. As explained in ICN Art, 7, *Ex. 2*, *Delesseria gmelinii* J.V.Lamouroux (1813a; 1813b) is a replacement name for *Fucus palmetta* S.G.Gmelin, the change of epithet necessitated by the simultaneous publication of *D. palmetta* (Stackhouse) J.V.Lamouroux. *Delesseria gmelinii* J.V.Lamouroux and *F. palmetta* S.G.Gmelin are homotypic.
4. *Fucus lomation* Bertoloni (1818) has been lectotypified here by the Bertoloni herbarium specimen collected in Portus Lunae (the Gulf of La Spezia), the only location explicitly mentioned in the protologue.
5. *Sphaerococcus lactuca* C.Agardh (1822) has been determined to be a nomenclaturally superfluous and illegitimate name (Art. 52.1) for *Fucus palmetta* S.G.Gmelin. As a result, *S. lactuca* is automatically typified (Art. 7.5) by the type of *Delesseria gmelinii* J.V.Lamouroux (1813a, 1813b), in turn a homotypic synonym of *F. palmetta* S.G.Gmelin (1768).
6. C. Agardh (1822) should have adopted the nomenclaturally available epithet '*gmelinii*' when he placed *F. palmetta* S.G.Gmelin in *Sphaerococcus* and not created the new epithet '*lactuca*'.
7. Detailed studies by GF and MC of photos of Herbarium sheets containing numerous specimens confirm that *Fucus palmetta* S.G.Gmelin and *F. lomation* Bertoloni are heterotypic synonyms. When both names are considered applicable to the same species

within *Sphaerococcus*, as was done by C. Agardh (1822; 1824), the 1813 epithet '*gmelinii*' (from *Delesseria gmelinii*, a legitimate replacement name for *F. palmetta*) has priority over the 1818 epithet '*lomation'*.

8. The post-1824 treatment of all four names, particularly involving transfers to other genera, and the consequent nomenclatural problems are dealt with separately (Woelkerling *et al*. 2019).

Sincere thanks are due to Dr Ulf Arup and Dr Patrik Frödén (Botanical Museum of Lund, **LD**) for photographs of herbarium specimens. The images of the epitype of *Fucus palmetta* (Fig. 2) and the lectotype of *Fucus lomation* (Fig. 3) were supplied by Dr Line Le Gall (MNHN, Paris) (through the service "colhelper") and by Dr Umberto Mossetti (Erbario Sistema Museale di Ateneo Università di Bologna, **BOLO**), respectively. Sincere thanks are also due to Dr Nélida Abarca, Drs Mark Carine and Michelle Casanova, Dr Anton Igersheim, Dr Anna Donatelli, Dr Lucia Amadei, Prof. Dr Dietrich Ober, Curators of the Herbaria **B, BM, W, FI, PI, KIEL**, respectively, for loans of photos of Herbarium sheets of *Cryptonemia lomation*. The detailed reviews of Dr W.-H. Kusber (Botanic Garden and Botanical Museum Berlin, Freie Universität Berlin), Dr M.J. Wynne (University of Michigan), and the Editor of *Notulae Algarum* (Dr M.D. Guiry) were very much appreciated.

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