Ulva fasciata f. *costata* M.Howe is a heterotypic synonym of *Ulva dactylifera* Setchell & N.L.Gardner (Ulvaceae, Ulvophyceae)

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Ulva fasciata f. *costata* M.Howe (1914: 20, pls 1, 2: figs 10–23) was described by Marshall Avery Howe (1867–1936) from epilithic specimens collected from the Chincha Islands (Islas Chincha), a group of three small islands 21 kilometres off the southwest coast of Peru, by the zoologist Robert Ervin Coker (1876–1967) on June 18, 1907 ("*Coker* 193 *p. p.*"). The thallus was said to be "narrow and elongate (usually 30–70 cm x 0.5–2 cm), crisped and ruffled", and having a thick costa that was two times as thick as the margins. Howe discussed the relationship of f. *costata* to *U. lactuca* Linnaeus (1753: 1163), *U. nematoidea* Bory (1828: 190), and *U. fasciata* Delile (1813: 297), as well as noting its resemblance to a species from California, *Ulva taeniata* (Setchell) Setchell & N.L.Gardner (1920: 286, as *U. fasciata* f. *taeniata* Setchell). Setchell & Gardner (1920: 286) were the first to comment on f. *costata*. They suggested that it was nearest to *U. dactylifera*, "but differs as to the basal portion, thickness, and possibly also in proportions of cells". Taylor (1947: 60) accepted the name and reported f. *costata* from numerous localities in Peru. Citing variation in the thallus, Levring (1960: 10) concluded that *U. lobata* (Kützing) Harvey, *U. nematoidea* and *U. fasciata* f. *costata* belonged to the same species. Dawson & al. (1964: 8–9, pl 3) included *Ulva fasciata* f. *costata* in the flora of Peru. Hollenberg (1971) proposed a new combination, *Ulva costata* (M.Howe) Hollenberg (1971: 283); the name, however, is superfluous (but not illegitimate: Art 52.4, Turland & al. 2025) as it is a later homonym of *Ulva costata* Wollny (1881: 30). Regardless, Abbott & Hollenberg (1976: 80) accepted the name *U. costata*, recognizing it from southern California as a distinct species. Wynne (2002) examined the lectotype and other historical collections of *U. nematoidea* as well as six herbarium sheets of f. *costata* in **NY** (herbarium acronyms follow Thiers, 2026), including the lectotype, and concluded that f. *costata* was conspecific with *U. nematoidea*. Based on internal transcribed spacer (ITS) and *rbc*L sequencing of specimens from San Diego, California, Hayden & Waaland (2004: 376) merged *U. dactylifera*, *U. nematoidea*, and f. *costata* with *U. taeniata*.

However, whole genome sequencing of the lectotype specimen of *U. nematoidea* from **PC** later showed that this species is assignable to *U. lactuca* (Hughey & Gabrielson 2022) and sequences from the type specimens of *U. taeniata* and *U. dactylifera* at **UC** established that they are distinct species (Hughey & al. 2024). No other DNA sequences of f. *costata* from Peru have been published or are publicly available in GenBank.

To determine the identity of f. *costata* we isolated DNA and performed high-throughput sequencing methodologies following previous protocols (Hughey & Gabrielson 2012; Hughey & al. 2019, 2021) on a recently collected specimen from Lima, Peru (**UC** 2126565) and an isotype specimen of *U. fasciata* f. *costata* (**UC** 197872). The Lima specimen generated a complete chloroplast genome (GenBank accession number QB273914) that was 99.90–99.99% similar to three genomes deposited in GenBank under the name *U. lactuca*. By contrast, the isotype specimen of f. *costata*, likely due to it being fixed in Formalin (Howe 1914), yielded only partial internal transcribed

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spacer ITS (740 bp, GenBank accession number QB263671) and *tuf*A (770 bp, GenBank accession number QB264206) marker sequences.

Phylogenetic analysis resolved the f. *costata* isotype sequences in a clade with the holotype of *U. dactylifera* from California as well as with sequences deposited in GenBank under the names *Ulva* sp. and *Ulva spinulosa* Okamura & Segawa (1936: 177) from Korea. Nucleotide BLAST+ searches of the ITS and *tuf*A sequences found them to be identical or nearly identical to these same sequences. This confirms the presence of *U. dactylifera* in Korea and Peru for the first time and the absence of *U. fasciata* f. *costata* from the Peruvian flora. We also verify that Californian "*U. costata*" is *U. dactylifera*, not *U. taeniata*.

Ulva lactuca and *U. dactylifera* can both display costate thalli. This finding explains the reason for the taxonomic difficulties outlined in the literature (Wynne 2002). The data here support the conclusion that the isotype material of *Ulva fasciata* f. *costata* is assignable to *U. dactylifera*. They also indicate that *U. dactylifera* is distributed in the western Pacific as well as north and southeastern Pacific Ocean.

Ulva dactylifera Setchell & N.L.Gardner 1920: 285.
Heterotypic synonym: *Ulva fasciata* f. *costata* M.Howe 1914: 20.

Abbott, I.A. & Hollenberg, G.J. (1976). *Marine algae of California*. pp. [i]–xii, [1]–827, 701 figures. California: Stanford University Press.

Bory de St-Vincent, J.B. (1828). Botanique, Cryptogamie. In: *Voyage autour du monde, exécuté par ordre du Roi, sur la corvette de Sa Majesté, la Coquille, pendant les années 1822, 1823, 1824 et 1825*. (Duperrey, L.I. Eds), pp. 97–200. Paris: Bertrand.

Dawson, E.Y., Acleto, C. & Foldvik, N. (1964). The seaweeds of Peru. *Beihefte zur Nova Hedwigia* 13: 1–111, 81 plates.

Delile, A.R. (1813). *Description de l'Égypte* ou recueile des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française, publié par les orderes de Sa Majesté l'Empereur Napoléon le Grand.*Histoire naturelle. Tom. Second. Histoire naturelle*. Vol. 2 (fasc. 2 'troisème livraison') pp. 145–320 [*Flore d'Égypte, explication des planches*], pls 1–62 [1826]. Paris: Imprimerie Impériale.

Hayden, H.S. & Waaland, J.R. (2004). A molecular systematic study of *Ulva* (Ulvaceae, Ulvales) from the northeast Pacific. *Phycologia* 43: 364–382.

Hollenberg, G.J. (1971). Phycological notes. VI. New records, new combinations, and noteworthy observations concerning marine algae of California. *Phycologia* 10: 281–289.

Howe, M.A. (1914). The marine algae of Peru. *Memoirs of the Torrey Botanical Club* 15: 1–185, 44 figs, 66 plates.

Hughey, J.R., & Gabrielson, P.W. (2012). Comment on "Acquiring DNA sequence data from dried archival red algae (Florideophyceae) for the purpose of applying available names to contemporary genetic species: a critical assessment". *Botany* 90(12): 1191–1194.

Hughey, J.R., & Gabrielson, P.W. (2022). DNA analysis of the lectotype specimen of *Ulva nematoidea* Bory (Ulvaceae, Chlorophyta) determines its synonymy with *Ulva lactuca* L. *Cryptogamie, Algologie*, 43(2): 117–124, 1 fig., 1 table.

Hughey, J.R., Gabrielson, P.W., Maggs, C.A. & Mineur, F. (2021). Genomic analysis of the lectotype specimens of European *Ulva rigida* and *Ulva lacinulata* (Ulvaceae, Chlorophyta) reveals the ongoing misapplication of names. *European Journal of Phycology*, 57(2): 143–153.

Hughey, J.R., Maggs, C.A., Mineur, F., Jarvis, C., Miller, K.A., Shabaka, S.H. & Gabrielson, P.W. (2019). Genetic analysis of the Linnaean *Ulva lactuca* (Ulvales, Chlorophyta) holotype and

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related type specimens reveals name misapplications, unexpected origins, and new synonymies (Letter). *Journal of Phycology* 55(3): 503–508, 2 figs.

Hughey, J.R., Miller, K.A. & Gabrielson, P.W. (2024). Genetic analysis of *Ulva* (Ulvaceae, Chlorophyta) type specimens resolves northeast Pacific blade-forming species. *Botanica Marina* 67(2): 165–179.

Levring, T. (1960). Contributions to the marine algal flora of Chile. *Acta Universitatis Lundensis* 56(10): 1–85, 22 figs.

Linnaeus, C. (1753). *Species plantarum*, exhibentes plantas rite cognitas, ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas. Vol. 2 pp. [i], 561–1200, [1-30, index], [i, err.]. Holmiae [Stockholm]: Impensis Laurentii Salvii.

Segawa, S. (1936). On the marine algae of Susaki, Prov. Izu, and its vicinity II. *Scientific Papers of the Institute of Algological Research, Faculty of Science, Hokkaido Imperial University* 1: 175–197.

Setchell, W.A. & Gardner, N.L. (1920). Phycological contributions. I. *University of California Publications in Botany* 7: 279–324, pls. 21–31.

Taylor, W.R. (1947). Algae collected by the "Hassler", "Albatross" and Schmitt expeditions. III. Marine algae from Peru and Chile. *Papers of the Michigan Academy of Sciences, Arts and Letters* 31: 57–90, 14 pls.

Thiers, B.M. (2026) [Continuously updated electronic resource]. *Index herbariorum: A global directory of public herbaria and associated staff.* New York Botanical Garden's Virtual Herbarium, New York. http://sweetgum.nybg.org/ih/.

Turland, N.J., Wiersema, J.H., Barrie, F.R., Gandhi, K.N., Gravendyck, J., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Klopper, R.R., Knapp, S., Kusber, W.-H., Li, D.-Z., May, T.W., Monro, A.M., Prado, J., Price, M.J., Smith, G.F. & Zamora Señoret, J.C. editors (2025). *International code of nomenclature for algae, fungi, and plants (2025 Edition Madrid Code)* Regnum Vegetabile Volume 162. pp. [i]–xlvii, 1–303. Chicago & London: The University of Chicago Press.

Wollny, R. (1881). Die Meeresalgen von Helgoland. *Hedwigia* 20: 1–8, 17–32, pls I, II.

Wynne, M.J. (2002). The reinstatement of the name *Ulva nematoidea* Bory de Saint-Vincent (Chlorophyta) and the placement of *U. costata* (Howe) Hollenberg in its taxonomic synonymy. *Cryptogamie Algologie* 23: 5–12.

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