

PROPOSALS TO CONSERVE OR REJECT NAMES

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(2302) Proposal to reject the name *Gonyaulax catenella* (*Alexandrium catenella*) (*Dinophyceae*)Uwe John,¹ Wayne Litaker,² Marina Montresor,³ Shauna Murray,⁴ Michael L. Brosnahan⁵
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(2302) *Gonyaulax catenella* Whedon & Kof. in Univ. Calif. Publ. Zool. 41: 25, fig. 1–7. 1936 [*Dinoflagellata*, *Dinophyceae*], nom. utique rej. prop.
Typus: non designatus.

The dinoflagellate species *Alexandrium catenella* (Whedon & Kof.) Balech (in Anderson & al., Toxic Dinoflagellates: 37. 1985), first published as *Gonyaulax catenella* Whedon & Kof., was described from marine waters off San Francisco, California, U.S.A. The protologue included the species diagnosis, a detailed description and seven drawings in which the thecal plate pattern in apical, antapical, dorsal and ventral view was provided, as well as a sketch of four cells joined in a chain and two drawings showing the shape and position of the nucleus. The species name was published according to the *International Code of Zoological Nomenclature* and did not include a Latin diagnosis). The type material for the name, however, was not designated. *Gonyaulax catenella* was subsequently transferred to the genus *Alexandrium* by Balech (l.c. 1985), but no lectotype was designated.

Alexandrium catenella, together with *A. tamarensis* (M. Lebour) Balech and *A. fundyense* Balech, comprise the *A. tamarensis* species complex, one of the most studied marine dinoflagellate groups due to their ecological, toxicological and economic importance. Several members of this complex produce saxitoxins, potent neurotoxins that cause paralytic shellfish poisoning.

Identification of thecate dinoflagellates such as *Alexandrium* is largely based on the number, shape and arrangement of the thecal plates that surround vegetative cells. The three morpho-species grouped in the *A. tamarensis* species complex are morphologically very similar, share the same plate pattern and have been distinguished based on the combination of two main characters: the ability to form chains and the presence/absence of a ventral pore between plates 1 and 4 (Balech, l.c. 1985; Genus *Alexandrium*. 1995).

John & al. (in Protist, in review) critically reviewed the taxonomic status of the species grouped into the *Alexandrium tamarensis* species complex. This analysis included a broad range of information on cell morphology, sequences of multiple regions in the rDNA operon, mating compatibility, ITS/5.8S genetic distances, ITS2

compensatory base changes, toxicity and presence of the gene *sxtA* published over the last several decades. As already shown by various independent studies (for a complete list of references, see John & al., l.c. in review) morphological characters used to identify the three species are not consistent and/or distinctive. Moreover, phylogenies based on multiple rDNA regions (SSU, LSU, ITS) indicate that the sequences from morphologically indistinguishable isolates consistently partition into five clades, designated Groups I–V (John & al. in Molec. Biol. Evol. 20: 1015–1027. 2003; Lilly & al. in J. Phycol. 43: 1329–1338. 2007). The preponderance of evidence supports each of these groups as distinct species (John & al., l.c. in review). A majority of the Group I sequences currently come from isolates in regions adjacent to the type locality for *A. fundyense* (Bay of Fundy, Canada). Similarly the Group III sequences come primarily from isolates obtained in regions adjacent to the type locality for *A. tamarensis* (Tamar River Estuary, England). Given that these two genetically distinct species are morphologically indistinguishable, it was logical to designate Group I as *A. fundyense* and Group III as *A. tamarensis* (John & al., l.c. in review). Since most of the published studies on *A. fundyense* and *A. tamarensis* encompass Group I and Group III sequences, respectively, these revised species designations cause a minimum of confusion with regard to the current literature. The same, however, is not true for *A. catenella*.

Alexandrium catenella cells were originally described as being slightly broader than long and to form chains. Based on these morphological criteria, a majority of the strains isolated in various sites in the Pacific Ocean were reported as *A. catenella* (see the recent reviews Anderson & al. in Harmful Algae 14: 10–35. 2012; in Annual Rev. Mar. Sci. 4: 143–176. 2012). However, the molecular analysis of these “morphologically” identified strains primarily fell into either Clade I (primarily eastern Pacific along coasts of North, Central and South America) or Clade IV (primarily western Pacific). The isolates sequenced to date from the *A. catenella* type locality (California) belong to Group I (Ruiz Sebastián & al. in Phycologia 44: 49–60. 2005; Jester & al. in Mar. Biol. 156: 493–504. 2010; Garneau & al. in Appl. Environm. Microbiol. 77: 7669–7680. 2011). These observations indicate that the Group I morphology is more variable than originally described and that the *A. catenella* species description was incorrectly

based on a population of *A. fundyense* cells exhibiting chain formation and the shape slightly broader than long (i.e., *A. catenella* simply represents one of the distinct morphological variants of *A. fundyense*).

Therefore based on Art. 56.1 of the ICN (McNeill & al. in Regnum Veg. 154. 2012) we propose rejection of the basionym of *Alexandrium catenella* (Whedon & Kof.) Balech for the following reasons:

(1) The identity of the type material on which this species was based remains unclear. No type was designated by the author and strains isolated from the region from which the material most likely originated that was the basis of the species description belong to a different species (*A. fundyense*).

(2) *Alexandrium catenella* could in principle supplant the name *A. fundyense* and be applied to all Group I strains, because its original description (Whedon & Kofoid, l.c.) predates that of *A. fundyense* (Balech, l.c. 1985). However, a large number of studies on Group I strains have been published using the name *A. fundyense* and making

this nomenclatural change would cause considerable confusion in the research community. As an alternative, John & al. (l.c. in review) proposed in their revision of the *A. tamarensis* species complex that *A. fundyense* be retained as an accepted species name. This required formally designating a lectotype and epitype for *A. fundyense*.

(3) Retention of *A. catenella* would foster continued confusion in the literature concerning whether the data in a given study pertains to Group I or Group IV species.

To rectify the existing taxonomic confusion in this group, John & al. (l.c. in review) formally proposed Group I isolates as *A. fundyense*, Group III isolates as *A. tamarensis* and Group IV isolates as a new species, *Alexandrium pacificum* Litaker (in John & al., l.c. in review). The designation of *Alexandrium pacificum* as distinct from *A. fundyense* will allow the confusion caused by the *A. catenella* species designation having been simultaneously applied to Group I and IV to be more easily addressed.