

Reinstatement of the Lancelet Name *Asymmetron lucayanum*, Recently Proposed as a Junior Synonym of *Branchiostoma pelagicum* (Cephalochordata)

Teruaki Nishikawa

Department of Zoology, National Museum of Nature and Science, 4-1-1 Amakubo, Tsukuba, Ibaraki 305-0005, Japan
E-mail: nishikawateruaki@gmail.com

(Received 15 February 2018; Accepted 15 March 2018)

A recent proposal to reduce the binomen *Asymmetron lucayanum* Andrews, 1893 to the synonymy of *Branchiostoma pelagicum* Günther, 1889 lacked supporting evidence, and is considered flawed due to the uncertain taxonomic status of the latter. Examination of the holotype of *B. pelagicum* was hindered by its highly deteriorated state, to the extent that gonad condition and hence generic affinity could not be unequivocally determined. However, the description of gonads on both sides of the body in the original description suggests correct placement of the species in *Branchiostoma*. Furthermore, a published figure of a likely syntype (pelagic larva) of *A. lucayanum* showed the specimen to possess an elongated urostyloid process, such being absent in the (pelagic) holotype of *B. pelagicum* comparable in size and morphology with the former. It is proposed that *Asymmetron lucayanum* Andrews, 1893 be reinstated as a valid species.

Key Words: Nomenclature, valid name, synonymy, *Asymmetron lucayanum*, *Branchiostoma pelagicum*.

Igawa *et al.*'s (2017) molecular phylogenetic study of lancelets (= Cephalochordata), included a proposal that “*Asymmetron pelagicum* Günther, 1889 [sic], —should be used as the correct binominal name—, replacing the junior synonym *Asymmetron lucayanum* Andrews, 1893—” (p. 10). Such a nomenclatural act would have far-reaching effects in lancelet nomenclature, since usage of the binomen *A. lucayanum* is currently well established. Nevertheless, such a change, if based on a clear taxonomic judgement, might well be entertained. Unfortunately, however, Igawa *et al.* (2017) overlooked the uncertain taxonomic status of the holotype of “*A. pelagicum*”.

Nomenclatural and taxonomic premises. Because the two taxa concerned have different name-bearing types, Igawa *et al.*'s (2017) synonymy of *Asymmetron lucayanum* under “*A. pelagicum*” is subjective [see Glossary in International Commission of Zoological Nomenclature (1999)]. However, the fact remains that “*A. pelagicum*” is of uncertain taxonomic identity, and may in fact belong to the genus *Branchiostoma*, rather than to *Asymmetron*.

Lancelets are presently classified into three genera (*Branchiostoma*, *Asymmetron* and *Epigonichthys*) from both morphological and molecular perspectives, supported by Nishikawa (2004, 2017), Nohara *et al.* (2005), Kon *et al.* (2007), Li *et al.* (2014), and Igawa *et al.* (2017). The genus *Branchiostoma* has a longitudinal series of gonads on both sides of the body, whereas the other genera have gonads on the right side only.

Brief historical review. *Branchiostoma pelagicum* Günther, 1889 was established for a single 10 mm long (holotype) specimen (Fig. 1A), “captured in open sea, at a great distance from land—a few degrees north of Honolulu [Hawaii]” in a “deep haul, 1,000 fathoms, July 26, 1875” during

the Challenger Expedition (Günther 1889: 43). Günther's (1889) original description clearly stated “gonads not fully developed, extending from the first to the twenty-sixth myomere [=myomere], and forming two series in the middle” (p. 44, author's italics). This description alone indicated that the species belonged to *Branchiostoma*, as currently recognized.

Subsequently, Gill (1895) established a new genus *Amphioxides* in the “Brachiostomidae” (=Branchiostomatidae), being “a fifth genus apparently represented by *B. pelagicum* Günther” and defined as “brachiostomids [sic] with bilateral(?) gonads,—” (p. 458), but gave no explanation for questioning the gonad condition. However, the binomen *Branchiostoma pelagicum* was retained by Tattersall (1903) and Parker (1904), due to the presence of gonads on both sides fitting their definitions of the genus. Parker (1904) reported a well-preserved 9 mm-long specimen collected “between one hundred and fifty fathoms and the surface” off the Maldives as having 33 gonads on each side. However, the possibility cannot be excluded that, as suggested by Goldschmidt (1905a), the above-cited “gonads” may have been another organ (e.g., gill pouches), but this remains equivocal as Wickstead (1973, 1975) detected incipient gonads in 8.8 mm- and 9.1 mm-long pelagic larvae from the Indian Ocean by examining sections microscopically.

Goldschmidt (1905a, b) detected gonads only on the right side in 7.5 to 10 mm-long pelagic specimens identified as *Amphioxides pelagicus* and *A. valdiviae* Goldschmidt, 1905. Subsequently, Goldschmidt (1906) rejected the validity of *Amphioxides*, recognizing that it had been based on planktonic (sometimes neotenic) larvae. Gibson (1910) seems to have been the first to suggest that *Branchiostoma pelagicum* may have been based on a larval *Asymmetron lucayanum*,

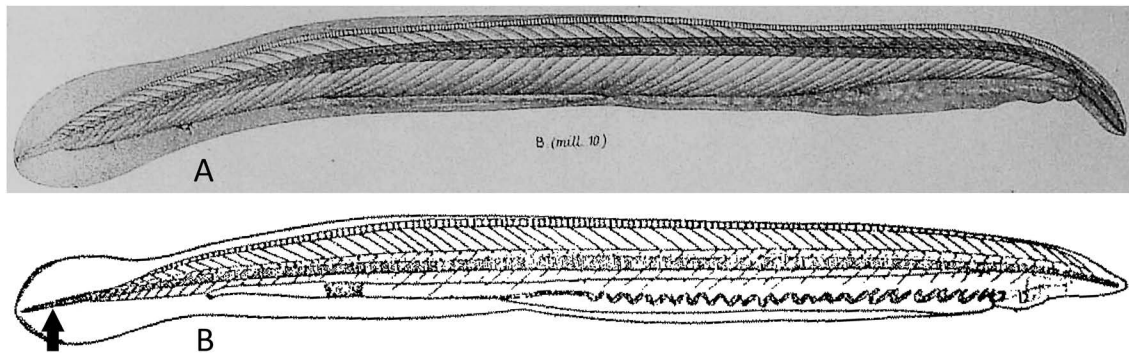


Fig. 1. A: Holotype of *Branchiostoma pelagicum*, 10 mm long, reproduced from Günther (1889, pl. V, fig. B); B: A preserved 6 mm-long larva of *Asymmetron lucayanum* collected from the Bahamas, reproduced from Andrews (1893, pl. XIII, fig. 5), laterally inverted for comparison with A. Arrow indicates urostyle process.

due to the similarity in myomere numbers and right side-only disposition of gonads. This view was followed by Bone (1957), Wickstead and Bone (1959), Wickstead (1964, 1971, 1975), Nishikawa (1981), and Gibbs and Wickstead (1996), who all failed to consider the original description of the former (mentioning gonads in two series), or subsequent descriptions in Tattersall (1903) and Parker (1904).

Poss and Boschung (1996) were first to explicitly regard *B. pelagicum* as a senior synonym of *A. lucayanum*, stating that the former “is in all likelihood based on larvae of *E. [pigonichthys]. lucayanus [= A. lucayanum]*” (p. S38), but without supporting evidence. Nevertheless, they continued to refer to *lucayanus* and referred to an application for plenary suppression of *pelagicum* due to priority granted to the latter “severely disrupt[ing] contemporary usage” (p. S38). However, *pelagicum* is not included in the “Official Index of Rejected and Invalid Specific Names in Zoology” (see International Commission on Zoological Nomenclature, 2012 and subsequent volumes of the Bulletin of Zoological Nomenclature), possibly because their application to the International Commission on Zoological Nomenclature was not completed or was rejected. These considerations were overlooked by Igawa *et al.* (2017), although they were aware of the article by Poss and Boschung (1996). Furthermore, Igawa *et al.* gave no supporting evidence for their own nomenclatural act, omitting any mention of previous taxonomic or nomenclatural studies.

Uncertain taxonomic identity of *B. pelagicum*. The holotype of *B. pelagicum* was “mounted in glycerin for the microscope at the time of its capture” (Günther 1889: 43). Subsequently, Kirkaldy (1895: 320) stated, “After Dr. Günther’s description and figure were published it [= the holotype] was examined by Professor Lankester by means of transverse sections, but the state of preservation was such as to render any satisfactory observation impossible”. In fact, those sections are now mounted on 7 slides, each with the label “*Amphioxus pelagicus*, [18]92.6.25.1, Type”, in the Invertebrates Division, Department of Life Sciences, Natural History Museum, London, with the new registration number NHMUK: ecatalogue 3118289. A photograph of the 7 slides clearly showed the sectioned and mounted pieces

to be too deteriorated for effective close examination, the precise nature of the gonads of the holotype (and therefore clarification of its generic affiliation) being unable to be determined. Accordingly, but for the description of gonads on both sides of the body by Günther (1889), the status of *B. pelagicum* might well be considered *incertae sedis*.

In addition, the only figure of the pelagic larva of *A. lucayanum* comparable in size and morphology to the holotype of *B. pelagicum* is that published by Andrews (1893: pl. XIII, fig. 5) and reproduced here (Fig. 1B), indicating that both the figured specimen and *B. pelagicum* holotype possessed a paddle-shaped caudal fin and lacked buccal tentacles. The figured specimen, “one of the youngest larvae, —6 mm long with 22 gill-slits, and—64 myotomes” (Andrews 1893: 245) is likely to be a syntype of *A. lucayanum*. At 6 mm in length, the specimen had a markedly elongated urostyle process at the tail end, one of the diagnostic features of the genus *Asymmetron* (see, e.g., Nishikawa 2004). However, the 10 mm long holotype of *B. pelagicum* (Fig. 1A) lacks such a conspicuous process and it seems highly unlikely that larval development in *A. lucayanum* would result in the urostyle process diminishing in proportional length to such an extent. Unfortunately, Holland and Holland’s (2010) detailed description of early development in *A. lucayanum* did not cover stages from 6–10 mm length.

In conclusion, synonymization of *B. pelagicum* with *A. lucayanum* is without basis, being unsupported by the original descriptions or the type material, and *A. lucayanum* should continue to be recognized as a valid species.

Acknowledgments

I am particularly grateful to Drs. James Maclaine and Miranda Lowe, Invertebrates Division, Natural History Museum, London for their assistance, the latter kindly sending me a photograph of the slide series of the holotype of *B. pelagicum* in August, 2017. Dr. Graham S. Hardy (Ngunguru, New Zealand) helped with English improvements to the manuscript.

References

- Andrews, E. A. 1893. An undescribed acraniate: *Asymmetron lucayanum*. Studies from the Biological Laboratory, Johns Hopkins University 5: 213–247.
- Bone, Q. 1957. The problem of the ‘amphioxides’ larva. Nature 180: 1462–1464.
- Gibbs, P. E. and Wickstead, J. H. 1996. The myotome formula of the lancelet *Epigonichthys lucayanum* (Acrania): Can variation be related to larval dispersion patterns? Journal of Natural History 30: 615–627.
- Gibson, H. O. S. 1910. The Cephalochorda: “Amphioxides”. Transactions of the Linnean Society of London Second Series Zoology 13: 213–254.
- Gill, T. 1895. The genera of Branchiostomidae. American Naturalist 29: 457–459.
- Goldschmidt, R. 1905a. Amphioxides, Vertreter einer neuen Acranier-Familie. Biologisches Zentralblatt 25: 235–240.
- Goldschmidt, R. 1905b. Amphioxides. Pp. 1–92. In: Chun, C. (Ed.) *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer ‘Valdivia’ 1898–1899, Vol 12*. Gustav Fischer, Jena.
- Goldschmidt, R. 1906. Amphioxides und Amphioxus. Zoologischer Anzeiger 30: 443–448.
- Günther, A. W. 1889. Report on the pelagic fishes collected by H.M.S. Challenger during the years 1873–1876. Challenger Report (Zoology, pt. 78) 31 (2): 1–47.
- Holland, N. D. and Holland, L. Z. 2010. Laboratory spawning and development of the Bahama lancelet, *Asymmetron lucayanum* (Cephalochordata): Fertilization through feeding larvae. Biological Bulletin 219: 132–141.
- Igawa, T., Nozawa, M., Suzuki, D. G., Reimer, J. D., Morov, A. R., Wang, Y., Henmi, Y., and Yasui, K. 2017. Evolutionary history of the extant amphioxus lineage with shallow-branching diversification. Scientific Reports 7 (1157): 1–14.
- International Commission on Zoological Nomenclature 1999. *International Code of Zoological Nomenclature, Fourth Edition*. International Trust for Zoological Nomenclature, London, xxix + 306 pp.
- International Commission on Zoological Nomenclature 2012. *Official Lists and Indexes of Names in Zoology, updated December 2012*. Available at http://www.iczn.org/sites/iczn.org/files/Official_List_updated_December_2012.pdf (10 October 2017)
- Kirkaldy J. W. 1895. A revision of the genera and species of the Branchiostomidae. Quarterly Journal of Microscopical Science New Series 37: 303–323.
- Kon, T., Nohara, M., Yamanoue, Y., Fujiwara, Y., Nishida, M., and Nishikawa, T. 2007. Phylogenetic position of a whale-fall lancelet (Cephalochordata) inferred from whole mitochondrial genome sequence. BMC Evolutionary Biology 7 (127): 1–12.
- Li, W. Y., Fang, S. H., and Wang, Y. Q. 2014. Complete mitochondrial genome of *Epigonichthys cultellus* (Cephalochordata: Branchiostomatidae). Zoological Science 31: 766–772.
- Nishikawa, T. 1981. Considerations on the taxonomic status of the lancelets of the genus *Branchiostoma* from the Japanese waters. Publications of the Seto Marine Biological Laboratory 25: 167–173.
- Nishikawa, T. 2004. A new deep-water lancelet (Cephalochordata) from off Cape Nomamisaki, SW Japan, with a proposal of the revised system recovering the genus *Asymmetron*. Zoological Science 21: 1131–1136.
- Nishikawa, T. 2017. Chapter 27. A taxonomic review of lancelets (Cephalochordata) in Japanese waters. Pp. 703–714. In: Motokawa, M. and Kajihara, H. (Eds) *Species Diversity of Animals in Japan, Diversity and Commonality in Animals*. Springer Japan, Tokyo.
- Nohara, M., Nishida, M., Miya, M., and Nishikawa, T. 2005. Evolution of the mitochondrial genome in Cephalochordata as inferred from complete nucleotide sequences from two *Epigonichthys* species. Journal of Molecular Evolution 60: 526–537.
- Parker, G. H. 1904. Maldive cephalochordates, with the description of a new species from Florida. Bulletin of the Museum of Comparative Zoology 46: 39–52.
- Poss, S. G. and Boschung, H. T. 1996. Lancelets (Cephalochordata: Branchiostomatidae): How many species are valid? Israel Journal of Zoology 42 Supplement: S13–S66.
- Tattersall, W. M. 1903. Notes on the classification and geographical distribution of the Cephalochorda. Transactions of the Liverpool Biological Society 17: 269–302.
- Wickstead, J. H. 1964. Acraniate larvae from the Zanzibar area of the Indian Ocean. Journal of the Linnean Society (Zoology) 45: 191–199.
- Wickstead, J. H. 1971. Report on the Acrania (Phylum Chordata) collected by the ‘DANA’ expedition of 1928–1930. Cahiers du Pacifique 15: 163–168.
- Wickstead, J. H. 1973. Report to the Council: other faunistic studies. Journal of the Marine Biological Association of the United Kingdom 53: 1017.
- Wickstead, J. H. 1975. Chapter 9. Chordata: Acrania (Cephalochordata). Pp. 283–319. In: Giese, A. C. (Ed.) *Reproduction of Marine Invertebrates Vol 2*. Academic Press, New York.
- Wickstead J. H. and Bone, Q. 1959. Ecology of acraniate larvae. Nature 184: 1849–1851.