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ON THE TAXONOMIC IDENTITY OF THE HOLOTYPE OF *TURSIO*? *PANOPE* PHILIPPI, 1895

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ABSTRACT

The recent assignation of the holotype skull of *Tursio*? *Panope* Philippi, 1895 to *Cephalorhynchus eutropia* is here critically reviewed. This re-identification was based on mt-DNA sequence analysis performed on one tooth of the holotype and of Chilean dolphin skulls available in the mammal collection at Chile's National Museum of Natural History. A detailed review of the diagnostic characters of the skull of *Tursio*? *Panope* demonstrates, however, that these are consistent with *Lagenorhynchus obscurus*, as was previously pointed out by other researchers. Circumstances are described, such as misplaced teeth, which could explain the discrepancy between the morphological and molecular characteristics and the respective identifications.

Key words: Taxonomy, Chilean dolphin, Skull characters, DNA, *Tursio panope*.

RESUMEN

Sobre la Identidad Taxonómica del Holotipo de *Tursio*? *Panope* Philippi, 1895. Se revisa la asignación del holotipo de *Tursio*? *Panope* Philippi, 1895 a *Cephalorhynchus eutropia* sobre la base de el análisis de secuencias de ADN mitocondrial de piezas dentales de los ejemplares en existencia en la colección mastozoológica del Museo Nacional de Historia Natural de Chile. Una revisión detallada de los caracteres diagnósticos del cráneo de *T.*? *Panope* evidencia que sería un ejemplar de *Lagenorhynchus obscurus*, como fue señalado con anterioridad por otras investigaciones. Se presentan antecedentes que podrían explicar esta discrepancia entre los caracteres morfológicos y moleculares en esta determinación.

Palabras claves: Taxonomía, Caracteres craneales, ADN, *Tursio panope*.

INTRODUCTION

Among the many species described by Rudolph Amandus Philippi the cetaceans and particularly the Odontoceti occupied a prominent position in his studies on Chilean zoology (Philippi 1893, 1895, 1896).

Although more than a hundred years have passed since the original description of the species *Tursio*? *Panope* [sic] performed by Philippi (1895), its true taxonomic position still has not been determined in a satisfactory way, in spite of the reviews effected by different specialists on the base of morphologic comparisons (Goodall *et al.* 1988, Brownell and Mead 1989), reviews of the literature (Harmer 1922, Hershkovitz 1966, Tamayo and Frassinetti 1980, Wilson and Reeder 2005) and mt-DNA sequences (Pichler and Olavarría 2001).

Among the species mentioned by Philippi, both *Tursio platyrrhinus* (Philippi 1895) and *Tursio* (*Phocaena*) *albiventris* (Pérez Canto, 1895) were placed into synonymy of *Cephalorhynchus eutropia* (Gray, 1846) by True (1903), except for *Tursio*? *Panope* for which he stated "I confess I am unable to determinate even genus to which this singular species belongs". He further indicated a certain similarity with the genus *Lissodelphis*, highlighting the differences between *T. panope*[1] and this genus. Furthermore he argued that the characters exhibited for *T. panope* are not present in any other Delphinidae. Finally, True (1903: 143) indicated the case of *Tursio panope* in the column labeled "Probable identity …New genus".
Later, in the review carried out by Goodall *et al.* (1988), these authors also raised doubts about the taxonomic status of *Tursio panope*, stating that "…We prefer to leave its classification uncertain…", thus leaving the specimen without a precise definition, while the specimen was archived as belonging

1. *Tursio panope* onwards according to article 28 of The International Trust of Zoological Nomeclature (ITNZ) 2009

to *Cephalorhynchus eutropia*, in the mammal collection of Chile's National Museum of Natural History under the catalogue number MNHN 584. Subsequently Brownell and Mead (1989) determined *T. panope* as a junior synonym of *Lagenorhynchus obscurus*. Also Van Waerebeek (1992) as part of a comprehensive study of dusky dolphin biology indicated that MNHN 584 belongs to *L. obscurus*, in textual form "Philippi (1895) described *Tursio*? *Panope* [sic] based on a skull of unknown origin (N°584, Museo de Historia Natural de Santiago, Chile) but supposedly Chilean. Brownell and Mead (1989) recognized it as belonging to *L. obscurus*. In 1988, both the author and J.C. Reyes independently examined the skull at the Santiago museum and came to the same conclusion".

However, a new revision of the National Museum of Natural History specimens identified MNHN 584 as *Cephalorhynchus eutropia*, but this time PCR amplification and mitochondrial DNA sequencing revealed that *T. panope* would correspond to *C. eutropia* and not *L. obscurus* (Pichler and Olavarría 2001). These contradictions in the allocation of the designated specimen demonstrate that its taxonomic identity remains unresolved.

This paper reviews the taxonomic status of specimen MNHN 584 archived as *Cephalorhynchus eutropia*, reassessing the descriptions above based on both morphological and molecular aspects.

MATERIAL AND METHODS

The skulls of *Cephalorhynchus eutropia* (MNHN 580, 581, 582, 583, 585, 587, 1003 and 1493), *Lagenorhynchus obscurus* (MNHN 1492), and *Lagenorhynchus australis* (MNHN 586) were morphologically compared with the holotype of *Tursio panope* (MNHN 584). All of them are deposited in the mammal collection of the National Museum of Natural History, Chile.

The key for the identification of cetacean species developed by Reyes and Molina (1997) based on skulls, as well as the descriptions provided by Philippi (1895, 1896), True (1903) and Sielfeld (1983) were used. For the anatomy of the skull (Figure 1) the lexicon provided by Rommel (1990), Mead and Fordyce (2009) was adopted. For morphometric measurements of the skull Schnell *et al*. (1985) was followed, using Vernier callipers with 0.1 mm precision.

The morphology of the pterygoid bone, given that it is incomplete in most of the specimens, was discarded as a character.

RESULTS AND DISCUSSION

1. Morphological evaluation

True (1903) was the first to point out that the specimen MNHN 584 (holotype of *Tursio panope*) is different from *Cephalorhynchus eutropia* based on the descriptions and illustrations of Philippi (1893, 1895, 1896). Subsequently Goodall *et al*. (1988) in their review of *Cephalorhynchus eutropia* preferred to leave it in an uncertain classification, stating that the condylobasal length (CBL) of MNHN 584 (about 379 mm) is greater than that observed in *C. eutropia* with a maximum recorded CBL value (n=13) of 364 mm. Only Brownell and Mead (1989) and Van Waerebeek (1992) pointed out that the skull belongs to *Lagenorhynchus obscurus* mainly because all cranial characteristics are concordant with this species. Brownell and Mead (1989) further indicated that it would be a juvenile, considering that the basioccpital is not fused with the vomer and the left zygomatic is not fused to the parietal and the exoccipital.

2. Molecular evaluation

Determinations on the basis of DNA have proved very effective in cetacean studies to confirm identifications based on morphological analyses (Cipriano and Palumbi 1999, Wada *et al*. 2003). In the case of cetaceans of Chilean waters, this is a very recent approach and regarding specimens in museum collections the study by Pichler and Olavarría (2001) was one of the first made in Chile on cetaceans. These researchers studied nine specimens of *Cephalorhynchus eutropia* (MNHN 581, 582, 583, 585, 587, 592, 594, 1493 and CZIP0529 of the Colección Zoológica, Instituto de la Patagonia), including those described by Philippi (1893, 1896), confirming all of them as *C. eutropia,* as well as the holotype of *Tursio panope* (MNHN 584). As a procedure they extracted DNA from a single tooth of each of the ten specimens, nine of them belonging to the mammal collection of the MNHN. For all specimens the identification by mt-DNA sequencing resulted in the species *Cephalorhynchus eutropia*. Pichler and Olavarría (2001: their table 1) indicated that of the total of the processed samples, only one (MNHN 587) failed to match *C. eutropia*, without presenting further explanations.

3. Morphological review of *Cephalorhynchus eutropia* specimens obtained by Philippi

Pichler and Olavarría's (2001) work identified nine different haplotypes for the control region which allowed them to confirm in nine of ten cases the current determination of *Cephalorhynchus eutropia* as the species corresponding to the examined material. Because the cranial morphology of specimen MNHN 584 does not concord with that of the genus *Cephalorhynchus* nor with *C. eutropia* as a species, as was succinctly indicated by Brownell and Mead (1989), it is necessary to point out in more detail the cranial characteristics of each genus and species which allow to exclude MNHN 584 from *C. eutropia*. With the key for skulls developed by Reyes and Molina (1997) and the background information provided by True (1903), it appears that the representatives of the genus *Cephalorhynchus* have the following distinguishing characters from other genera of Delphinidae:

1) Nasal bones with a clear definition on its anterior face. A sharp edge is observed (Figures 1A, 1C, 4).
2) Anterior edge of the choanae shaped in a "V" (Figures 1A, 1B, 2 and 3).
3) Vomer not visible on the surface of the palatine process of the maxilla (palate of Reyes and Molina 1997) (Figures 1B, 5).
4) Posterolateral *sulcus* of the premaxillary with broad and strong development proximally reflected in the form of a bulge in lateral view.

While for species of the genus *Lagenorhynchus*
1) Nasals do not exhibit a clear definition on its anterior face. No sharp edge is observe
2) Anterior border of the choanae take the form of "U" (Figures 3 and 4)
3) Vomer visible on the surface of the palatine process of the maxilla (Figure 5 B and C)
4) The posterolateral sulcus demonstrates very little development, except in *L. australis* having a thickening of the sulcus and in practice corresponds to greater convexity, a characteristic of this species (Figure 4).

Considering the shape of choanae and nasals and the other cranial features it is evident that the skull MNHN 584 does not meet the diagnostic features of *Cephalorhynchus*; instead it fully shares those reported for *Lagenorhynchus*. Also the cranial measures of the subadult MNHN 584 (condylobasal length 380+ mm, rostrum length 200.5 mm, zygomatic width 180 mm) fall within the range documented for adults of *L. obscurus* (Van Waerebeek 1993) but are greater than the range of measures provided for specimens of *C. eutropia* (Goodall *et al.* 1988, Table 1) but without specification whether the latter were adults or subadults. It must be considered that MNHN 584 would have grown even larger as it is cranially immature. Finally, no convexity was observed at the proximal end of the nose (premaxillae). Jointly these features allow assignment to *L. obscurus*.

The allocation of specimen MNHN 584 using DNA and the difference with the assessment through morphological characters can only be explained by an inadvertent error in sampling. It must be noted that the specimens studied by Philippi (1893, 1896) have suffered relocation and replacement from their containers for more than 100 years so that several skulls may have been grouped together in what was supposed

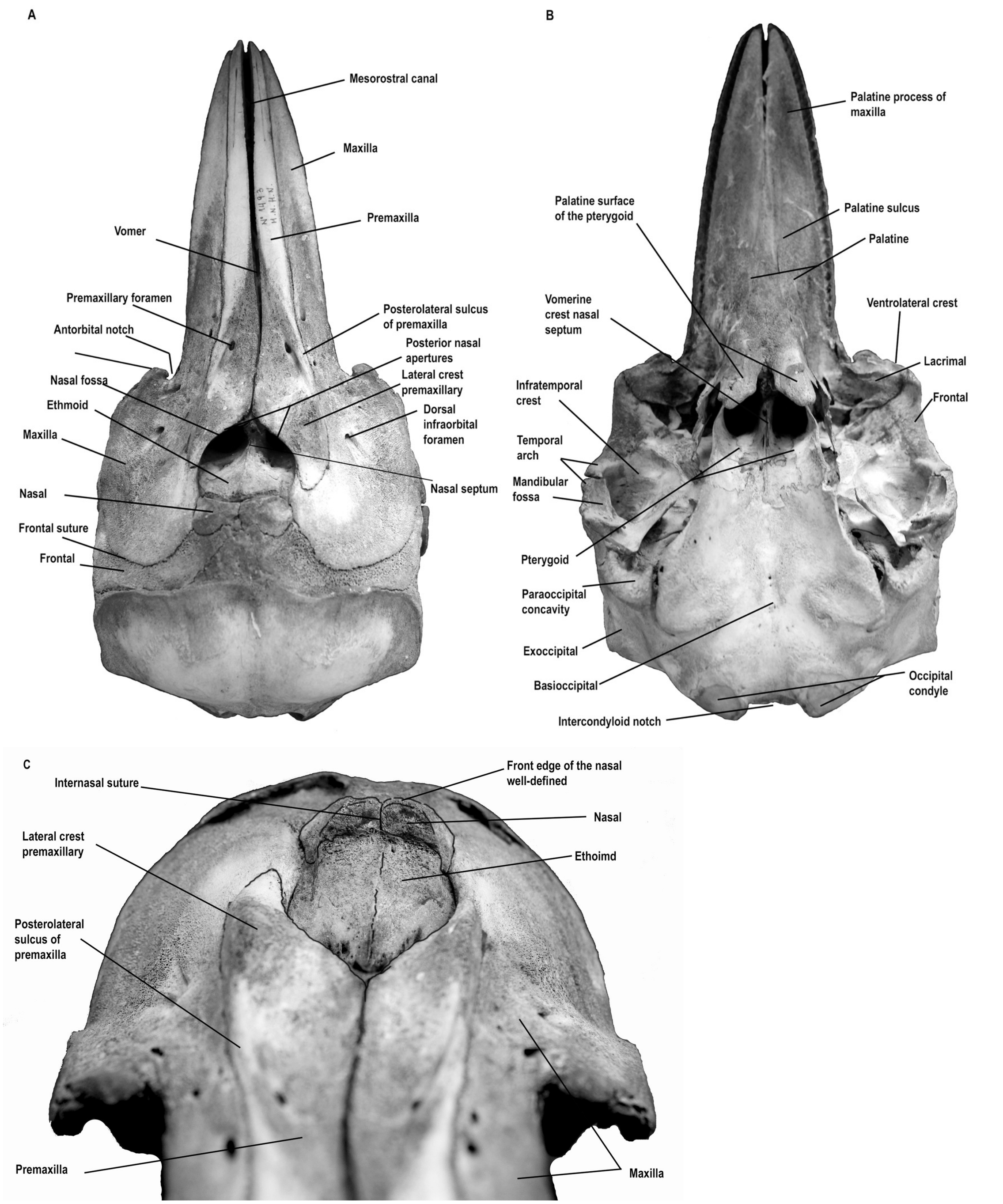

FIGURE 1. The skull of a *Cephalorhynchus eutropia* (MNHN 1493) in A) dorsal, B) ventral and C) frontal views, indicating the various cranial elements.

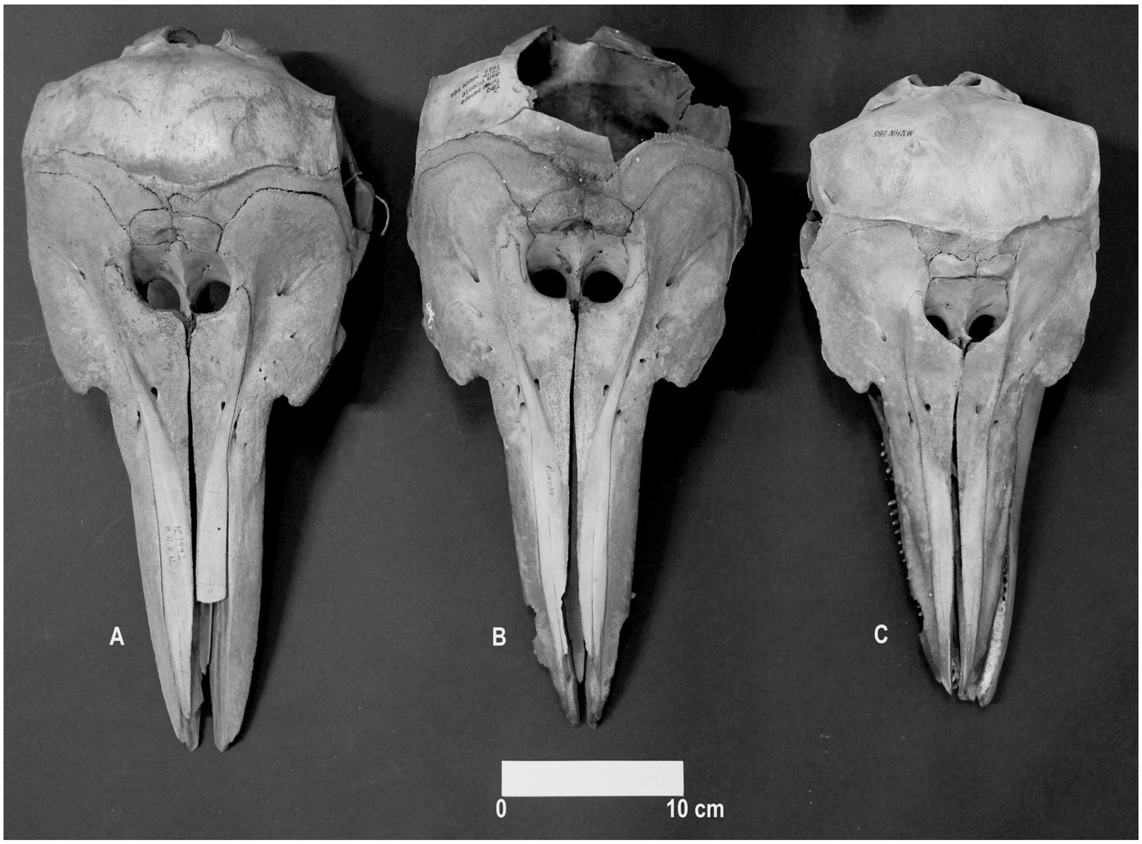

FIGURE 2. Dorsal views of dolphin skulls: A) *Lagenorhynchus obscurus* (MNHN 1492); B) holotype specimen of *Tursio panope* (MNHN 584) and C) *Cephalorhynchus eutropia* (MNHN 585). Skulls A and B show a greater morphological similarity in the relative arrangement, shape and size of cranial elements, also the skulls are larger, in comparison with skull C. Note wide section of frontal bone exposed between the posterior edges of maxillaries and the supraoccipital bone in skulls A and B compared to minimal frontal exposure in skull C.

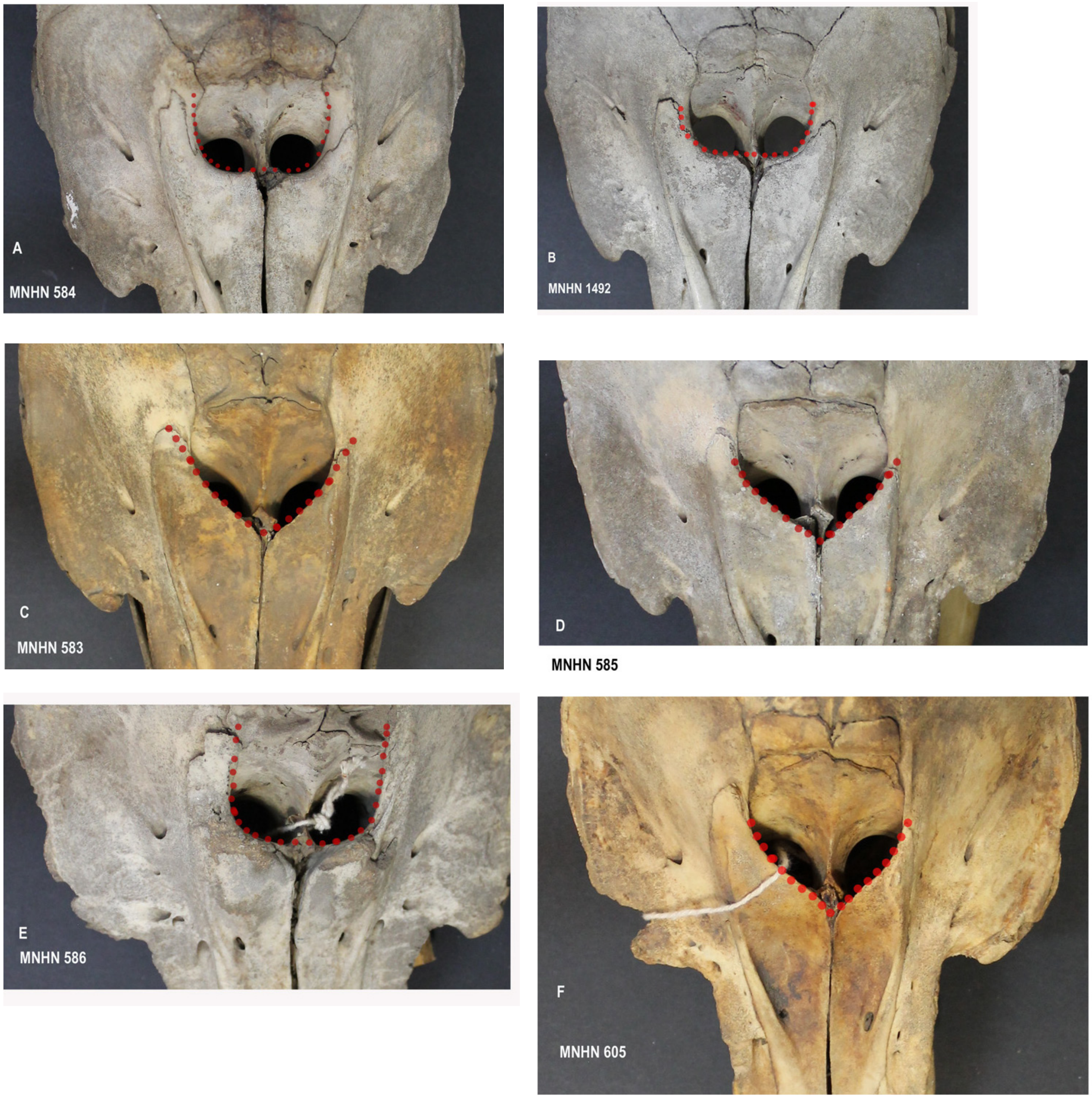

FIGURE 3. Views of the dorso-nasal area of dolphin skulls: A) *Tursio panope* (MNHN 584); B) *Lagenorhynchus obscurus* (MNHN 1492); C) *Cephalorhynchus eutropia* (MNHN 583); D) *Cephalorhynchus eutropia* (MNHN 585); E); *Lagenorhynchus australis* (MNHN 586) F) *Cephalorhynchus eutropia* (MNHN 605). The anterior edges of the choanae, as outlined by red dots, clearly demonstrate that it is "V"-shaped in the genus *Cephalorhynchus* and "U"-shaped in the genus *Lagenorhynchus*, in concordance with the cranial key by Reyes and Molina (1997). Note that choanae of holotype specimen *Tursio? Panope* (MNHN 584) show a "U"-shaped anterior border.

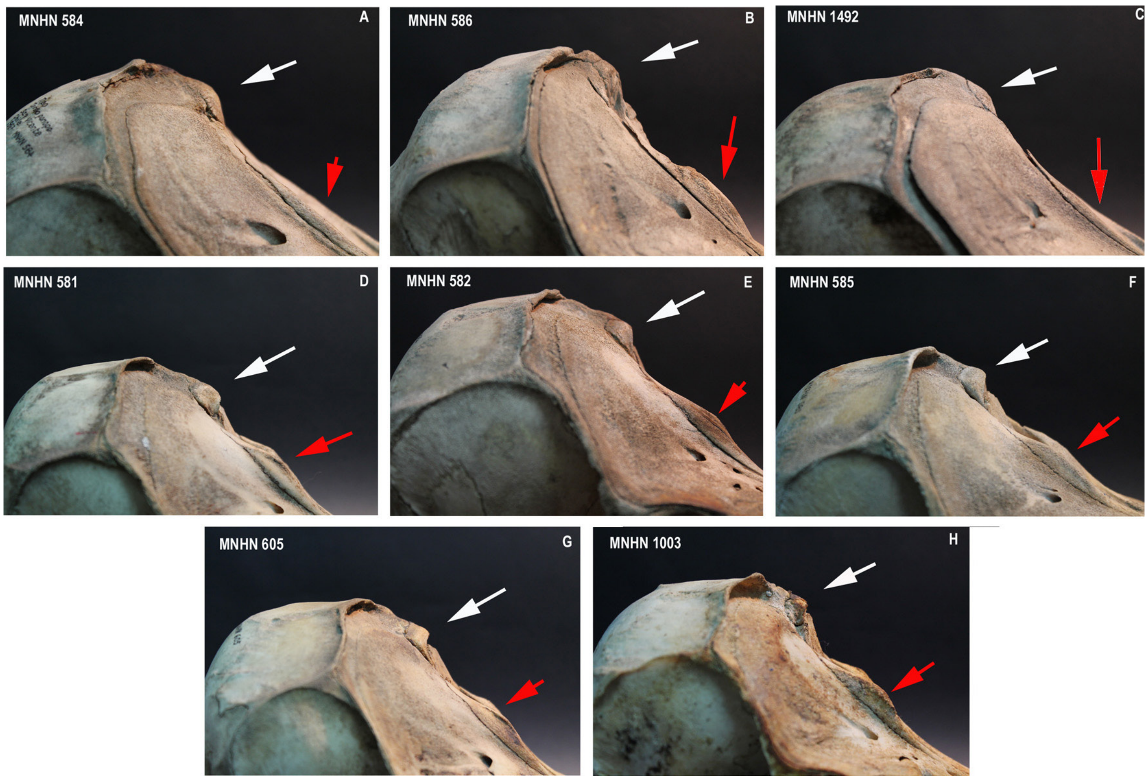

FIGURE 4. Upper lateral view of the skull showing the nasals and the proximal parts of premaxillaries in skulls: A) holotype of *Tursio panope* (MNHN 584); B) *Lagenorhynchus australis* (MNHN 586); C) *Lagenorhynchus obscurus* (MNHN 1492); D) *Cephalorhynchus eutropia* (MNHN 581); E) *Cephalorhynchus eutropia* (MNHN 582); F) *Cephalorhynchus eutropia* (MNHN 585); G) *Cephalorhynchus eutropia* (MNHN 605) and H) *Cephalorhynchus eutropia* (MNHN 1003). The anterior border of each nasal bone (white arrows) in skulls A, B and C show a convex shape without a well-defined sharp border, as described by Reyes and Molina (1997), while in specimens D till H the anterior border of nasals are sharply defined, almost linear (see also Figure 3). The red arrows indicate the posterolateral sulcus of the premaxillary, which in skulls A and C are poorly developed maintaining an almost flat projection, while in skull B the external and internal border of the premaxillary shows a convexity, characteristic for *L. australis*. In the skulls D and H the posterolateral sulcus of the premaxillary exhibits a marked development as a protuberance.

Table 1. Cranial measurements (in mm) for *Lagenorhynchus obscurus* and *Cephalorhynchus eutropia* compared to the holotype of *Tursio panope*. Despite its cranially immature status, the holotype measurements exceed values for *C. eutropia* but fall within the range of *L. obscurus (*except for a shorter rostrum). Reference data were taken from Table 4c in Goodall *et al*. (1988)* and Table 3 in Van Waerebeek (1993)**.

Measures	*C. eutropia**	*L.obscurus***	*T. panope*
Condylobasal length (Range)	302-364	377-410	380+
Condylobasal length (Mean)	341,4	394,9	
Rostrum length (Range)	175-197	208-235	200,5
Rostrum length (Mean)	182, 8	220,8	
Zygomatic width (Range)	131-167	178-199	180
Zygomatic width (Mean)	142,7	187,2	

to belong to the same species. Also it should be considered that many teeth were not fixed in their sockets and easily dropped out. Subsequent mixing of teeth from different specimens may have compromised the correct association between skull and teeth and therefore the correct identity of the samples used in the study of mt-DNA.

Without any doubts the above mentioned aspects contributed to the misidentification of MNHN 584 as *C. eutropia* based on the use of DNA.

CONCLUSIONS

After a detailed review of the cranial morphology of specimens of *Cephalorhynchus eutropia*, *Lagenorhunchus obscurus* and *L. australis* it is concluded that the holotype *Tursio panope* MNHN 584, previously synonymized with *Cephalorhynchus eutropia* corresponds to *Lagenorhynchus obscurus*.

The discrepancy in the results of the work by Pichler and Olavarría (2001) with respect to previous determinations based on morphology (Mead and Brownell 1989, Van Waerebeek 1992) and observations by True (1903) and Goodall *et al.* (1988) are probably due to the contamination of the samples by the use of loose teeth, aggravated by the absence of a detailed assessment of the morphological characters of the skulls studied by Philippi and deposited in the collection of in the National Museum of Natural History, Chile.

Finally, any future DNA-based study of MNHN 584 should be executed by taking a sample of the skull bones itself, which may allow to align molecular and morphological identifications.

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BIBLIOGRAPHIC REFERENCES

BROWNELL, Jr. R.L. and J.G. MEAD
1989 Taxonomic status of the delphinid (Mammalia: Cetacea) *Tursio*? *Panope* Philippi 1895. Proceedings of the Biological Society of Washington 102 (2): 532-534.
CIPRIANO, F. and S. PALUMBI
1999 Genetic tracking of a protected whale. Nature 392: 30-308.

GOODALL, R.N.P, K.S. NORRIS, A.R. GALEAZZI, J.A. OPORTO and I.S. CAMERON
1988 On the Chilean Dolphin, *Cephalorhynchus eutropia* (Gray 1846). In : Brownell Jr. RL & GP Donovan (eds), Biology of the genus *Cephalorhynchus*: 197-258. Special Issue 9 International Whaling Commision, Cambridge, U.K.
HARMER, S.F.
1922 On Commerson's Dolphin and other species of *Cephalorhynchus*. Proceedings of the Zoological Society of London 1922: 627-638.
HERSHKOVITZ, P.
1966 Catalogue of living whales. US. National Museum Bulletin Washington D.C. 246: 1-259.
MEAD, J.M. and R.E. FORDYCE
2009 The Therian skull. A lexicon with emphasis on the odontocetes. Smithsonian Contributions to Zoology 627: 1-248.
PÉREZ CANTO, C.
1895. Description de deauk nouveaux cétacés de la cóte du Chile. Actes de la Societe Scientifique du Chili (5):227-229
PICHLER, F.B. and C. OLAVARRÍA
2001 Resolving Chilean dolphin (*Cephalorhynchus eutropia*, Gray 1846) synonymy by sequencing DNA extracted from teeth of museum specimens. Revista de Biología Marina y Oceanografía 36(1): 117-121.
PHILIPPI, R.A.
1893 Los delfines de la punta austral de la América del Sur. Anales del Museo Nacional de Chile 1 (Zool.) 6: 5-17, 5 láms.
PHILIPPI, R.A.
1895 Los delfines chilenos. Anales de la Universidad. Memorias Científicas i Literarias. República de Chile Tomo XC: 281-285.
PHILIPPI, R.A.
1896 Los cráneos de delfines chilenos. Anales del Museo Nacional de Chile 12: 1-18.
REYES, J.C and D.M. MOLINA
1997 Clave artificial para la identificación de cráneos de cetáceos del Pacífico Sureste. Boletín Museo Nacional de Historia Natural, Chile 46: 95-119.
ROMMEL, S.
1990 Osteology of the Bottlenose dolphin. In: Leatherwood, S. and R. Reeves (eds.), The Bottlenose dolphin: 29-49. Academic Press, Inc. San Diego, California.
SCHNELL, G.D., M.E. DOUGLAS and D.J. HOUGH
1985 Sexual dimorphism in spotted dolphins (*Stenella attenuata*) in the Eastern tropical Pacific ocean. Marine Mammal Science 1(1): 1-14.
SIELFELD, W.
1983 Mamíferos marinos de Chile. Ediciones Universidad de Chile, 199 p.
TAMAYO, M. and D. FRASSINETTI.
1980 Catálogo de los mamíferos fósiles y vivientes de Chile. Boletín Museo Nacional de Historia Natural, Chile 37: 323-399.
TRUE, F.W.
1903 On species of South American Delphinidae described by Dr. R.A. Philippi in 1893 and 1896. Proceedings of the Biological Society of Washington 16: 133-143.
VAN WAEREBEEK, K.
1992 Records of dusky dolphins *Lagenorhynchus obscurus* (Gray, 1828) in the eastern south Pacific. Beaufortia 43: 45-61.
VAN WAEREBEEK, K.
1993 Geographic variation and sexual dimorphism in the skull of the dusky dolphin *Lagenorhynchus obscurus* (Gray, 1828). Fishery Bulletin 91(4): 754-774.
WADA S., M. OISHI and T. YAMADA
2003 A newly discovered species of living baleen whale. Nature 426:278-281.
WILSON, D. E. and D. M. REEDER
2005 Mammal species of the world. A taxonomic and geographic reference (3rd ed.), Johns Hopkins University Press, 2142 p.

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