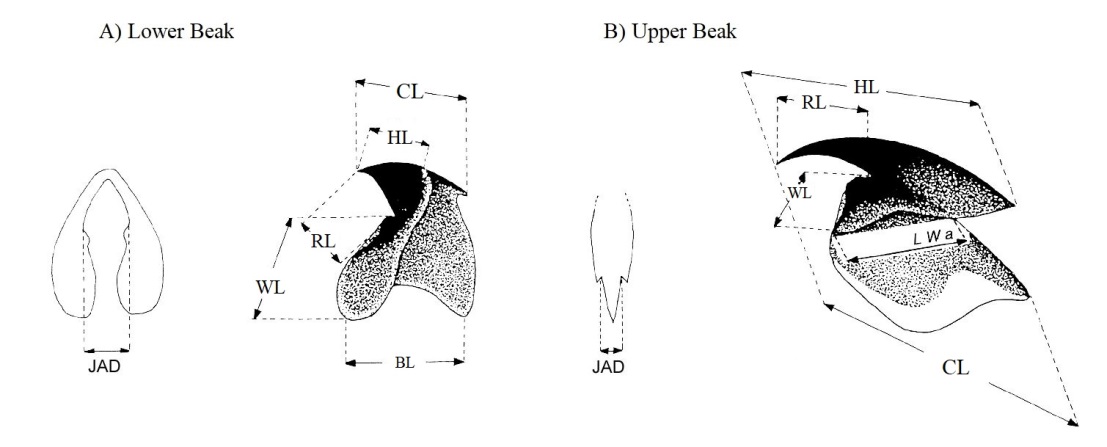
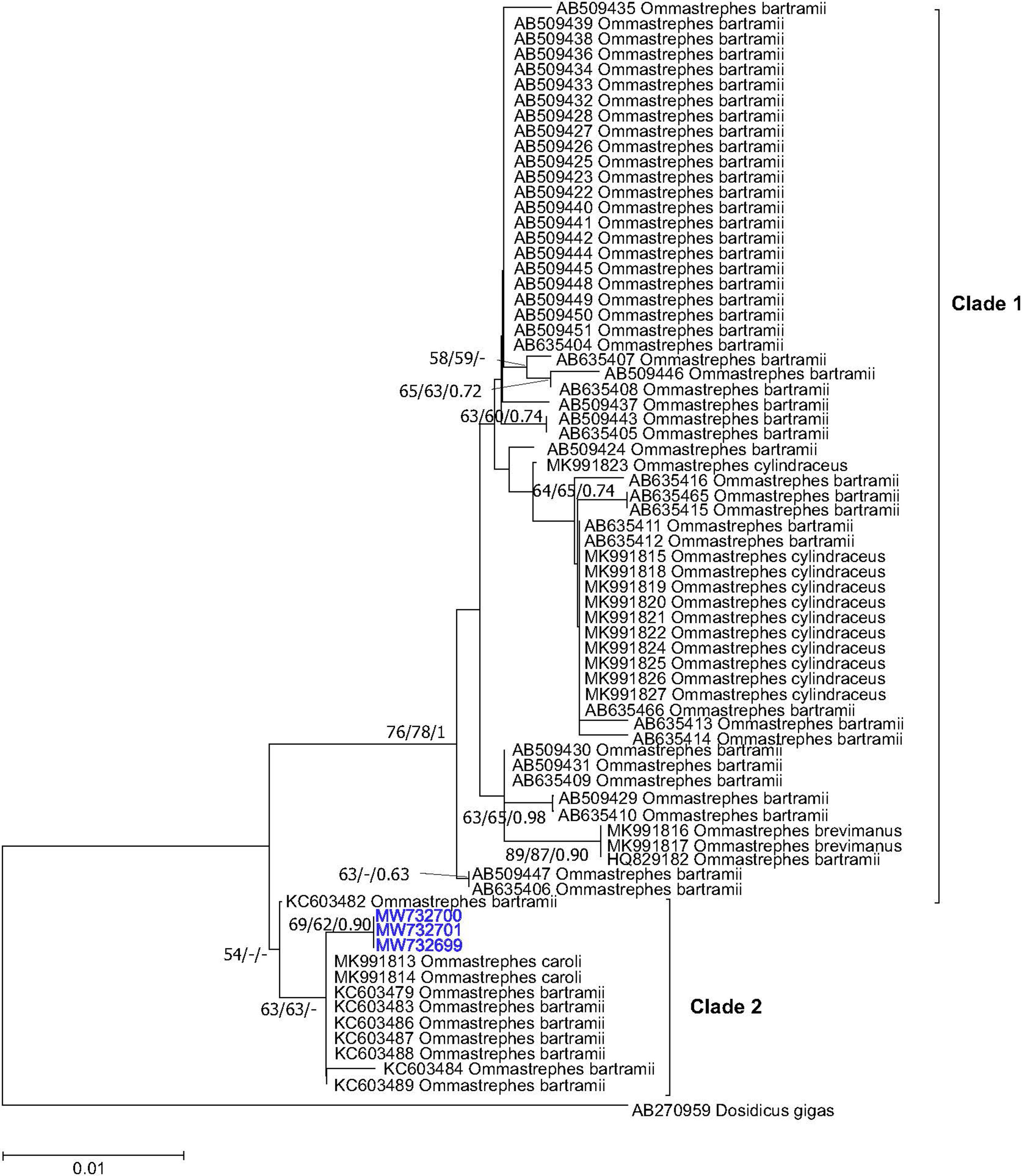
# Supplementary Figure 1



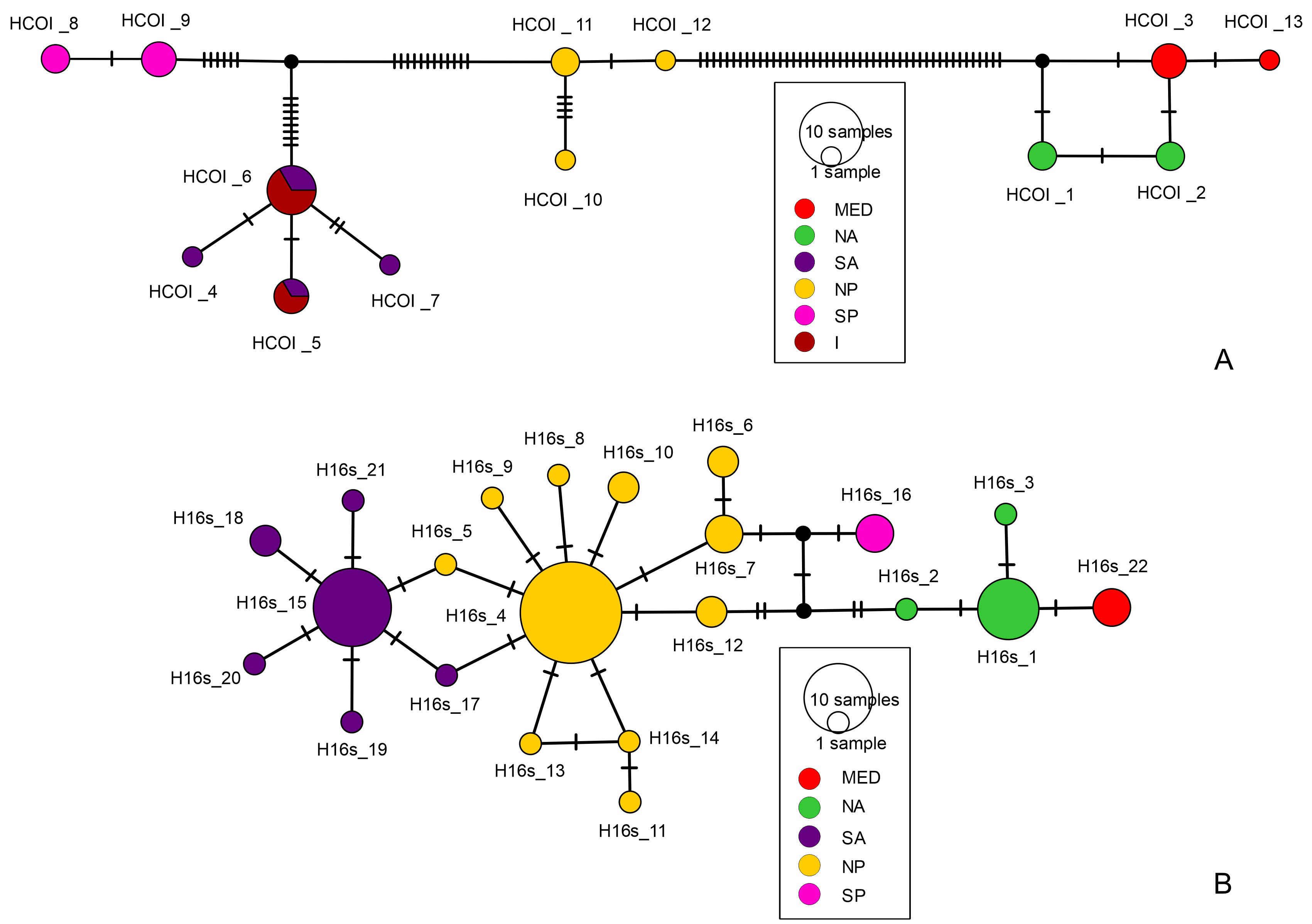
**Supplementary Figure 1.** Scheme of measurements taken from Lower Beak (A) and Upper Beak (B): Crest Length (CL), Hood Length (HL), Wing Length (WL), Rostrum Length (RL), Jaws Angle Distance (JAD), Baseline Length (BL), Lateral Wall amplitude (LWa), following Clarke, 1986.

# Supplementary Figure 2



**Supplementary Figure 2.** Neighbour joining (NJ) phylogenetic tree of the 16s sequences. Near the nodes are the support values obtained for NJ, Maximum Likelihood (ML) and Bayesian (BA) trees, respectively. NJ and ML values refer to bootstrap while BA support are posterior probabilities. Codes in the tips of branches correspond to the GenBank Accession number of sequences (see main text for details). In blue, the sequences from individuals obtained in the present study.

# Supplementary Figure 3



**Supplementary Figure 3.** Haplotype statistical parsimony networks constructed by the TCS function of PopART for each gene. The geographical origins of the samples are indicated on the legend. For GenBank records, the approximate geographical position was inferred when necessary. A) cytochrome *c* oxidase subunit I (COI). B) 16S rRNA (16S). Abbreviations: MED, Mediterranean Sea; NA, North Atlantic; SA, South Atlantic; NP, North Pacific; SP, South Pacific; I, Indian.

# Supplementary Table 1

Details of the COI sequences analyzed in this study – haplotype, species as in GenBank, GenBank accession number, reference (when available), sampling location and consensus species.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| **Haplotype** | **Submitted GenBank** | **GenBank Accession** | **Reference** | **Sampling Location** | **Consensus species** |
| HCOI\_1 | *Ommastrephes caroli* | MK995129 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:North | *Ommastrephes caroli* |
| HCOI\_2 | *Ommastrephes caroli* | MK995128 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:North | *Ommastrephes caroli* |
| HCOI\_2 | *Ommastrephes caroli* | MK995127 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:North | *Ommastrephes caroli* |
| HCOI\_1 | *Ommastrephes caroli* | MK995126 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:North | *Ommastrephes caroli* |
| HCOI\_3 | *Ommastrephes bartramii* | KF212462 | Franjevic et al., 2015 | Mediterranean Sea - Croatia | *Ommastrephes caroli* |
| HCOI\_4 | *Ommastrephes sp.* | MF980596 | Fernández-Álvarez et al., 2018 | Atlantic Ocean:South | *Ommastrephes cylindraceus* |
| HCOI\_5 | *Ommastrephes cylindraceus* | MK995141 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:South | *Ommastrephes cylindraceus* |
| HCOI\_6 | *Ommastrephes cylindraceus* | MK995140 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:South | *Ommastrephes cylindraceus* |
| HCOI\_6 | *Ommastrephes cylindraceus* | MK995139 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:South | *Ommastrephes cylindraceus* |
| HCOI\_7 | *Ommastrephes cylindraceus* | MK995138 | Fernández-Álvarez et al., 2020 | Atlantic Ocean:South | *Ommastrephes cylindraceus* |
| HCOI\_5 | *Ommastrephes cylindraceus* | MK995137 | Fernández-Álvarez et al., 2020 | Indian Ocean | *Ommastrephes cylindraceus* |
| HCOI\_6 | *Ommastrephes cylindraceus* | MK995136 | Fernández-Álvarez et al., 2020 | Indian Ocean | *Ommastrephes cylindraceus* |
| HCOI\_6 | *Ommastrephes cylindraceus* | MK995135 | Fernández-Álvarez et al., 2020 | Indian Ocean | *Ommastrephes cylindraceus* |
| HCOI\_6 | *Ommastrephes cylindraceus* | MK995134 | Fernández-Álvarez et al., 2020 | Indian Ocean | *Ommastrephes cylindraceus* |
| HCOI\_6 | *Ommastrephes cylindraceus* | MK995133 | Fernández-Álvarez et al., 2020 | Indian Ocean | *Ommastrephes cylindraceus* |
| HCOI\_5 | *Ommastrephes cylindraceus* | MK995132 | Fernández-Álvarez et al., 2020 | Indian Ocean | *Ommastrephes cylindraceus* |
| HCOI\_8 | *Ommastrephes bartramii* | HQ829183 | Unpublished | Pacific Ocean: South | *Ommastrephes brevimanus* |
| HCOI\_8 | *Ommastrephes bartramii* | HQ829184 | Unpublished | Pacific Ocean: South | *Ommastrephes brevimanus* |
| HCOI\_9 | *Ommastrephes brevimanus* | MK995130 | Fernández-Álvarez et al., 2020 | Pacific Ocean: South | *Ommastrephes brevimanus* |
| HCOI\_9 | *Ommastrephes brevimanus* | MK995131 | Fernández-Álvarez et al., 2020 | Pacific Ocean: South | *Ommastrephes brevimanus* |
| HCOI\_9 | *Ommastrephes bartramii* | MH347315 | Carrasco et al., 2019 | Pacific Ocean: South | *Ommastrephes brevimanus* |
| HCOI\_10 | *Ommastrephes bartramii* | AF000057 | Carlini et al., 1999 | Pacific Ocean: North | *Ommastrephes bartramii* |
| HCOI\_11 | *Ommastrephes bartramii* | AB199549 | Wakabayashi et al., 2006 | Pacific Ocean: North | *Ommastrephes bartramii* |
| HCOI\_12 | *Ommastrephes bartramii* | AB199551 | Wakabayashi et al., 2006 | Pacific Ocean: North | *Ommastrephes bartramii* |
| HCOI\_11 | *Ommastrephes bartramii* | AB270941 | Wakabayashi et al., 2012a | Pacific Ocean: North | *Ommastrephes bartramii* |
| HCOI\_3 | **Ommastrephes sp 2006** | **MW752851** | **present study** | **Mediterranean Sea - Sardinia** | ***Ommastrephes caroli*** |
| HCOI\_13 | **Ommastrephes sp 2012** | **MW752850** | **present study** | **Mediterranean Sea - Sardinia** | ***Ommastrephes caroli*** |
| HCOI\_3 | **Ommastrephes sp 2014** | **MW752849** | **present study** | **Mediterranean Sea - Sardinia** | ***Ommastrephes caroli*** |
| *outgroup* | *Dosidicus gigas* | AB270944 | Wakabayashi et al., 2012a | Pacific Ocean | *OUTGROUP* |

# Supplementary Table 2

Details of the 16S sequences analyzed in this study – haplotype, species as in GenBank, GenBank accession number, reference (when available), sampling location and consensus species.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| **Haplotype** | **Submitted GenBank** | **GenBank Accession** | **Reference** | **Sampling Location** | **Consensus species** |
| H16s\_1 | *Ommastrephes caroli* | MK991813 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes caroli* | MK991814 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes bartramii* | KC603479 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_2 | *Ommastrephes bartramii* | KC603482 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes bartramii* | KC603483 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_3 | *Ommastrephes bartramii* | KC603484 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes bartramii* | KC603486 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes bartramii* | KC603487 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes bartramii* | KC603488 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_1 | *Ommastrephes bartramii* | KC603489 | Alonso et al., 2014 | Atlantic Ocean: North | *Ommastrephes caroli* |
| H16s\_4 | *Ommastrephes bartramii* | AB509422 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509423 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_5 | *Ommastrephes bartramii* | AB509424 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509425 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509426 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509427 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509428 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_6 | *Ommastrephes bartramii* | AB509429 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_7 | *Ommastrephes bartramii* | AB509430 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_7 | *Ommastrephes bartramii* | AB509431 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509432 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509433 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509434 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_8 | *Ommastrephes bartramii* | AB509435 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509436 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_9 | *Ommastrephes bartramii* | AB509437 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509438 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509439 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509440 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509441 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509442 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_10 | *Ommastrephes bartramii* | AB509443 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509444 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509445 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_11 | *Ommastrephes bartramii* | AB509446 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_12 | *Ommastrephes bartramii* | AB509447 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509448 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509449 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509450 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB509451 | Unpublished | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_4 | *Ommastrephes bartramii* | AB635404 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_10 | *Ommastrephes bartramii* | AB635405 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_12 | *Ommastrephes bartramii* | AB635406 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_13 | *Ommastrephes bartramii* | AB635407 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_14 | *Ommastrephes bartramii* | AB635408 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_7 | *Ommastrephes bartramii* | AB635409 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_6 | *Ommastrephes bartramii* | AB635410 | Wakabayashi et al., 2012b | Pacific Ocean: North | *Ommastrephes bartramii* |
| H16s\_15 | *Ommastrephes bartramii* | AB635411 | Wakabayashi et al., 2012b | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes bartramii* | AB635412 | Wakabayashi et al., 2012b | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991815 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_16 | *Ommastrephes brevimanus* | MK991816 | Fernández-Álvarez et al., 2020 | Pacific Ocean: South | *Ommastrephes brevimanus* |
| H16s\_16 | *Ommastrephes brevimanus* | MK991817 | Fernández-Álvarez et al., 2020 | Pacific Ocean: South | *Ommastrephes brevimanus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991818 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991819 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991820 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991821 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991822 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_17 | *Ommastrephes cylindraceus* | MK991823 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991824 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991825 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991826 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes cylindraceus* | MK991827 | Fernández-Álvarez et al., 2020 | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_18 | *Ommastrephes bartramii* | AB635465 | Unpublished | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_15 | *Ommastrephes bartramii* | AB635466 | Unpublished | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_19 | *Ommastrephes bartramii* | AB635413 | Wakabayashi et al., 2012b | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_20 | *Ommastrephes bartramii* | AB635414 | Wakabayashi et al., 2012b | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_18 | *Ommastrephes bartramii* | AB635415 | Wakabayashi et al., 2012b | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_21 | *Ommastrephes bartramii* | AB635416 | Wakabayashi et al., 2012b | Atlantic Ocean: South | *Ommastrephes cylindraceus* |
| H16s\_16 | *Ommastrephes bartramii* | HQ829182 | Unpublished | Pacific Ocean: South | *Ommastrephes brevimanus* |
| H16s\_22 | **Ommastrephes sp 2006** | **MW732699** | **present study** | **Mediterranean Sea - Sardinia** | *Ommastrephes caroli* |
| H16s\_22 | **Ommastrephes sp 2012** | **MW732700** | **present study** | **Mediterranean Sea - Sardinia** | *Ommastrephes caroli* |
| H16s\_22 | **Ommastrephes sp 2014** | **MW732701** | **present study** | **Mediterranean Sea - Sardinia** | *Ommastrephes caroli* |
| *outgroup* | *Dosidicus gigas* | AB270959 | Wakabayashi et al., 2012° | Pacific Ocean | *OUTGROUP* |

# Supplementary Table 3

Relationships between the beak measurements and body sizes in *Ommastrephes caroli*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | |
| **Power model relationship**  **DML/beak** | **R2** | **Power model relationship**  **TW/beak** | **R2** | |
| DML = 36.802LCL0.8241 | 0.69 | TW = 1.1106LCL0.6257 | 0.7265 |
| DML = 84.159LHL0.7535 | 0.4985 | TW = 15.878LHL2.3902 | 0.5203 |
| DML = 36.165LRL1.094 | 0.9185 | TW = 1.2652LRL3.4078 | 0.9244 |
| DML=68.024LWL0.6915 | 0.6971 | TW= 6.47LWL2.271 | 0.7799 |
| DML = 51.29LBL0.6752 | 0.6328 | TW = 3.4985LBL2.1245 | 0.6498 |
| DML = 101.45LJAD0.6754 | 0.641 | TW = 32.041LJAD2.0957 | 0.6403 |
| DML = 15.596UCL0.9037 | 0.8061 | TW = 0.0777UCL2.8596 | 0.8371 |
| DML = 15.821UHL0.9526 | 0.8565 | TW = 0.0891UHL2.989 | 0.8746 |
| DML = 69.843URL0.7591 | 0.6163 | TW = 11.587URL2.3009 | 0.5872 |
| DML = 97.363UWL0.6818 | 0.6168 | TW = 25.185UWL2.1633 | 0.644 |
| DML = 74.45ULWA0.6265 | 0.6986 | TW = 14.051LWA1.8992 | 0.6659 |
| DML = 71.347UJAD0.8756 | 0.7383 | TW = 8.7755UJAD2.8088 | 0.788 |
|  |  |  |  |

# References

Alonso, H., Granadeiro, J.P., Waap, S., Xavier, J., Symondson, W.O., Ramos, J.A. et al. (2014). An holistic ecological analysis of the diet of Cory's shearwaters using prey morphological characters and DNA barcoding. Mol. Ecol. 23(15), 3719-3733. doi: 10.1111/mec.12785.

Carlini, D.B., and Graves, J.E. (1999). Phylogenetic analysis of cytochrome c oxidase I sequences to determine higher-level relationships within the coleoid cephalopods. Bull. Mar. Sci. 64(1), 57-76.

Carrasco, S.A., Meerhoff, E., Yannicelly, B., and Ibáñez, C.M. (2019). First Records and Descriptions of Early Life Stages of Cephalopods from Rapa Nui (Easter Island) and the Nearby Apolo Seamount. Pac. Sci. 73(1), 163-175. doi: [10.2984/73.1.8](https://doi.org/10.2984/73.1.8)

Clarke, M.R. (1986). A Handbook for the Identification of Cephalopod Beaks. Mar. Biol. Assoc. U.K. Plymouth: Clarendon Press: Oxford.

Fernández-Álvarez, F.Á., Braid, H.E., Nigmatullin, Ch.M., Bolstad, K.S.R., Haimovici, M., Sánchez P. et al. (2020). Global biodiversity of the genus *Ommastrephes* (Ommastrephidae: Cephalopoda): an allopatric cryptic species complex. Zool. J. Linn. Soc. 190(2), 460-482. doi: [10.1093/zoolinnean/zlaa014](https://doi.org/10.1093/zoolinnean/zlaa014)

Fernández-Álvarez, F.Á., Machordom, A., García-Jiménez, R., Salinas-Zavala, C.A., and Villanueva, R. (2018). Predatory flying squids are detritivores during their early planktonic life. Sci. Rep. 8(1): 3440. doi: [10.1038/s41598-018-21501-y](https://doi.org/10.1038/s41598-018-21501-y)

Franjević, D., Skaramuca, D., Katavić, V., Rajević, N., and Skaramuca, B. (2015). Genetic Identification of a Rare Record of *Ommastrephes bartramii* (Cephalopoda: Ommastrephidae) from the Eastern Adriatic Sea. Folia Biol. (Kraków). 63(1), 19-23. doi: [10.3409/fb63\_1.19](https://doi.org/10.3409/fb63_1.19)

Wakabayashi, T., Suzuki, N., Sakai, M., Ichii, T., and Chow, S. (2006). Identification of ommastrephid squid paralarvae collected in northern Hawaiian waters and phylogenetic implications for the family Ommastrephidae using mtDNA analysis. Fish. Sci. 72(3), 494-502. doi: [10.1111/j.1444-2906.2006.01177.x](https://doi.org/10.1111/j.1444-2906.2006.01177.x)

Wakabayashi, T., Suzuki, N., Sakai, M., Ichii, T., and Chow, S. (2012a). Phylogenetic relationships among the family Ommastrephidae (Mollusca: Cephalopoda) inferred from two mitochondrial DNA gene sequences. Mar. Genom. 7, 11-16. doi: [10.1016/j.margen.2012.04.005](https://doi.org/10.1016/j.margen.2012.04.005)

Wakabayashi, T., Wada, S., Ochi, Y., Ichii, T., and Sakai, M. (2012b). Genetic differentiation of the neon flying squid *Ommastrephes bartramii* between north Pacific and south Atlantic populations. Nippon Suisan Gakk. 78, 198-203.