**Table S1 Original data plotted in Figure 4, with sources. Measurements in parentheses were estimated based on photos in the cited sources.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Group** | **Species** | **Specimen number** | **Numbers of centrum used for calculation** | **Centrum height (mm)** | **Centrum length (mm)** | **Reference** |
| Basal Ichthyosauromorpha | *Nanchangosaurus suni* | GMC V 636 | 10, average | 7.6 | 3.6 | (Wang 1959) |
| Basal Ichthyosauromorpha | *Eohupehsuchus brevicollis* | WGSC V26003 | 3, average | (3.1) | (3.9) | (Chen et al. 2014a) |
| Basal Ichthyosauromorpha | *Hupehsuchus nanchangensis* | ZMNH M8127 | 3, average | (9) | (9.7) | (Carroll & Dong 1991) |
| Basal Ichthyosauromorpha | *Chaohusaurus brevifemoralis* | AGB7401 | 3, average | (6.7) | (8.3) | (Huang et al. 2019) |
| Basal Ichthyosauromorpha | *Chaohusaurus geishanensis* | IVPP V4001 | 3, average | (3.3) | (4.3) | (Young & Dong 1972) |
| Basal Ichthyosauromorpha | *Utatsusaurus hataii* | IGPS95941 | 10, average | 16.2 | 13.9 | (Shikama et al. 1978) |
| Basal Ichthyosauromorpha | *Grippia longirostris* | PMO 230.212 | 1 | (11.4) | (9.7) | (Roaldset 2017) |
| Basal Ichthyosauromorpha | *Gulosaurus helmi* | TMP 89.127.3 | 3, average | (8.6) | (6.1) | (Cuthbertson et al. 2013) |
| Basal Ichthyosauromorpha | *Omphalosaurus wolfi* | MBG 1500 | 1 | 75 | 58 | (Sander & Faber 2003) |
| Ichthyosauria | *Cymbospondylus buchseri* | PIMUZT 4351 | 4, average | (61.3) | (32.5) | (Sander 1989) |
| Ichthyosauria | *Cymbospondylus* sp. | PMO 229.734 | 1 | (44.2) | (23.7) | (Engelschiøn et al. 2018) |
| Ichthyosauria | *Cymbospondylus* sp. | PIMUZ A/III 496 | 1 | 61.5 | 30.8 | (Sander 1992) |
| Ichthyosauria | *Mixosaurus kuhnschnyderi* | YIGM SPCV-0810 | 1 | 3.6 | 2.5 | (Chen & Cheng 2009) |
| Ichthyosauria | *Qianichthyosaurus xingyiensis* | WS2011-46-R1 | 3, average | (17.5) | (11.7) | (Yang et al. 2013) |
| Ichthyosauria | *Shastasaurus neubigi* | BSP 1992 I 39 | 1 | 29 | 17 | (Sander 1997) |
| Ichthyosauria | *Ichthyosaurus communis* | NHMUK R15907 | 3, average | (11.3) | (6.7) | (Bennett et al. 2012) |
| Ichthyosauria | *Temnodontosaurus trigonodon* | SMNS 15950 | 3, average | (114.3) | (50.8) | (Pardo-Pérez et al. 2018) |
| Ichthyosauria | *Stenopterygius aaleniensis* | SMNS 90699 | 3, average | (44.2) | (20.1) | (Maxwell et al. 2012) |
| Ichthyosauria | *Gengasaurus nicosiai* | MSVG 39617 | 1 | 55.8 | 25.2 | (Paparella et al. 2016) |
| Ichthyosauria | *Muiscasaurus catheti* | FCG-CBP-16 | 3, average | (46.3) | (20.9) | (Paramo-Fonseca et al. 2021) |
| Sauropterygia | *Chinchenia sungi* | IVPP 3227 | 3, average | 9.8 | 14.1 | (Rieppel 1998a) |
| Sauropterygia | *Sanchiaosaurus dengi* | IVPP V2338 | 1 | 18.7 | 20.3 | (Rieppel 1998a) |
| Sauropterygia | *Corosaurus alcovensis* | UW 5485 | 3, average | (18.9) | (17.2) | (Rieppel 1998b) |
| Sauropterygia | *Augustasaurus hagdorni* | FMNH PR 1974 | 3, average | (36) | (40) | (Sander et al. 1997) |
| Sauropterygia | Eusauropterygiaindet. | UCM-CLV34 | 1 | (30.8) | (22.5) | (Pérez-Valera et al. 2020) |
| Sauropterygia | *Yunguisaurus liae* | XNGMXY-2013-R1 | 3, average | (7.7) | (12.2) | (Wang et al. 2019) |

**Tables S2 Sources of morphological information for trunk elements of various taxa illustrated in Figure 6.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number** | **Group** | **Species** | **Specimen number** | **References** |
| **A** | Ichthyosauromorpha | *Baisesaurus robustus* | CUGW VH107 |  |
| **B** | Ichthyosauromorpha | *Utatsusaurus hataii* | IGPS95941 | (Shikama et al. 1978) |
| **C** | Sauropterygia | *Lariosaurus sanxiaensis* | HFUT YZS-16-01 | (Li & Liu 2020) |
| **D** | Sauropterygia | *Dawazisaurus brevis* | NMNS000933-F034397 | (Cheng et al. 2016) |
| **E** | Thalattosauria | *Askeptosaurus italicus* | PIMUZ T 4832 | (Müller 2005) |
| **F** | Ichthyosauromorpha | *Baisesaurus robustus* | CUGW VH107 |  |
| **G** | Ichthyosauromorpha | *Chaohusaurus geishanensis* | P45-H85-23 | (Maisch 2001) |
| **H** | Ichthyosauromorpha | *Chaohusaurus chaoxianensis* | AGB6256 | (Huang et al. 2019) |
| **I** | Sauropterygia | *Kwangsisaurus orientalis* | IVPP V2338 | (Rieppel 1998a) |
| **J** | Sauropterygia | *Hanosaurus hupehensis* | IVPP V3231 | (Rieppel 1998c) |

**Tables S3 Sources of morphological information for forelimb elements of various taxa illustrated in Figure 7.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number** | **Group** | **Species** | **Specimen number** | **References** |
| **A** | Ichthyosauromorpha | *Baisesaurus robustus* | CUGW VH107 |  |
| **B** | Ichthyosauromorpha | *Parahupehsuchus longus* | WGSC 26005 | (Chen et al. 2014b) |
| **C** | Ichthyosauromorpha | *Hupehsuchus nanchangensis* | ZMNH M8127 | (Carroll & Dong 1991) |
| **D** | Ichthyosauromorpha | *Eohupehsuchus brevicollis* | WGSC V26003 | (Chen et al. 2014a) |
| **E** | Ichthyosauromorpha | *Eretmorhipis carrolldongi* | WGSC V26020 | (Chen et al. 2015) |
| **F** | Ichthyosauromorpha | *Chaohusaurus brevifemoralis* | AGB7408 | (Huang et al. 2019) |
| **G** | Ichthyosauromorpha | *Chaohusaurus zhangjiawanensis* | WHGMR V26025 | (Chen et al. 2013) |
| **H** | Ichthyosauromorpha | *Grippia longirostris* | PMU R472 | (Zou et al. 2020) |
| **I** | Ichthyosauromorpha | *Utatsusaurus hataii* | IGPS95941 | (Mazin 1986) |
| **J** | Sauropterygia | *Majiashanosaurus discocoracoidis* | AGM-AGB5954 | (Jiang et al. 2014) |
| **K** | Sauropterygia | *Qianxisaurus chajiangensis* | NMNS-KIKO-F044630 | (Cheng et al. 2012) |
| **L** | Sauropterygia | *Dawazisaurus brevis* | NMNS000933-F034397 | (Cheng et al. 2016) |
| **M** | Thalattosauria | *Askeptosaurus italicus* | MSNM V456 | (Müller 2005) |

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