**Phylogenetic placement of †Coccocephalichthys wildi**

†Coccocephalichthys wildi has been included in a number of phylogenetic analyses investigating the relationships of early ray-finned fishes\(^1\)–\(^{11}\). It was originally placed in the actinopterygian crown\(^1\), but all subsequent analyses resolve it on the actinopterygian stem, sometimes within a large polytomy including most other late Palaeozoic ray-finned fishes. A detailed redescription of †Coccocephalichthys based on new μCT data, in conjunction with an updated phylogenetic analysis, is currently in preparation (S.G., R.F., M.F.), although we do not anticipate this leading to a change in the phylogenetic placement of the taxon.

The cranial morphology of †Coccocephalichthys wildi is comparable to other late Palaeozoic taxa that are well-within the ray-finned fish stem. The clearest comparisons are with the Carboniferous †Kentuckia\(^{12}\), †Kansasiella\(^{13}\), and †Lawrenciella\(^{13}-^{15}\), all of which preserve information on the endocranium. In common with these taxa, †Coccocephalichthys has a completely enclosed spiracular canal, a posteroventrally-directed hyoid facet, and open vestibular fontanelles continuous with the oticoocippital fissure. As in †Kentuckia and †Lawrenciella, the aortic canal of †Coccocephalichthys is pierced by a single midline opening, and as in †Kentuckia the divergence of the lateral dorsal aortae is not enclosed within the aortic canal and the parasphenoid is flat rather than dorsally inflected below the orbit.

†Coccocephalichthys also shares other features in common with a subset of the above taxa, as well as with some Devonian and stratigraphically younger taxa.

†Coccocephalichthys is excluded from the crown by several successive nodes on the basis of the following ambiguous character optimisations (taken from ref. 5):
- Character 42: bone carrying otic portion of lateral line canal extends past posterior margin of parietals
- Character 89: two infradentaries
- Character 94: coronoid process formed by surangular
- Character 100: comineralised palatoquadrate ossifications
- Character 156: braincase comprises single ossification
- Character 171: parasphenoid terminates at/anterior to ventral otic fissure
- Character 178: aortic notch absent from parasphenoid
- Character 43: two pairs of extrascapulars
- Character 69: maxilla contributes to posterior margin of cheek
- Character 153: dorsal aorta not pierced by canal/s for exit of eff.a.1
- Character 175: parasphenoid teeth small

CT scanning parameters for all specimens
<table>
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<tr>
<th></th>
<th>Energy (kV)</th>
<th>Current (μA)</th>
<th>Exposure (S)</th>
<th>Filter</th>
<th>Filter (mm)</th>
<th>Voxel (mm)</th>
<th>Frames/Projection</th>
<th>Minimize Ring Artifact</th>
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</thead>
</table>
| **Coccocephalichthys wildi**  
(MM12451) | 120         | 125          | 2.83         | Cu     | 0.5         | 0.01535     | 8                 | YES                     |
| **Squalus acanthias**  
(UMMZ uncatalog.) | 160         | 120          | 1.42         | NA     | -           | 0.06243     | 2                 | YES                     |
| **Polypterus senegalus**  
(UMMZ 195008) | 100         | 172          | 0.25         | NA     | -           | 0.01733     | 16                | YES                     |
| **Acipenser brevirostrum**  
(UMMZ 219456) | 85          | 200          | 0.25         | NA     | -           | 0.03236     | 16                | YES                     |
| **Amia calva**  
(UMMZ 235291) | 85          | 200          | 0.25         | NA     | -           | 0.03451     | 16                | YES                     |


