

Appendix 3: Character State changes by clade as plotted on one of the most parsimonious trees. Clades with a taxonomic rank have the name indicated after the clade number. Genera of the Astroblepidae, *Lithogenes*, the new subfamily, the Neoplecostominae, and the Hypostominae for which there is only one species in this analysis have their character state changes indicated after the last numbered clade, genera arranged in alphabetical order. The character number is on the left and the change in states is on the right (-> is an arrow indicating change from one state to another). NUC = no unambiguous changes.

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|------------------------------|--------------------------|-----------------------------|------------------------|
| Clade 1 | Clade 6 | 14: 1->0 | 156: 0->1 |
| 79: 0->1 | 80: 1->0 | 161: 0->1 | 159: 0->1 |
| 121: 1->0 | 177: 0->1 | 163: 1->0 | 172: 0->1 |
| 140: 0->1 | Clade 7 | Clade 15: | 210: 0->1 |
| 145: 1->2 | 194: 0->1 | Hypoptopomatinae | 212: 0->1 |
| 146: 0->1 | Clade 8 | 1: 1->0 | Clade 21: |
| 157: 0->1 | 44: 1->2 | 20: 1->0 | <i>Hemipsilichthys</i> |
| 176: 0->1 | 81: 0->1 | 103: 0->1 | 7: 1->2 |
| Clade 2: Loricariidae | 86: 0->1 | 109: 0->2 | 35: 0->1 |
| 7: 0->1 | 152: 0->1 | 131: 0->1 | 85: 0->1 |
| 8: 0->1 | 157: 0->1 | 154: 0->1 | 86: 0->1 |
| 14: 0->1 | 164: 1->0 | 162: 1->0 | 183: 0->1 |
| 18: 0->1 | 181: 0->1 | 177: 1->0 | 187: 0->1 |
| 30: 0->1 | Clade 9 | 195: 1->0 | 188: 0->1 |
| 52: 0->1 | 1: 1->0 | 203: 0->1 | Clade 22 |
| 97: 0->2 | 20: 1->0 | Clade 16 | 83: 0->1 |
| 100: 1->2 | 80: 0->1 | 15: 0->1 | 152: 0->1 |
| 105: 0->1 | 203: 0->1 | 95: 0->1 | 181: 0->1 |
| 120: 0->1 | Clade 10: | 97: 2->1 | Clade 23 |
| 201: 0->1 | <i>Neoplecostomus</i> | 141: 1->0 | 177: 0->1 |
| Clade 3 | 14: 1->0 | 154: 1->2 | Clade 24 |
| 27: 1->0 | 29: 1->0 | 160: 1->0 | 53: 2->1 |
| 28: 0->1 | 30: 1->0 | 172: 1->0 | 67: 0->1 |
| 64: 1->2 | 96: 1->0 | Clade 17 | 80: 1->0 |
| 66: 0->1 | 116: 0->1 | 43: 0->1 | 102: 0->1 |
| 73: 0->1 | 126: 1->0 | 87: 0->1 | 122: 1->0 |
| 81: 0->1 | 128: 0->1 | 202: 0->1 | 138: 1->0 |
| 115: 0->1 | 151: 0->1 | Clade 18 | 156: 0->1 |
| 128: 0->1 | 173: 0->1 | 44: 1->0 | 172: 1->0 |
| 147: 0->1 | 175: 2->1 | 57: 2->0 | Clade 25 |
| 167: 0->2 | Clade 11: | 98: 1->0 | 137: 0->1 |
| 170: 0->1 | <i>Isbrueckerichthys</i> | 105: 1->2 | 167: 0->1 |
| 183: 0->1 | 4: 0->1 | 110: 1->0 | 172: 1->0 |
| 188: 0->1 | 23: 1->0 | Clade 19 | Clade 26: |
| 192: 0->1 | 45: 0->1 | 54: 0->1 | <i>Loricariinae</i> |
| 196: 2->3 | 53: 2->1 | 88: 1->0 | 1: 1->0 |
| Clade 4 | 78: 1->0 | 131: 1->0 | 27: 1->0 |
| 17: 0->1 | 83: 0->2 | 141: 0->1 | 28: 0->1 |
| 52: 1->2 | 183: 0->1 | Clade 20: Otocinclus | 92: 0->1 |
| 53: 0->2 | 187: 0->1 | 11: 0->1 | 121: 1->0 |
| 57: 0->2 | 188: 0->1 | 14: 0->1 | 124: 0->1 |
| 74: 0->1 | 196: 2->3 | 51: 1->0 | 127: 0->1 |
| 82: 0->1 | Clade 12 | 52: 2->0 | 144: 0->1 |
| 93: 0->1 | 27: 1->2 | 53: 1->0 | 145: 1->0 |
| Clade 5 | 53: 2->1 | 62: 0->2 | 163: 1->0 |
| 16: 0->1 | Clade 13: | 64: 1->2 | 191: 1->0 |
| 63: 0->1 | <i>Kronichthys</i> | 97: 1->0 | 195: 1->0 |
| 96: 0->1 | 156: 0->1 | 128: 0->1 | Clade 27 |
| 126: 0->1 | Clade 14 | 148: 1->0 | 7: 1->0 |

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| 8: 1->0 | 26: 1->2 | 106: 0->1 | 26: 2->0 |
| 14: 1->2 | 43: 0->1 | 129: 0->1 | 111: 1->0 |
| 17: 1->0 | 85: 0->1 | 162: 1->0 | 179: 0->1 |
| 30: 1->0 | 104: 0->1 | 210: 0->1 | 204: 0->1 |
| 50: 0->1 | 132: 0->1 | 211: 0->1 | Clade 50 |
| 60: 0->1 | 141: 0->1 | Clade 41 | 25: 0->1 |
| 69: 0->1 | 173: 0->1 | 25: 0->1 | Clade 51 |
| 72: 0->1 | 183: 0->1 | 61: 0->1 | 158: 1->0 |
| 108: 0->1 | 188: 0->1 | 62: 0->1 | Clade 52 |
| 155: 0->1 | Clade 35: | 99: 0->1 | 46: 0->1 |
| 189: 0->1 | Hypostominae | 194: 0->1 | 68: 0->1 |
| Clade 28 | 7: 1->2 | 211: 1->2 | 69: 0->1 |
| 22: 0->1 | 83: 0->1 | Clade 42: | 81: 1->2 |
| 55: 0->1 | 97: 2->1 | <i>Pogonopoma</i> | Clade 53 |
| 74: 1->0 | 123: 0->1 | 54: 0->1 | 36: 1->0 |
| 83: 0->1 | 148: 1->0 | 57: 2->1 | 70: 0->1 |
| 106: 0->1 | 173: 0->1 | 73: 0->1 | 205: 0->1 |
| 141: 0->1 | Clade 36 | 74: 1->0 | Clade 54 |
| 153: 0->1 | 8: 1->2 | 122: 0->1 | 136: 0->1 |
| Clade 29 | 88: 1->2 | 131: 0->1 | Clade 55 |
| 11: 0->1 | 94: 0->1 | 156: 0->1 | 11: 0->1 |
| 12: 0->1 | 98: 1->0 | 167: 1->2 | 44: 2->1 |
| 13: 0->1 | 122: 1->0 | 174: 0->1 | Clade 56 |
| 18: 1->0 | 160: 1->0 | 211: 2->3 | 44: 1->2 |
| 44: 1->0 | 196: 2->3 | Clade 43: | Clade 57 |
| 88: 1->2 | 197: 2->1 | <i>Hypostomus</i> | 91: 1->2 |
| 135: 0->1 | Clade 37 | 78: 0->1 | Clade 58 |
| 164: 1->0 | 33: 0->1 | 112: 0->1 | NUC |
| 167: 1->0 | 81: 0->1 | 156: 0->1 | Clade 59 |
| 168: 1->0 | 111: 0->1 | Clade 44 | 25: 0->1 |
| 179: 0->1 | 119: 0->1 | 132: 0->1 | 70: 0->1 |
| 197: 2->1 | 137: 1->0 | 133: 0->1 | Clade 60: |
| 206: 0->1 | 150: 1->2 | Clade 45 | Pterygoplichthini |
| Clade 30: | 184: 0->1 | 74: 1->0 | 81: 1->2 |
| <i>Crossoloricaria</i> | 190: 0->1 | Clade 46 | 158: 1->0 |
| 4: 0->1 | Clade 38 | 23: 0->1 | 213: 0->1 |
| 103: 0->1 | 88: 2->3 | 91: 1->2 | Clade 61: |
| 129: 0->2 | 183: 0->2 | 99: 0->1 | <i>Hemiancistrus</i> |
| 163: 0->1 | 184: 1->2 | 178: 0->1 | <i>annectens</i> group |
| Clade 31 | Clade 39: | 199: 0->1 | 11: 0->1 |
| 23: 0->1 | <i>Corymbophanes</i> | Clade 47 | 74: 1->0 |
| 52: 2->0 | 15: 0->1 | 1: 1->0 | 112: 0->1 |
| 110: 1->0 | 16: 0->1 | 15: 0->1 | Clade 62 |
| 183: 0->1 | 30: 1->0 | 16: 0->1 | 133: 0->1 |
| 188: 0->1 | 46: 0->1 | 20: 1->0 | Clade 63: |
| Clade 32 | 58: 0->1 | 57: 2->1 | <i>Pterygoplichthys</i> |
| 11: 0->1 | 62: 0->1 | 92: 0->1 | 26: 2->0 |
| 98: 1->0 | 63: 0->1 | Clade 48 | 27: 1->2 |
| Clade 33 | 85: 0->1 | 74: 0->1 | 121: 1->2 |
| 14: 1->0 | 100: 2->1 | 120: 1->0 | 142: 0->1 |
| 81: 0->1 | 138: 1->0 | Clade 49 | Clade 64 |
| 97: 2->1 | 192: 0->1 | 3: 1->2 | 91: 1->2 |
| 103: 0->1 | Clade 40: Rhineleporini | 4: 0->1 | Clade 65 |
| 134: 0->1 | 31: 0->1 | 8: 2->1 | 3: 1->2 |
| 197: 2->1 | 59: 0->1 | 15: 1->0 | 105: 1->2 |
| Clade 34 | 105: 1->2 | 24: 0->1 | Clade 66 |

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| 8: 2->1 | Clade 76: | 77: 0->1 | 34: 1->0 |
| 183: 2->0 | <i>Spectracanthicus</i> | Clade 88 | 42: 1->0 |
| Clade 67 | 55: 0->1 | 40: 0->1 | 111: 1->0 |
| 8: 2->1 | 58: 0->1 | 48: 0->1 | 116: 1->0 |
| 20: 1->0 | 98: 0->1 | 77: 1->2 | 135: 1->0 |
| 74: 1->0 | 143: 0->1 | Clade 89 | Clade 96 |
| 118: 0->1 | Clade 77 | 21: 0->1 | 77: 1->0 |
| Clade 68: Ancistrini | 158: 1->0 | 64: 1->0 | 121: 2->1 |
| 44: 1->2 | 199: 0->1 | 208: 1->2 | Clade 97 |
| 61: 0->1 | Clade 78 | 209: 1->2 | 157: 0->1 |
| 94: 1->0 | 16: 1->0 | Clade 90: Ancistrus | 185: 0->1 |
| Clade 69 | 26: 2->1 | 44: 1->2 | 188: 0->1 |
| 62: 0->1 | 33: 1->0 | 88: 3->2 | Clade 98: |
| 75: 0->1 | 57: 2->1 | 101: 0->1 | <i>Dolichancistrus</i> |
| 85: 0->1 | 112: 1->0 | 105: 1->2 | 122: 0->1 |
| 111: 1->2 | Clade 79 | 150: 1->2 | 125: 0->1 |
| Clade 70 | 15: 0->1 | 188: 1->0 | 166: 0->1 |
| 79: 0->1 | 91: 1->2 | 201: 1->0 | 177: 1->0 |
| 156: 0->1 | 94: 0->1 | 208: 2->3 | Clade 99 |
| 167: 1->0 | Clade 80 | Clade 91: | 7: 2->1 |
| Clade 81 | 1: 1->0 | <i>Lasiancistrus</i> | 8: 2->1 |
| 69: 0->1 | 46: 0->1 | 5: 0->1 | 14: 1->0 |
| 101: 0->1 | 99: 0->1 | 11: 0->1 | 17: 1->0 |
| Clade 72 | 132: 0->1 | 65: 0->1 | 23: 0->1 |
| 36: 1->0 | Clade 81: Panaque | 89: 0->1 | 26: 2->0 |
| 79: 1->0 | 36: 1->0 | 98: 1->0 | 30: 1->0 |
| 111: 2->1 | 67: 0->1 | 114: 0->1 | 32: 0->1 |
| 134: 0->1 | 97: 1->2 | 117: 0->1 | 40: 0->1 |
| Clade 73 | 205: 0->1 | 128: 0->1 | 41: 0->1 |
| 3: 1->0 | Clade 82 | 186: 0->1 | 48: 0->1 |
| 8: 2->1 | 53: 2->1 | Clade 92 | 52: 2->1 |
| 42: 1->0 | 136: 0->1 | 88: 3->2 | 57: 2->1 |
| 49: 0->1 | Clade 83 | 116: 0->1 | 68: 0->1 |
| 66: 1->0 | 3: 1->0 | 119: 1->0 | 69: 0->1 |
| 74: 1->0 | 29: 1->0 | 135: 0->1 | 71: 0->1 |
| 91: 1->2 | 91: 2->1 | 164: 1->0 | 100: 2->1 |
| 142: 0->1 | 199: 1->0 | Clade 93 | 122: 0->1 |
| 150: 2->1 | Clade 84 | 3: 1->0 | 125: 0->1 |
| 188: 0->1 | 3: 1->0 | 6: 0->1 | 157: 0->1 |
| 198: 0->1 | 85: 1->0 | 27: 1->0 | 167: 2->0 |
| Clade 74 | Clade 85 | 38: 0->1 | 173: 1->0 |
| 109: 0->1 | 98: 0->1 | 84: 0->1 | 205: 0->2 |
| 135: 0->1 | 121: 1->2 | 102: 0->1 | Clade 100: |
| 167: 0->1 | 160: 0->1 | 105: 1->0 | <i>Exastilithoxus</i> |
| Clade 75 | Clade 86 | 111: 2->1 | 42: 1->0 |
| 11: 0->1 | 1: 1->0 | 142: 0->1 | 81: 1->0 |
| 61: 0->1 | 134: 0->1 | 147: 0->1 | 100: 1->0 |
| 62: 0->1 | 150: 2->1 | 149: 0->1 | 168: 1->0 |
| 81: 1->2 | 158: 1->2 | 177: 0->1 | 171: 1->0 |
| 107: 0->1 | 167: 1->2 | Clade 94 | 207: 0->1 |
| 111: 1->2 | 169: 0->1 | 2: 0->1 | Clade 101: Lithoxus |
| 128: 0->1 | Clade 87 | 21: 0->1 | 3: 1->2 |
| 130: 0->1 | 39: 0->1 | 55: 0->1 | 47: 0->1 |
| 131: 0->1 | 42: 0->1 | 167: 2->1 | 58: 0->2 |
| 215: 0->1 | 75: 1->2 | Clade 95: | 93: 1->0 |
| | 76: 0->1 | <i>Chaetostoma</i> | 128: 0->1 |

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| 153: 0->1 | 23: 0->1 | <i>Leporacanthicus</i> | 109: 0->1 |
| 155: 0->1 | 49: 1->0 | 7: 2->1 | 113: 0->1 |
| 169: 1->0 | 69: 1->0 | 17: 1->0 | 116: 0->1 |
| 210: 0->1 | 91: 2->1 | 23: 0->1 | 143: 0->1 |
| 214: 0->1 | 92: 0->1 | 30: 1->0 | 156: 1->0 |
| Clade 102: | 101: 1->0 | 57: 2->1 | 209: 0->1 |
| <i>Dekeyseria</i> | 105: 1->0 | 67: 0->1 | <i>Pareiorhina rudolphi</i> |
| 26: 2->0 | 137: 0->1 | 71: 0->1 | 14: 1->0 |
| 125: 0->1 | 159: 0->1 | 83: 1->0 | 43: 0->1 |
| 155: 0->1 | 169: 0->1 | 90: 1->2 | 83: 0->2 |
| 198: 0->1 | 205: 2->0 | 92: 0->1 | 85: 0->1 |
| Clade 103: | <i>Baryancistrus</i> | 118: 0->1 | 156: 0->1 |
| <i>Neblinichthys</i> | 91: 1->2 | 197: 1->2 | <i>Pareiorhina sp.</i> |
| 1: 0->1 | 143: 0->1 | 203: 1->0 | 27: 1->2 |
| 37: 0->1 | <i>Cordylancistrus</i> | <i>Leptoancistrus</i> | 36: 1->0 |
| 46: 0->1 | 29: 0->1 | 1: 0->1 | 61: 0->1 |
| 65: 0->1 | 132: 0->1 | 45: 0->1 | 153: 0->1 |
| 128: 0->1 | <i>Delturus</i> | 48: 0->1 | 165: 0->1 |
| 199: 0->1 | 11: 0->1 | 137: 0->1 | 168: 1->0 |
| 200: 0->1 | 91: 1->2 | 138: 1->0 | <i>Pseudacanthicus</i> |
| Clade 104: | 97: 2->1 | 150: 1/2->4 | 15: 0->1 |
| <i>Pseudancistrus</i> | 121: 1->2 | 167: 1->0 | 70: 0->1 |
| 34: 1->0 | 142: 0->1 | 169: 1->0 | 88: 3->2 |
| 35: 0->1 | 143: 0->1 | 192: 0->1 | 112: 1->0 |
| 58: 0->1 | 148: 1->0 | <i>Lithogenes</i> | 129: 2->0 |
| 105: 1->0 | 156: 0->1 | 1: 1->0 | 160: 0->1 |
| 117: 0->1 | <i>Hemiancistrus</i> | 28: 0->1 | <i>Pseudolithoxus</i> |
| 172: 0->1 | <i>landoni</i> | 34: 0->1 | 27: 1->0 |
| Clade 105 | 11: 0->1 | 44: 1->2 | <i>Pseudorinelepis</i> |
| 46: 0->1 | 29: 0->1 | 49: 0->1 | 1: 1->0 |
| 61: 1->0 | 70: 0->1 | 73: 0->1 | 11: 0->1 |
| 62: 1->0 | 158: 1->0 | 92: 0->1 | 27: 1->2 |
| 129: 0->2 | <i>Hemiancistrus sp.</i> | 97: 0->1 | 48: 0->1 |
| 188: 0->1 | Brazil | 110: 0->1 | 64: 1->2 |
| 208: 0->1 | 11: 0->1 | 116: 0->1 | 158: 1->0 |
| Clade 106 | 20: 1->0 | 126: 0->1 | 161: 0->1 |
| 1: 0->1 | 29: 0->1 | 132: 0->1 | 163: 1->0 |
| 111: 2->1 | 105: 1->0 | 169: 0->1 | 183: 0->2 |
| 112: 0->1 | 120: 1->3 | <i>Megalancistrus</i> | 188: 0->1 |
| 128: 0->1 | 137: 0->1 | 36: 0->1 | <i>Rhinelepis</i> |
| 184: 2->1 | 156: 0->1 | 53: 2->4 | 23: 0->1 |
| <i>Astroblepus</i> | 168: 1->0 | 55: 0->1 | 110: 1->0 |
| 21: 0->1 | 195: 1->0 | 74: 0->1 | 153: 0->1 |
| 24: 0->1 | 197: 1->2 | 98: 0->1 | 155: 0->1 |
| 27: 1->0 | <i>Hemipsilichthys?</i> | 117: 0->1 | <i>Upsilonodus</i> |
| 44: 1->0 | 4: 0->1 | 134: 1->0 | 21: 0->1 |
| 67: 0->1 | 7: 1->2 | 156: 1->0 | 121: 1->0 |
| 74: 0->1 | 35: 0->1 | <i>Parancistrus</i> | 126: 0->1 |
| 96: 0->2 | 43: 0->1 | 3: 1->0 | 132: 0->1 |
| 167: 0->1 | 46: 0->1 | 22: 0->1 | 152: 0->1 |
| 174: 0->1 | 57: 2->1 | 40: 0->1 | 157: 0->1 |
| 175: 2->4 | 88: 1->2 | 44: 2->1 | 172: 1->0 |
| 196: 2->0 | 157: 0->1 | 48: 0->1 | |
| <i>Acanthicus</i> | 169: 0->1 | 55: 0->1 | |
| 8: 1->2 | 196: 2->3 | 81: 1->2 | |

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