**Appendix table 1.** **Study specimens, morphological data and scan data sources.** CP, cribriform plate surface area; OOL, occipital-orbit length (occipital condyle to anterior orbit border); SkL, Skull length (occipital condyle to prosthion), SnL, Snout length (anterior orbit border to prosthion) F, female; M, male; U, unknown sex. Museums and collections: H, Illinois State Museum; IZCA, Institute of Zoology of the Chinese Academy of Sciences; LACM, Museum of Natural History Los Angeles; MFWP, Montana Fish, Wildlife and Parks; MVZ, Museum of Vertebrate Zoology UC Berkeley; SO, Southwest Fisheries; UCLA, Donald R. Dickey Collection; USNM, National Museum of Natural History. Habitats: T, terrestrial; A, aquatic, SA, semi-aquatic.

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| **Species** | **Common name** | **Sex** | **ID number** | **CP (mm2)** | **OOL  (mm)** | **SkL (mm)** | **SnL (mm)** | **Habitat** |
| *Mephitis mephitis* | Striped skunk | M | USNM147553 | 334.65 | 56.49 | 79.78 | 23.29 | T |
| *Mephitis mephitis* | Striped skunk | F | UCLAJXS001 | 279.35 | 50.05 | 70.35 | 20.3 | T |
| *Enhydra lutris* | Sea otter | M | SO2951 | 363.13 | 113.93 | 133.2 | 19.27 | A |
| *Enhydra lutris* | Sea otter | F | SO2853-97 | 321.03 | 106.29 | 126.94 | 20.65 | A |
| *Gulo gulo* | Wolverine | M | USNM314885 | 889.6 | 103.6 | 173.36 | 69.76 | T |
| *Gulo gulo* | Wolverine | F | USNM157327 | 813.88 | 100.78 | 152.5 | 51.72 | T |
| *Lontra canadensis* | No. Amer. river otter | M | UCLA15275 | 223.29 | 87.14 | 121.93 | 34.79 | SA |
| *Lontra canadensis* | No. Amer. river otter | F | UCLA18958 | 280.77 | 89.24 | 121.02 | 31.78 | SA |
| *Mustela frenata* | Long tailed weasel | M | USNM52702 | 70.43 | 38.54 | 49.78 | 11.24 | T |
| *Mustela frenata* | Long tailed weasel | F | USNM95054 | 49.5 | 31.55 | 40.27 | 8.72 | T |
| *Neovison vison* | American mink | M | UCLA8488 | 125.09 | 59.96 | 73.51 | 13.55 | SA |
| *Taxidea taxus* | American badger | M | UCLA14841 | 558.62 | 78 | 121.79 | 43.79 | T |
| *Taxidea taxus* | American badger | F | LACM45012 | 644.17 | 86.3 | 128.99 | 42.69 | T |
| *Potos flavus* | Kinkajou | M | USNM291066 | 268.54 | 66.76 | 88.71 | 21.95 | T |
| *Potos flavus* | Kinkajou | F | LACM07241 | 228.84 | 64.56 | 87.45 | 22.89 | T |
| *Procyon lotor* | Raccoon | M | LACM52261 | 353.08 | 75.53 | 120.95 | 45.42 | T |
| *Procyon lotor* | Raccoon | F | LACM07241 | 412 | 77.94 | 122.62 | 44.68 | T |
| *Ailuropda melanoleuca* | Giant panda | U | CAS6072 | 741.58 | 170.52 | 247.93 | 77.41 | T |
| *Ursus americanus* | American black bear | M | USNM22070 | 2218.1 | 178.74 | 231.46 | 52.72 | T |
| *Ursus americanus* | American black bear | F | USNM211397 | 1339.4 | 129.79 | 261.7 | 131.91 | T |
| *Ursus americanus* | American black bear | M | MVZ162985 | 1607.4 | 196.6 | 301.2 | 104.6 | T |
| *Ursus arctos* | Grizzly bear | M | USNM82003 | 2964.9 | 237.14 | 371.24 | 134.1 | T |
| *Ursus arctos* | Grizzly bear | F | USNM98062 | 2317.9 | 205.65 | 325.7 | 120.05 | T |
| *Ursus arctos* | Grizzly bear | U | MFWP113 | 1467.8 | 194.8 | 277.88 | 83.08 | T |
| *Ursus maritimus* | Polar bear | F | MVZ123991 | 2453.6 | 232.1 | 329.2 | 97.1 | T |
| *Ursus maritimus* | Polar bear | M | H001\_51 | 2800.1 | 266.74 | 374.41 | 107.67 | T |
| *Ursus maritimus* | Polar bear | U | USNM275072 | 3523.5 | 279.7 | 395.22 | 115.52 | T |
| *Erignathus barbatus* | Bearded seal | M | LACM072575 | 337.6 | 139.56 | 195.57 | 56.01 | A |
| *Erignathus barbatus* | Bearded seal | F | LACM072576 | 468.15 | 155.01 | 222.8 | 67.79 | A |
| *Hydrurga leptonyx* | Leopard seal | M | USNM270326 | 992.41 | 254.23 | 374.49 | 120.26 | A |
| *Hydrurga leptonyx* | Leopard seal | F | USNM269533 | 973.3 | 273.88 | 385.05 | 111.17 | A |
| *Leptonychotes weddellii* | Weddell seal | F | MVZ127755 | 548.55 | 214.5 | NA | NA | A |
| *Lobodon carcinophagus* | Crabeater seal | U | MVZ127751 | 552.23 | 175.53 | 246.13 | 70.6 | A |
| *Lobodon carcinophagus* | Crabeater seal | F | MVZ127754 | 541.97 | 156.11 | 218.79 | 62.68 | A |
| *Mirounga angustirostris* | No. elephant seal | F | MVZ 184140 | 310.62 | 181.51 | 241.74 | 60.23 | A |
| *Mirounga angustirostris* | No. elephant seal | M | LACM054394 | 729 | 352.92 | 481.74 | 128.82 | A |
| *Mirounga leonina* | So. elephant seal | M | LACM084290 | 755.24 | 365 | NA | NA | A |
| *Mirounga leonina* | So. elephant seal | F | LACM084245 | 575 | 264.93 | NA | NA | A |
| *Neomonachus schauinslandi* | Hawaiian monk seal | U | LACM54438 | 453.85 | 184.95 | NA | NA | A |
| *Neomonachus schauinslandi* | Hawaiian monk seal | U | LACM53325 | 451.18 | 176.64 | 230.72 | 54.08 | A |
| *Neomonachus tropicalis* | Tropical monk seal | M | USNM100358 | 510.89 | 187.09 | 268.61 | 81.52 | A |
| *Neomonachus tropicalis* | Tropical monk seal | F | USNM102527 | 407 | 170.38 | 236.7 | 66.32 | A |
| *Pusa sibirica* | Baikal seal | U | LACM52337 | 187.99 | 109.44 | 150.04 | 40.6 | A |
| *Phoca vitulina* | Harbor seal | U | UCLA1408 | 339.3 | 156.9 | NA | NA | A |
| *Phoca vitulina* | Harbor seal | M | LACM095963 | 295 | 125.21 | 167.61 | 42.4 | A |
| *Phoca vitulina* | Harbor seal | F | LACM31462 | 348.67 | 139.04 | 199.53 | 60.49 | A |
| *Pusa hispida* | Ringed seal | M | LACM54781 | 216.29 | 132.37 | 177.75 | 45.38 | A |
| *Pusa hispida* | Ringed seal | F | LACM22949 | 195.35 | 115.75 | 152.01 | 36.26 | A |
| *Arctocephalus galapagoensis* | Galapagos fur seal | M | LACM031309 | 524.4 | 152.22 | 199.69 | 47.47 | A |
| *Arctocephalus pusillus* | Cape fur seal | M | LACM052358 | 614.92 | 190.35 | 252.9 | 62.55 | A |
| *Arctocephalus pusillus* | Cape fur seal | F | LACM052359 | 396.92 | 155.49 | 196.77 | 41.28 | A |
| *Callorhinus ursinus* | Northern fur seal | M | LACM052343 | 453.18 | 144.56 | 194.96 | 50.4 | A |
| *Callorhinus ursinus* | Northern fur seal | F | LACM054630 | 411.63 | 149.01 | 188.51 | 39.5 | A |
| *Eumetopias jubatus* | Steller sea lion | M | LACM052314 | 1475.2 | 295.39 | 374.75 | 79.36 | A |
| *Eumetopias jubatus* | Steller sea lion | F | LACM052316 | 996.41 | 241.81 | 310.61 | 68.8 | A |
| *Otaria flavescens* | So. Amer. sea lion | M | LACM095756 | 681.19 | 237.95 | 335.19 | 97.24 | A |
| *Otaria flavescens* | So. Amer. sea lion | F | LACM095771 | 461.62 | 161.96 | 208.94 | 46.98 | A |
| *Zalophus californianus* | California sea lion | M | UCLA252 | 868.25 | 214.3 | 291.75 | 77.45 | A |
| *Zalophus californianus* | California sea lion | F | LACM95730 | 599.49 | 155.72 | 203.29 | 47.57 | A |
| *Zalophus californianus* | California sea lion | M | UCLA1118 | 888.52 | 200.39 | NA | NA | A |
| *Odobenus rosmarus* | Walrus | F | UCLA2471 | 1018.2 | 258.82 | 350.42 | 91.6 | A |
| *Odobenus rosmarus* | Walrus | M | UCLA15306 | 1104.7 | 270.46 | 367.47 | 97.01 | A |
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| **High resolution CT scanner** | **Scanning facility** |  |  |  |  |  |  |  |
| GE Phoenix nanotom s | Molecular Imaging Center, University of Southern California | | | | |  |  |  |
| Nikon Metrology XT H 225 ST | Molecular Imaging Center, University of Southern California | | | | |  |  |  |
| North Star Imaging ACTIS | The Univ. of Texas High-Resolution X-ray Computed Tomography Facility | | | | | | |  |
| Xradia microXCT | The Univ. of Texas High-Resolution X-ray Computed Tomography Facility | | | | | | |  |
| Siemens SOMATOM  Definition AS64 | Ronald Reagan Medical Center UCLA | | |  |  |  |  |  |
| **Imaging software** |  |  |  |  |  |  |  |  |
| Mimics v. 15.0-21.0 | Materialise; Leuven, Belgium | | |  |  |  |  |  |
| 3-Matics v. 7.0.1-13.0 | Materialise; Leuven, Belgium | | |  |  |  |  |  |
| Rhinoceros v. 4 | Robert McNeel and Associates | | |  |  |  |  |  |

**CONTACT FOR RESOURCE SHARING.**

Further information and requests for resources, scanning parameters, CT scan files, and 3D skull models should be directed to and will be fulfilled by the Lead Contact, Deborah Bird (dbirdseed@gmail.com).