## **Supporting Information**

## Gillis et al. 10.1073/pnas.1012968108

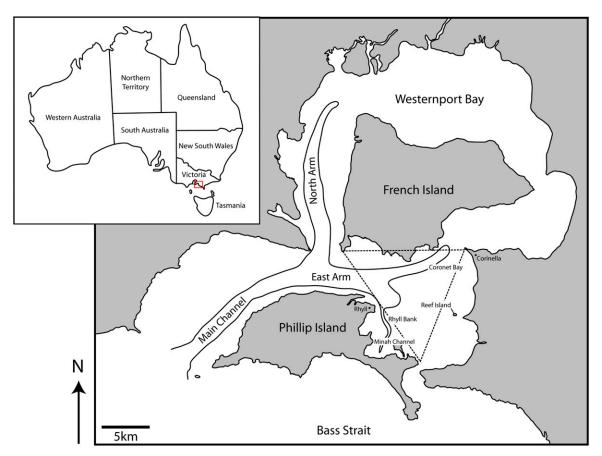


Fig. S1. The "elephant triangle" of Westernport Bay, Victoria, Australia. The red box in the inset map of Australia shows the location of Westernport Bay on the southern coast of Victoria. Westernport Bay contains two islands—French Island and Phillip Island. The elephant triangle (dashed line) is bound by French Island to the northwest, Phillip Island to the south, and Corinella to the northeast.

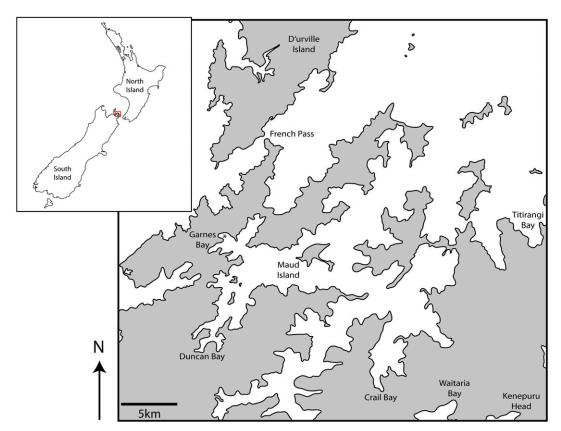


Fig. S2. Garnes Bay, Pelorus Sound, New Zealand. The red box in the inset map of New Zealand shows the location of Garnes Bay (asterisk) within Pelorus Sound on New Zealand's South Island.

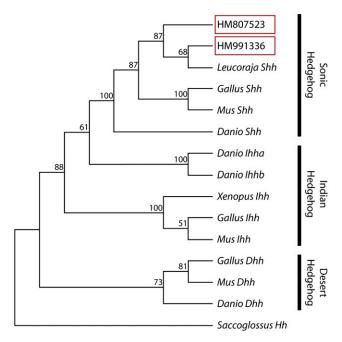


Fig. S3. Neighbor-joining analysis of predicted protein sequences of gnathostome Hedgehog (Hh) family members. Gnathostome Hh orthologs are abbreviated Shh (Sonic hedgehog), Ihh (Indian hedgehog), and Dhh (Desert hedgehog), and taxa included in the analysis were skate (*Leucoraja*), chicken (*Galus*), mouse (*Mus*), zebrafish (*Danio*), and frog (*Xenopus*). The single hemichordate (*Saccoglossus*) Hh ortholog was used to root the analysis. GenBank accession nos. HM991336 (*Scyliorhinus canicula Shh*) and HM807523 (*Callorhinchus milii Shh*) cluster with actinopterygian and tetrapod Shh orthologs. Figures adjacent to nodes are percentage support values from bootstrap resampling of the data (1,000 replicates).

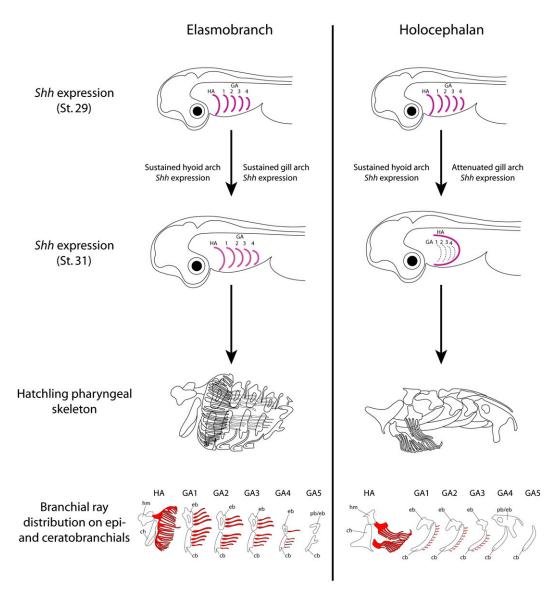


Fig. S4. Shh signaling and branchial ray distribution in chondrichthyans. In elasmobranchs (Left), Shh is expressed in the hyoid arch (HA) and gill arches (GA) at stage (st.) 29. This expression is sustained through st. 31 and beyond. This pattern of Shh expression correlates with the initiation and sustained outgrowth of branchial rays (solid red) from the hyomandibula (hm) and ceratohyal (ch) elements of the hyoid arch, and from the epibranchial (eb) and ceratobranchial (cb) elements of gill arches 1–4 (pb/eb refers to a compound pharyngobranchial/epibranchial cartilage). In holocephalans (Right), Shh is expressed in the hyoid arch and gill arches at st. 29, although Shh expression is sustained only in the hyoid arch at st. 31. This pattern of Shh expression correlates with the initiation and sustained outgrowth of branchial rays (solid red) from the hyomandibula (hm) and ceratohyal (ch) elements of the hyoid arch only, giving rise to the opercular skeleton. In the gill arches, branchial ray outgrowth is initiated but is not maintained, leaving behind only vestiges (light red) of gill arch branchial rays on the ceratobranchial elements of gill arches 1–3.