

### Supplementary Material

#### Genomic population structure of great hammerhead sharks (*Sphyrna mokarran*) across the Indo-Pacific

Naomi L. Brunjes<sup>A,\*</sup>, Samuel M. Williams<sup>A,B,C</sup>, Alexis L. Levengood<sup>A</sup>, Matt K. Broadhurst<sup>C,D</sup>, Vincent Raoult<sup>E</sup>, Alastair V. Harry<sup>F</sup>, Matias Braccini<sup>F</sup>, Madeline E. Green<sup>G</sup>, Julia L. Y. Spaet<sup>H</sup>, Michael J. Travers<sup>F</sup>, and Bonnie J. Holmes<sup>A</sup>

<sup>A</sup>University of the Sunshine Coast, School of Science, Technology and Engineering, Sippy Downs, Qld 4556, Australia.

<sup>B</sup>Department of Agriculture and Fisheries, Agri-Science Queensland, Dutton Park, Qld 4102, Australia.

<sup>C</sup>School of the Environment, The University of Queensland, St Lucia, Qld 4067, Australia.

<sup>D</sup>New South Wales Department of Primary Industries and Fisheries, Coffs Harbour, NSW 2450, Australia.

<sup>E</sup>Marine Ecology Group, School of Natural Sciences, Macquarie University, Ourimbah, NSW 2109, Australia.

<sup>F</sup>Western Australian Fisheries and Marine Research Laboratories, Department of Primary Industries and Regional Development, Government of Western Australia, North Beach, WA 6920, Australia.

<sup>G</sup>Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 49, Hobart, Tas., Australia.

<sup>H</sup>Evolutionary Ecology Group, Department of Zoology, University of Cambridge, Downing Street, Cambridge, CB2 3EJ, UK.

\*Correspondence to: Naomi L. Brunjes University of the Sunshine Coast, School of Science, Technology and Engineering, Sippy Downs, Qld 4556, Australia Email: [naomibrunjes@gmail.com](mailto:naomibrunjes@gmail.com)

**Table S1.** Year of collection for catch location of samples from great hammerhead (*Sphyrna mokarran*) sharks used for genetic population structure analysis.

<b>Location</b>	<b>Year collected</b>
Western Australia	2015–2021
Northern Territory	2016–2019
Gulf of Carpentaria	2016–2019
North-east Queensland	2018–2020
South-east Queensland	2003–2007 and 2019–2021
New South Wales	2016–2018
Red Sea	2011–2013

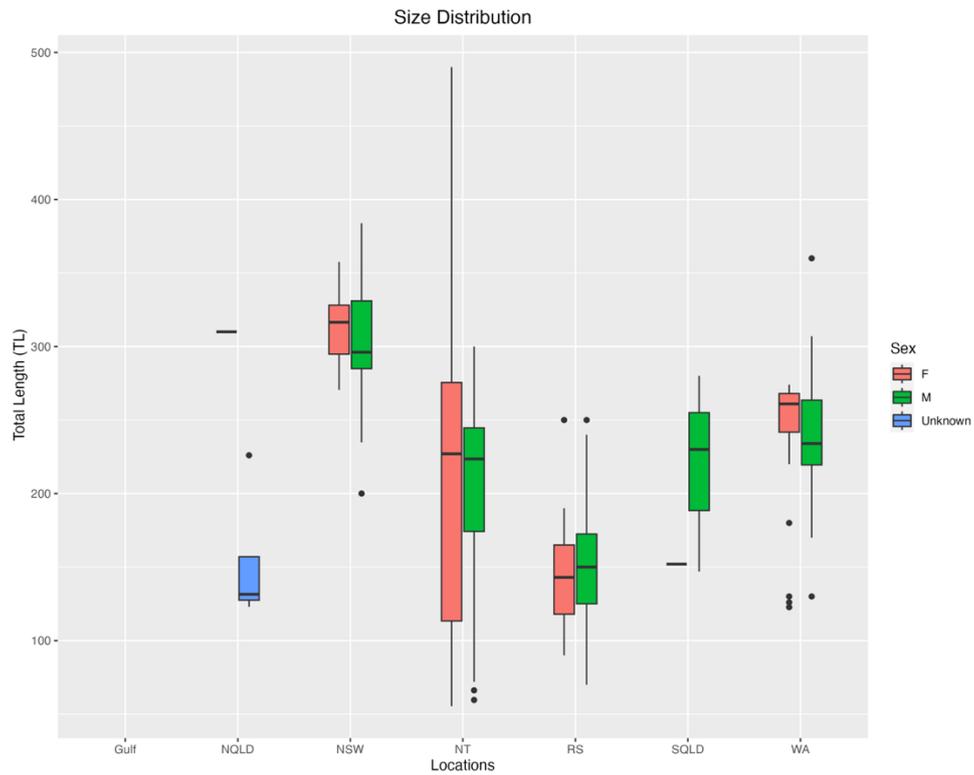
**Table S2.** Filtering process of samples of great hammerhead (*Sphyrna mokarran*) for genetic population structure analysis.

<b>Filtering step</b>	<b>Number of loci</b>	<b>Number of individuals</b>
Initial import	83,579	233
Filter monomorphic loci	–	–
Filter repeatability and reproducibility (0.99)	74,170 (9409 removed)	–
Filter monomorphic loci	–	–
Filter loci call-rate (0.7)	71,387 (2783 removed)	–
Filter individual call-rate (0.55)	–	213 (20 removed)
Filter monomorphic loci	26,057 (45,330 removed)	–
Filter secondaries	23,866 (2191 removed)	–
Filter minor allele frequencies (0.01)	4358 (19,508 removed)	–
Filter read depth (3–30)	4318 (40 removed)	–
Filter HWE		
Out any / Each population	4288 (30 removed)	–
Out across / All populations pooled	3915 (403 removed)	–
Sex linked loci (none detected)	–	–
Outflank outliers	3846 (69 removed)	
LEA / tess3r Admixture	3,846	211 (2 removed – outlier individuals)
DAPC	3,846	211
PCOA	3,846	211

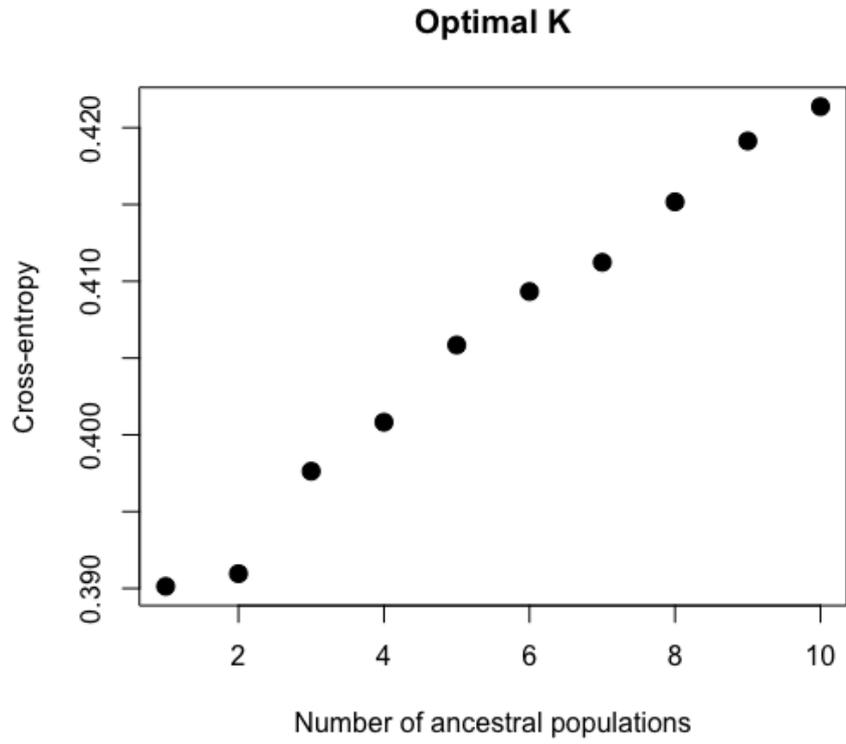
**Table S3.** Genetic distance matrix for great hammerhead (*Sphyrna mokarran*) samples based on Euclidean distance.

	<b>Gulf</b>	<b>Qld</b>	<b>NSW</b>	<b>NT</b>	<b>Red Sea</b>
<b>Qld</b>	3.3619	*	*	*	*
<b>NSW</b>	2.8516	2.9071	*	*	*
<b>NT</b>	3.2815	3.2555	2.8151	*	*
<b>Red Sea</b>	4.5556	4.5719	4.1690	4.4124	*
<b>WA</b>	2.7669	2.9282	2.3401	2.7857	4.1104

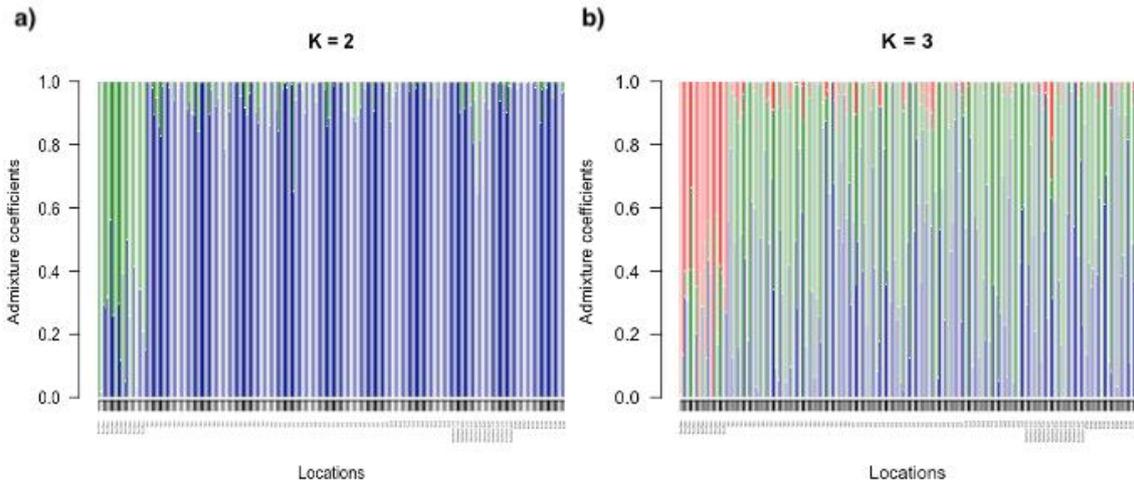
Gulf, Queensland Gulf of Carpentaria; Qld, Queensland; NSW, New South Wales; NT, Northern Territory; RS, Red Sea; WA, Western Australia.



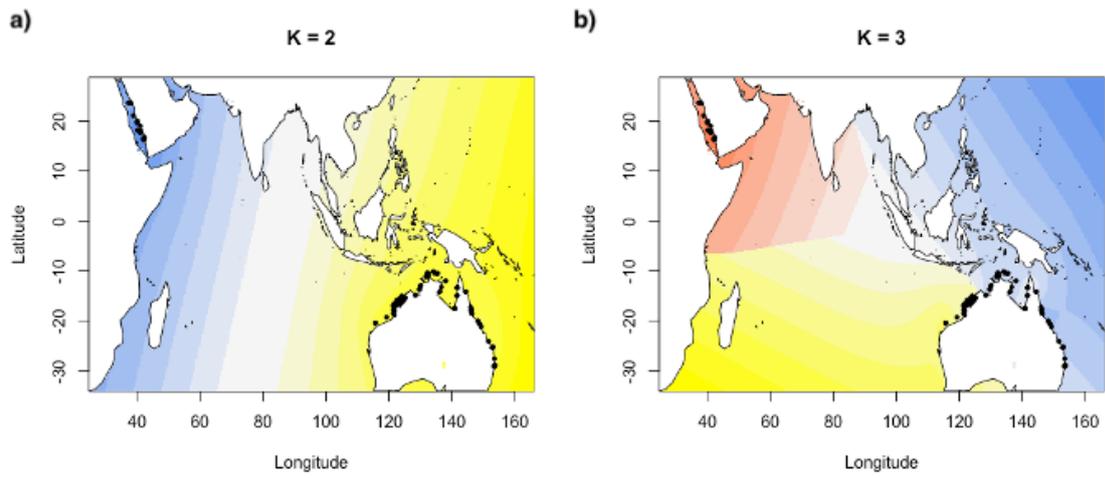
**Fig. S1.** Size distribution (total length, TL) for great hammerhead (*Sphyrna mokarran*) plotted from their catch location shown for each sex. Biological data for all Gulf and the majority of NQld individuals were unavailable. Gulf, Queensland Gulf of Carpentaria; NQld, northern Queensland; NSW, New South Wales; NT, Northern Territory; RS, Red Sea; QLD, southern Queensland; and WA, Western Australia.



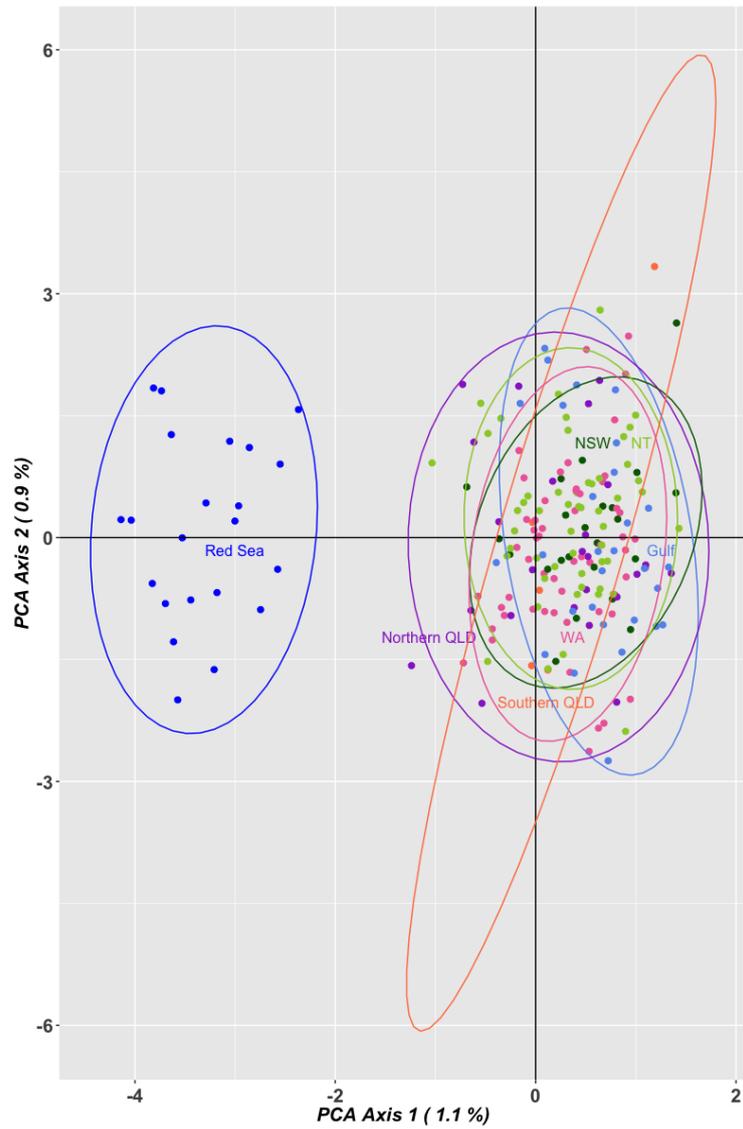
**Fig. S2.** The minimal cross-entropy in function of K for great hammerhead (*Sphyrna mokarran*) sampled across Australia and the Saudi Arabian Red Sea.



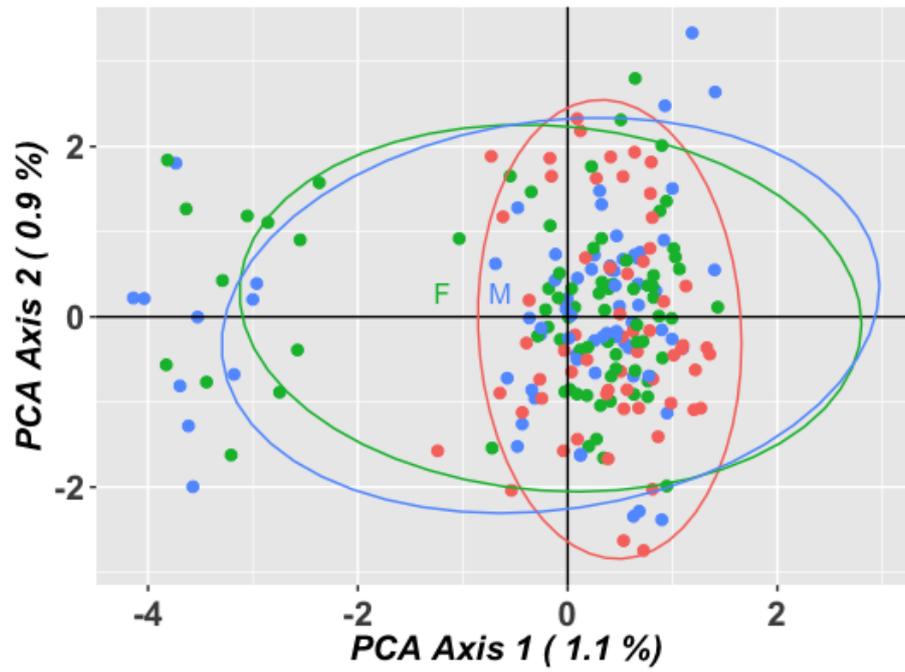
**Fig. S3.** The ancestry admixture proportion for each individual great hammerhead (*Sphyrna mokarran*) plotted against their catch location for scenario (a)  $K = 2$  and (b)  $K = 3$ . Colours represent the different admixture defined by  $K$ . Locations are ordered left to right from west to east: Red Sea, Western Australia (WA), Northern Territory (NT), Queensland Gulf of Carpentaria (Gulf), northern Queensland (Qld), southern Qld and New South Wales (NSW).



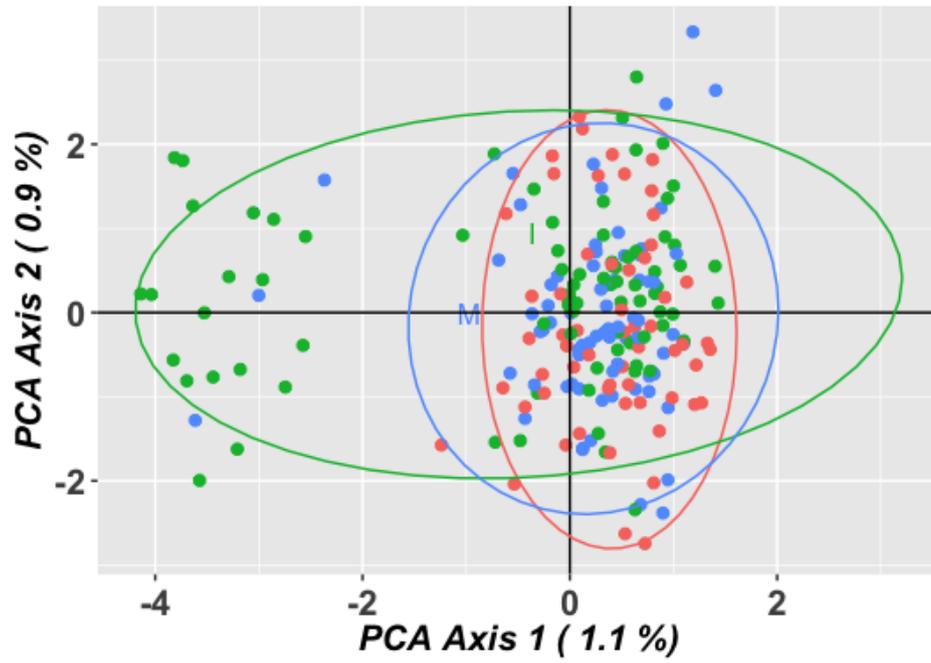
**Fig. S4.** The ancestry admixture proportion for each individual great hammerhead (*Sphyrna mokarran*) plotted from their catch location shown for scenario (a)  $K = 2$  and (b)  $K = 3$ . Colours represent the different admixture clusters defined by  $K$ .



**Fig. S5.** Scatterplot of great hammerhead (*Sphyrna mokarran*) Indo-Pacific structuring using PCoA modelling. The first two principal coordinate axes are shown with the amount of variance explained by each axis in parentheses.



**Fig. S6.** Sex distribution for great hammerhead (*Sphyrna mokarran*). Biological data for all Gulf and the majority of NQld individuals were unavailable. F (green), females; M (blue), males; orange, unknown sex.



**Fig. S7.** Maturity distribution for great hammerhead (*Sphyrna mokarran*). Biological data for all Gulf and the majority of NQld individuals were unavailable. I (green), immature; M (blue), mature; orange, unknown size.