Supplementary Material

**Untangling multi-species fisheries data with species distribution models**

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**Table S1**. Sources of sediment survey data used as inputs for habitat modelling. M/G/S = mud, gravel, and sand; CaCO3 = calcium carbonate.

|  |  |  |  |
| --- | --- | --- | --- |
| **Survey** | **M/G/S** | **CaCO3** | **Source** |
| Various  | 4,725 | 3,459 | MARS (Matthews 2007) |
| FRDC Project 2017-048 | 166 | 165 | Courtney et al. (2021) |
| Hervey Bay Coast | 721\*\* | 0 | Stephens et al. (1988) |
| Hervey Bay and its Estuaries | 47 | 0 | Ribbe (2014) |
| Southern Great Barrier Reef | 158 | 310 | Maxwell and Maiklem (1964) |
| Great Sand Strait | 85 | 0 | Tarabbia (1990) |
| GBR Banks | 0 | 1,605 | Harris et al. (2013) |
| Burdekin Region | 215 | 215 | Belperio (1978) |
| Townsville bug survey | 132 | 132 | Louw et al. (In review) |
| Bowen/Princess Charlotte Bay | 314 | 307 | Frankel (PhD thesis) |
| Hinchinbrook and Halifax Bay | 131 | 131 | Orpin (PhD thesis) |
| Northern GBR Reefs | 67 | 67 | Flood Orme Scoffin (1978) |
| **Total**  | **6,761** | **5,851** |  |

**Table S2**. Covariates used in the modelling of sediment properties.

|  |  |
| --- | --- |
| **Covariate description** | **Source** |
| Bathymetry (m) | Beaman (2010) |
| Aspect (degrees) | “ “ |
| Slope (degrees) | “ “ |
| Standard Deviation of bathymetry within a 3x3 kernel (100 m resolution) | “ “ |
| Standard Deviation of bathymetry within a 3x3 kernel (1,000 m res.) | “ “ |
| Topographic position index within a 3x3 kernel (100 m res.) | “ “ |
| Topographic position index within a 3x3 kernel (1,000 m res.) | “ “ |
| Binary ‘bank’ or ‘not-bank’ raster | Harris et al. (2013) |
| Distance from banks (kilometres) | “ “ |
| Average significant wave height (m) | Steven et al. (2019) |
| Average significant wave direction (degrees) | “ “ |
| Average significant wave stress | “ “ |
| Maximum current velocity (m/s) | “ “ |
| Maximum current direction (degrees) | “ “ |
| Average current velocity (m/s) | “ “ |
| Average current direction (degrees) | “ “ |
| Major axis of the current ellipse  | “ “ |
| Minor axis of the current ellipse  | “ “ |
| Eccentricity of the current ellipse  | “ “ |
| Orientation of the current ellipse (degrees) | “ “ |
| Latitude (degrees) | N/a |
| Longitude (degrees) | N/a |
| Distance from the coast (kilometres) | N/a |
| Distance from the continental shelf (using 200 m depth contour) | N/a  |

**Table S3**. Results of Variance Explained by cross validation (VEcv) for sediment parameters modelled for use as predictor variables in *Thenus* species distribution models.

|  |  |  |
| --- | --- | --- |
| **Sediment parameter** | **VEcv score** | **VEcv rating** |
| Mud content | **63.5** | Good |
| Sand content | **52.7** | Good |
| Gravel content | **31.9** | Moderate |
| CaCO3 | **85.9** | Excellent |
| Mean grain size | **57.4** | Good |
| Very fine sand  | **38.6** | Moderate |
| Fine sand | **34.2** | Moderate |
| Medium sand  | **33.6** | Moderate |
| Coarse sand | **40.9** | Moderate |
| Very coarse sand | **32.2** | Moderate |
| Grain size St. Dev. | **37.3** | Moderate |
| Trask sorting coeff. | **23.5** | Poor |

**Table S4.** Raster variables trialled as predictors in modelling of *Thenus* species distributions.

|  |  |  |
| --- | --- | --- |
| **Variable**  | **Description** | **Source** |
| Bathymetry  | Depth to the seabed in meters | Beaman (2010) |
| Maximum current  | Maximum tidal current (knots) | Steven et al. (2019) |
| Distance from coast | Distance from the mainland (nm) | This study |
| Mean grain size | Sediment mean grainsize in Phi units | “ “ |
| Sediment SD | Standard deviation of sediment grainsize | “ “ |
| Mud fraction | Percent mud (<0.063mm) in sediment profile | “ “ |
| Very fine sand fraction | Percent very fine sand (0.63mm–0.125mm)  | “ “ |
| Fine sand fraction | Percent fine sand (0.125mm–0.25mm)  | “ “ |
| Medium sand fraction | Percent medium sand (0.25mm–0.5mm)  | “ “ |
| Coarse sand fraction | Percent coarse sand (0.5mm–1mm)  | “ “ |
| Very coarse sand fraction | Percent very coarse sand (1mm–2mm)  | “ “ |
| Gravel fraction | Percent gravel (>2mm) | “ “ |
| Calcium carbonate | Percent CaCO3 in sediment  | “ “ |