Supplementary Information S1

Artificial coastal infrastructure was categorised into 4 types: Breakwalls, Pontoons, Jetties, and Wharves.

1. Calculation of Linear Distance of coastal infrastructure (all locations)

Breakwall measurements were made by measuring the linear length of coastline they occupied in each model location. Wharves and Jetties extend away from the coast. Their extent was quantified as a linear measurement of the length of the structure (i.e. not by tracing each side). Marina pontoons are often configurated as main central walkways, with 'fingers' extending out to each side. The linear extent of marina pontoons was quantified by summing the length of the central walkway and the lengths of the fingers along the central walkway.

2. Calculation of Surface Area of coastal infrastructure (New Zealand locations only)

The surface area of artificial structures at each location was measured and calculated using the Linear Distances calculated as described above, depth data obtained from Land Information New Zealand (LINZ) Data Service bathymetric maps and, depending on structure type, specific measurements or assumptions.

Depth of breakwalls, wharves and jetties

When a mapped structure crossed multiple depths on the bathymetry chart, the average depth was calculated (this average was not weighted). The depth datum used was Mean Low Water Spring tides (MLWS).

Surface Area Calculations

Breakwalls:

- Surface Area = Linear Distance (m) * Depth MLWS (m)

Jetties:

Based on the authors' personal observations of coastal jetties around New Zealand and overseas, we assumed an average pile diameter of 0.5 m for all jetty piles, a distance of 7 m between successive rows of piles, and that each row consisted of 3 piles. The submerged surface area of jetties was calculated as:

- No. Piles = Linear Distance (m) / Pile Length Distribution (7) * Piles per Row (3)
- Surface Area = 2πr (~1.57) * Depth MLWS (m) * No. Piles

Wharves:

Based on the authors' personal observations of ports/commercial wharves around New Zealand and overseas, we assumed that all wharves consisted of wharf decks built upon an array of piles. We assumed an average pile diameter of 1 m, with a distance of 10 m between successive rows of piles, and that each row consisted of 1 pile for every 7 m of width. The submerged surface area of wharves was calculated as:

- No. Piles = Linear Distance (m) / Pile Length Distribution (10) * Width (m) / Pile Width Distribution (7)
- Surface Area = 2πr (~3.14) * Depth MLWS (m) * No. Piles

Pontoons:

Calculations were based on the authors' personal observations of recreational boating and marina facilities around New Zealand, plus additional Google Earth measurements obtained for three marinas. First, we assumed an average width of 1.5 m for all pontoons. In reality, the central walkway of a marina pontoon usually has a width of approx. 2 m, while its 'fingers' have widths of approx. 1 m. 'Intersections' between central walkway and successive fingers occur on average every 13.3 m. We assumed an average pontoon draft of 0.5 m. The submerged surface area of pontoons was calculated as:

- Surface Area = 2 * SUM[Linear Distance (m)] * Pontoon Depth (0.5 m) + SUM[Linear Distance (m)] * Pontoon Width (1.5 m)

Pontoon Piles:

Each 'intersection' of the central pontoon walkway with a perpendicular finger was associated with 3 pilings holding the pontoon in place. Pilings were assumed to have a diameter of 0.5 m.

- Surface Area = 2πr (~1.57) * AVERAGE[Depth MLWS (m)] * SUM[Linear Distance (m)] / Pile Length Distribution (13.3)

The surface area of the overall pontoon structures associated with a mapped location was the sum of the surface area of pontoons plus the surface area of all piles.