Identifying and quantifying the gaps in coastal sediment valuation: a case study of inter-tidal fisheries

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1. Introduction

Coastal fisheries utilizing inter-tidal habitats are often perceived as low value as they are data-limited, locally focussed, and largely unregulated. This is despite many of them having significant ecological impacts and extracting some of the most valuable organisms from the sea. However, these fisheries remain a critical gap in our understanding the value of these source habitats in terms of ecosystems goods and services. Using the collection of polychaete bait and the edible cockle from the Solent as a case study we calculate the current extent of source habitats and then integrated the retail value of these fisheries under different species population estimates and also habitat accessibility. These results will enable managers to incorporate these values to the other services and goods provided by intertidal sediments and, thus producing a holistic approach to valuation to inform sustainable management in the future.

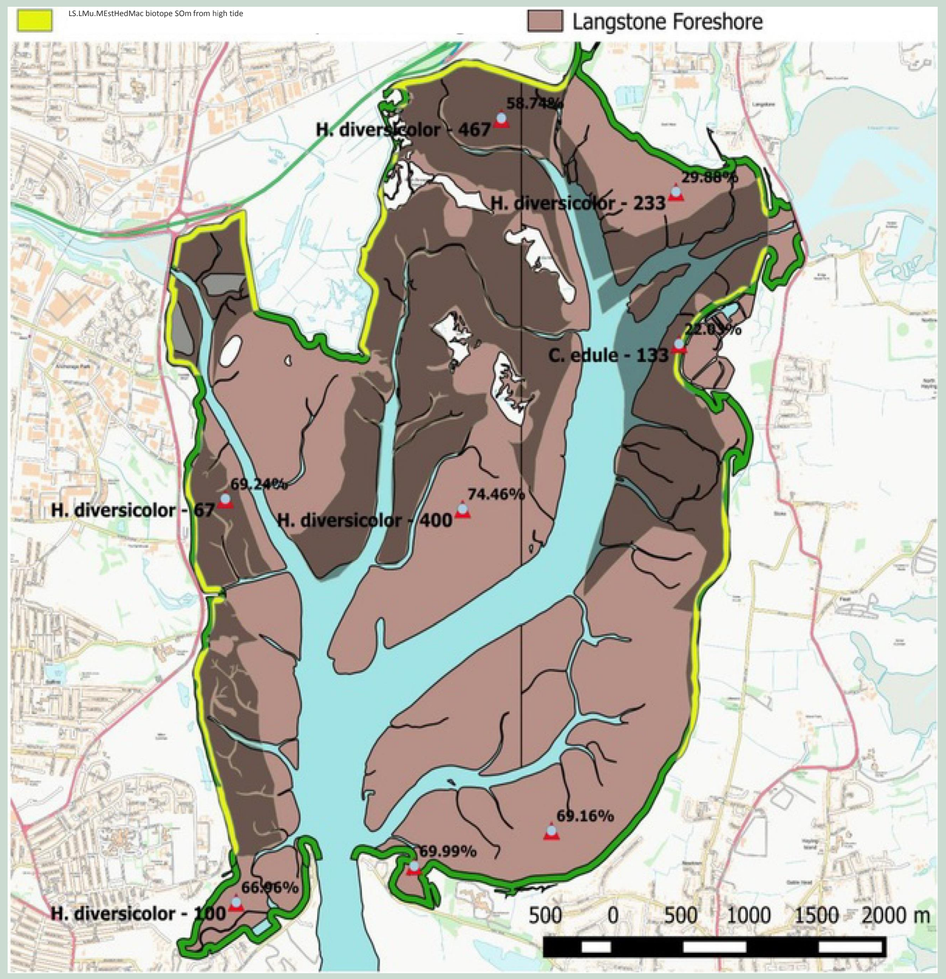
2. Methods

Four key species (the king ragworm: *Alitta virens*; lugworm: *Arenicola marina*; harbour ragworm: *Hediste diversicolor,* and edible cockle: *Cerastoderma edule*) were identified as being common species collected for food and bait in the UK (Figure 1). Collection methods are species-specific for inter-tidal soft sediments and include hand digging by fork and raking as well as dredging from boats. As such, the amount of accessible habitat to these fisheries is determined by the extraction method employed.

Using Langstone harbour (a fully marine sheltered harbour within the Solent as a case study we firstly calculated the amount of biotope available for each fishery/species. Using Quantum GIS (QGIS) we used the EUNIS LS.LMu.Mest.HedMac (*Hediste diversicolor* and *Macoma balthica* in littoral sandy mud) biotope from Thomas et al (2016) as the biotope most suitable baseline for the 4 species. This equated to 672.15 ha and is represented by the dark brown area in Figure 2. To reflect access by walking (used for cockle raking and hand digging) we then calculated the area of this biotope that was within 50 m of the high tide line. This equated to 45.17 ha and is represented by the yellow areas in Figure 2.

Fig. 1 a-d. Target species: a) king ragworms, b) cockles, c) lugworms and d) harbour ragworms.

Literature (see references section) was used to generate the population (low, median and high) densities for each species and associated mean individual weights. Value (retail price) per m^2 of sediment; biomass removed (tonnes); and value of the hypothetical fishery (biomass removed) was calculated for each species and the three population densities for the full biotope and the area 50 m below the high tide line.



GIS mapped area of Langstone Harbour, Solent. Light brown: full intertidal area (1491 ha); dark brown: LS.LMu.Mest.HedMac biotope (672 ha); green: intertidal sediment (50 m below high tide line (127 ha); yellow: LS.LMu.Mest.HedMac biotope 50 m below high tide line (45 ha).

3. Results

Species	Pop. density	Pop. den. (ind. m^{-2})	Individual weight (g)	Value (£ m^{-2})	Biotope (<50 m) Biomass removed (t) (45.17 ha)	Biotope (<50 m) Value (x £1000)	Full biotope Biomass removed (t) (672.15 ha)	Full biotope Value (x £1000)
Alitta virens	Low	10	3.3	1.1	15	484	218	7,208
	Median	23	3.5	2.8	38	1,268	572	18,865
	High	223	3.8	24.8	378	12,464	5,620	185,417
Arenicola marina	Low	8	1.3	0.4	4.9	198	73.6	2,946
	Median	44	2.5	4.4	50	1,980	737	29,472
	High	81	4.7	15.3	173	6,907	2,570	102,790
Hediste diversicolor	Low	35	0.39	0.4	6.1	191	92	2,884
	Median	430	0.41	5.7	80	2,466	1184	36,692
	High	8800	0.43	117.3	1,709	52,893	25,433	788,453
Cerastoderma edule	Low	33	7.7	0.3	23	126	342	1,881
	Median	104	13.8	1.6	129	710	1,917	10,563
	High	1250	18	24.8	2,032	11,195	30,246	166,597

4. Conclusions

1. Inter-tidal fisheries are of high value with 1 m^2 of sediment worth up to £117 depending on target species and population densities.
2. Langstone harbour as a resource could be worth between £100-788 million if exploited fully and depending on species.
3. Inter-tidal fisheries must be included in any valuation of ecosystems services and goods for coastal areas.
4. Significant resilience of inter-tidal sediment habitats compared to other biotopes could enable sustainable exploitation and management (i.e. farming) to be initiated.
5. Impacts on key species (e.g. wading birds) and long term stability of exploited populations must be assessed.
6. Value of the inter-tidal sediment could be impacted by anthropogenic stressors (pollution, climate change, algal mats).

5. References

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