Assessing the natural capital value of water quality using a EUNIS habitat classification approach

Stephen C. L. Watson\textsuperscript{a}, Joanne Preston\textsuperscript{b}, Gordon J. Watson\textsuperscript{a}
Charlotte Lines\textsuperscript{b}, Jackaline Mellan\textsuperscript{b}, Tim Sykes\textsuperscript{b}

\textsuperscript{a} Institute of Marine Sciences, School of Biological Sciences, University of Portsmouth, Ferry Road, Portsmouth PO4 9LY, UK.

\textsuperscript{b} Environment Planning and Engagement, Environment Agency, Canal Walk, Romsey, S051 7LP, UK

1 Introduction
Integrating the value of natural capital within economic and environmental management systems is gaining increasing attention and interest from the government, regulators, and companies. However, future coastal management interventions to improve water quality are often confounded by an inability to understand natural capital in terms of the function of critical habitats. Using the Solent region of the UK as a case study, we adopted a three-step approach to assess the contribution of marine habitats to remediating nitrogen and phosphorus impacts. This critical evidence base will enable coastal managers and regulators to ensure natural resources are given an appropriate level of protection, whilst supporting sustainable economic growth, which together deliver Net Environmental gain.

2. Methods
1) Information on EUNIS habitat extent for six main biotopes (littoral sediments, sublittoral sediments, saltmarsh, seagrass beds, water-fringing reedbeds (Phragmites australis) and native oyster beds (Ostrea edulis)) were collated into maps using GIS for the Solent (Figure 1)
2) We then combined measureable biophysical rates for nitrogen (N), and phosphorus (P) removal, as a function of denitrification and burial in soils and sediments. Rates were quantified from previous studies and literature reviews (see references) of coastal and estuarine habitats similar to those being restored in the Solent.
3) To estimate the economic value associated with nitrogen and phosphorus storage we used a replacement cost valuation method using actual costs of nutrient reduction measures undertaken on the UK’s southwest coast. Average abatement costs of reducing nitrogen and phosphorus from these sources are estimated here as £295 kg\textsuperscript{-1} for N and £282 kg\textsuperscript{-1} for P.

3. Results

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|}
\hline
Solent Region & Vegetated coastal habitats & Coastal and marine sediments & Native Oysters (Ostrea edulis) & Av Total Value (£) & Av Total Value (£) \\
\hline
Tonnes (yr\textsuperscript{-1}) & Nitrogen & Phosphorus & Nitrogen & Phosphorus & Nitrogen & Phosphorus & Nitrogen & Phosphorus \\
\hline
Lymington Estuary & 36 & 7 & 39 & 6 & 0 & 0 & £22,038,683 & £364,335 \\
Beaulieu Estuary & 41 & 9 & 45 & 6 & 0 & 0 & £25,214,822 & £889,390 \\
Southampton Water & 90 & 24 & 237 & 24 & 172 & 1.6 & £147,329,649 & £176,060 \\
Portsmouth Harbour & 58 & 10 & 178 & -59 & 83 & 0.8 & £94,406,444 & £13,694,987 \\
Langstone Harbour & 65 & 11 & 266 & -78 & 147 & 1.3 & £140,839,933 & £18,645,053 \\
Chichester Harbour & 151 & 23 & 388 & -53 & 130 & 1.2 & £197,445,259 & £8,346,847 \\
Pagham Harbour & 49 & 8 & 44 & -6 & 0 & 0 & £27,367,551 & £695,895 \\
Western Yar Estuary & 18 & 6 & 10 & -1 & 0 & 0 & £8,320,171 & £1,167,101 \\
Newport Harbour & 23 & 3 & 37 & -10 & 0 & 0 & £17,817,545 & £2,068,536 \\
Medina Estuary & 13 & 2 & 12 & -4 & 0 & 0 & £7,381,323 & £387,502 \\
Bembridge Harbour & 2 & 0 & 6 & -2 & 0 & 0 & £2,471,696 & £360,321 \\
Solent (open water) & 193 & 43 & 544 & -32 & 316 & 2.8 & £310,846,082 & £4,718,972 \\
Total & 739 & 145 & 1807 & -282 & 849 & 8 & £1,001,479,218 & £35,491,294 \\
\hline
\end{tabular}
\caption{EUNIS map of the Solent}
\end{table}

4. Conclusions
1. The biogeochemical data presented here provides a comprehensive view of N and P burial within both vegetated coastal habitats and marine sediments using a EUNIS habitats approach to assess stocks of natural capital.
2. The bioremediation potential of habitats in the Solent is of high value, providing nutrient reductions of ~3400 tonnes of N per year equivalent to just over £1 billion per year in avoided nitrogen abatement costs.
3. Coastal and offshore sediments are the largest stores for N in the Solent while vegetated coastal habitats are the most efficient per m\textsuperscript{2} in removing P.
4. Future accrual of value associated with maintaining usable clean water could rapidly increase when taking into account the additional costs of water treatment infrastructure that is likely as the region’s population continues to grow.

5. References