

Northumberland and North Tyneside Rocky Reef and Foreshore 'Coastal Squeeze' Study

Executive Summary

1 Background and Links with the Shoreline Management Plan 2

The Northumberland and North Tyneside *Shoreline Management Plan 2* ('the SMP2') was undertaken by Royal Haskoning on behalf of the Local Authorities, the Environment Agency, Natural England and the Northumberland Coast AONB between September 2007 and May 2009. The SMP2 was then 'signed-off' by relevant organisations and adopted by the relevant authorities throughout the remainder of 2009.

In signing-off the SMP2, Natural England identified an issue considered to be of national significance relating to the potential impact of SMP2 policies on designated areas of inter-tidal rocky reef and foreshore within the Berwickshire and North Northumberland Coast SAC, the Northumbrian Coast SPA, and the various SSSIs. This was particularly associated with SMP2 policies in future epochs (rather than being an immediate 'showstopper') due to ongoing concerns relating to climate change and predicted sea level rise.

During the SMP2 development, a semi-quantitative assessment was made of the impact of SMP2 policies on environmental receptors. This identified impacts of minor and major positive or negative significance and was deemed suitable to meet the requirements of the Strategic Environmental Assessment (SEA) Directive. In addition, the implications of SMP2 policies on all designated sites (including the 'rocky shore' within the SPA, the 'inter-tidal reefs' within the SAC, and the 'inter-tidal rock' within the various SSSIs) was assessed qualitatively in terms of gain or loss in each Management Area of the SMP2.

The methodology for this assessment was developed jointly by Royal Haskoning and Natural England and its results satisfied Natural England that the SMP2 could be signed-off without recourse to the Secretary of State under the Habitats Regulations. However, this sign-off of SMP2 was conditional upon the progression of further quantitative studies of future inter-tidal rocky reef and foreshore habitat gains and losses, which is the purpose of the present study, prior to development of the future SMP3.

2 What is 'Coastal Squeeze' of Rocky Reef and Foreshore?

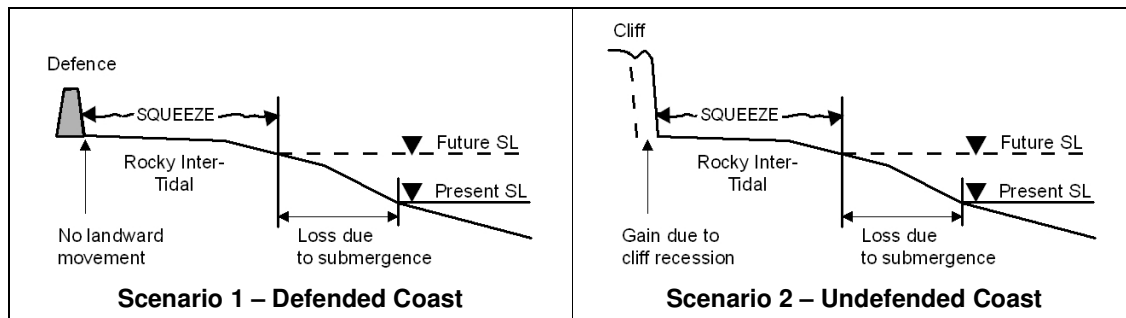
'Coastal Squeeze' occurs due to sea level rise and is a consequence of the low water mark migrating landwards while the high water mark remains static or migrates landwards more slowly, leading to a gradual loss, or 'squeeze', of the inter-tidal area. In Northumberland and North Tyneside the issue of rocky reef and foreshore loss associated with coastal squeeze can arise under two scenarios.

Scenario 1 – Defended Coast

Along managed frontages, where the foreshore is backed by coastal defences such as sea walls, the rocky inter-tidal areas will become progressively 'squeezed' between a rising low water level (due to submergence associated with sea level rise) and a static back-stop defence.

Scenario 2 – undefended Coast

Along undefended frontages, the process of submergence at the seaward end of the rocky foreshore profile will continue, but at the upper profile landward cliff recession will result in the emergence of some new underlying rock which will form part of the new upper foreshore. Due to differences in profile gradient between the lower and upper foreshores, and due to the relative resistance of the cliff geology, the rate of low water submergence of the foreshore will be greater than the rate of upper foreshore gain through cliff recession and therefore there will still be a net loss associated with 'coastal squeeze'.



3 What is the Purpose of the Study?

The purpose of the study has been to objectively quantify the individual gains and losses of inter-tidal rocky reef and foreshore in order to calculate the net loss over the next 20, 50 and 100 years due to SMP2 policies and processes of coastal squeeze associated with sea level rise. In doing this, opportunities for habitat creation have also been considered in attempt to mitigate and/or compensate for the losses, and advice has been provided on the future monitoring and general implications for the future SMP3.

4 Study Methodology

- (1) **Desk Top Study** – Existing information and data was collated and reviewed, including the SMP2, aerial photographs, Futurecoast, and Lidar data. In addition, the United Kingdom Climate Impacts Programme '09 (UKCP09) User Interface was interrogated to obtain the full range of future sea level rise projections at principal locations under the 'low', 'medium' and 'high' greenhouse gas emissions scenarios for the next 20, 50 and 100 years. The 'medium' scenario was then taken as the basis for assessments within this study.
- (2) **Consultation** – Consultation was undertaken at the outset of the study to engage with key organisations in order to: (i) raise awareness of the study; (ii) identify any relevant data sources; and (ii) establish the aspirations of key stakeholders for the future management of inter-tidal rocky reef and foreshore habitats.
- (3) **Scoping Report** - Based on the findings of tasks 1 and 2, a Scoping Report was prepared which described in detail the methodology to be adopted to achieve the aims and objectives of the study, whilst taking into account specific aspirations and data availability.
- (4) **Analysis** – The main technical stage of the study focused on identifying and quantifying potential areas of Coastal Squeeze. A suite of Digital Ground Models (DGMs) was created using Geographic Information Systems (GIS) computer software for the study frontage. The areas of potential Coastal Squeeze (under Scenarios 1 and 2) were then located in the GIS by superimposing the mapping of:
 - the location of rocky reefs and foreshores contained in the SMP2 database,
 - the locations of coastal defences and cliff features,
 - future water level scenarios for the next 20, 50 and 100 years which were derived from UKCP09 ('medium' emissions scenario), and
 - geomorphological interpretation of future cliff recession lines for the next 20, 50 and 100 years contained within the SMP2 database.

The analysis process then assessed the potential areas of Coastal Squeeze within each Policy Development Zone (PDZ) of the SMP2 study area to quantify:

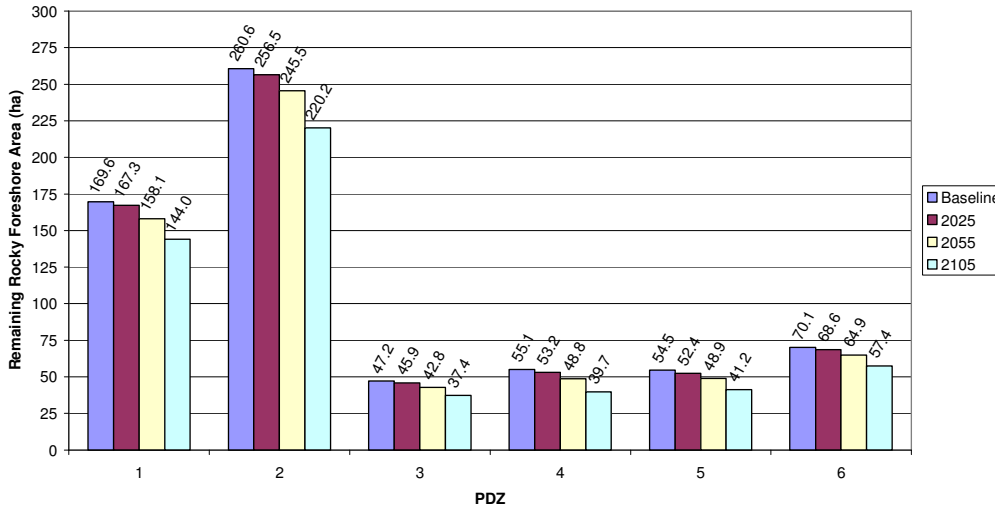
- (a) the habitat loss due to submergence of the low water rocky foreshore (Scenarios 1 and 2),
- (b) the gain that will occur in the upper rocky foreshore (Scenario 2), and
- (c) the net loss of rocky reef and foreshore over epochs of 20, 50 and 100 years.

5 What Are the Main Findings?

(a) Rocky Foreshore Loss Due to Submergence under Rising Sea Levels

With sea level rise, it has been calculated that all PDZs will lose rocky foreshore area due to submergence under rising sea levels between the baseline and the three future epochs.

Loss Due to Submergence of Rocky Foreshore Area due to Sea Level Rise over Future Epochs

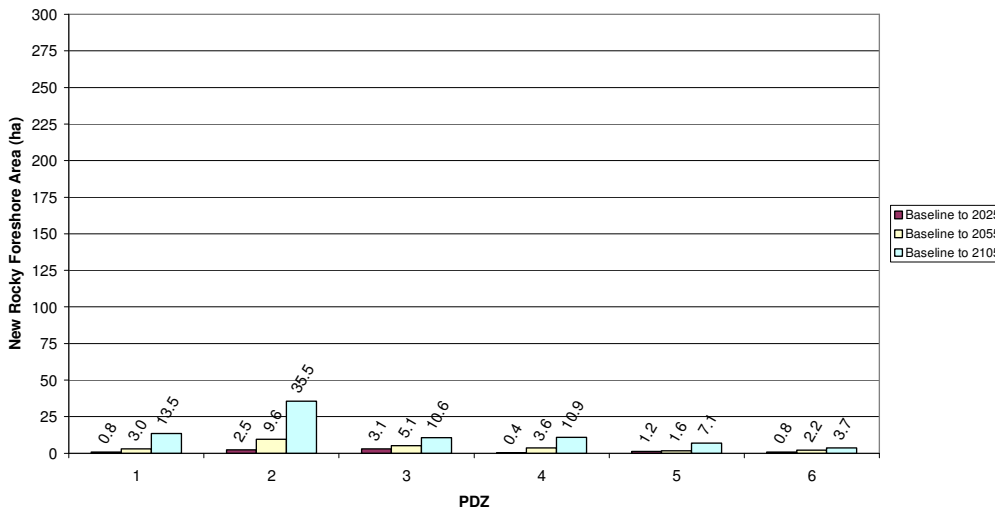


Considering the SMP2 area as a whole, the loss due to submergence is 13.2ha by 2025, 48.0ha by 2055 and 117.2ha by 2105.

(b) Gain in Rocky Foreshore Due to Erosion

Based upon the SMP2 erosion lines, it has been calculated that all PDZs will gain rocky foreshore area due to emergence as cliffs and dune erode landwards between the baseline and the three future epochs.

Gain Due to Emergence of Rocky Foreshore Area due to Coastal Recession over Future Epochs

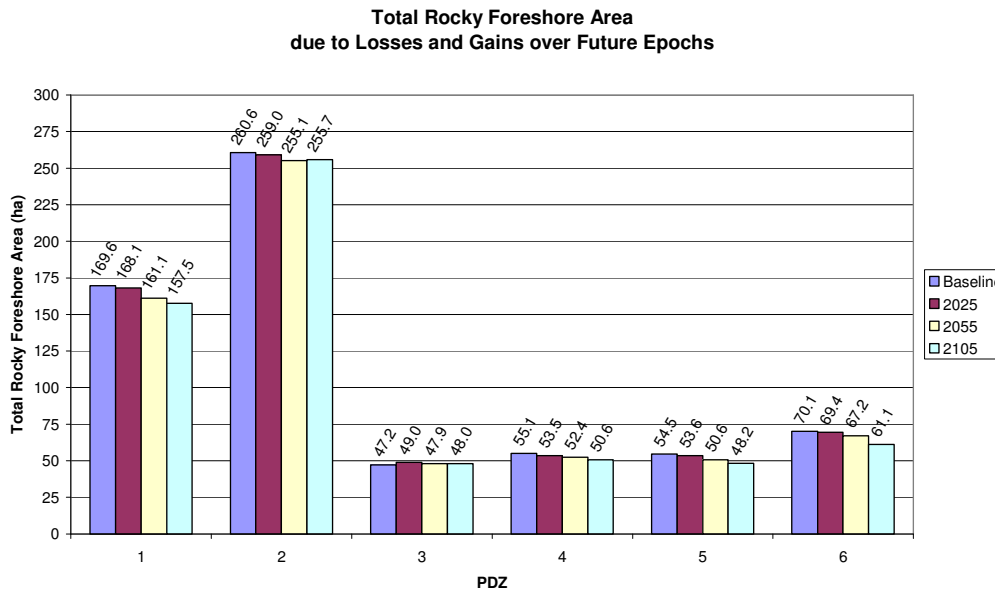


Considering the SMP2 area as a whole, the gain due to erosion is 8.8ha by 2025, 25.2ha by 2055 and 81.3ha by 2105.

The gains in habitat will occur where policies of 'No Active Intervention' or 'Management Realignment' are applicable. Where 'Hold the Line' is the preferred option, no new rocky foreshore will emerge as the cliffs or dunes will be stabilised in position, generally by coastal defence structures. Opportunities to identify further new areas for rocky foreshore habitat creation beyond those delivered by NAI or MR policies from the SMP2 are limited.

(c) Net Change in Rocky Foreshore

The net change in rocky foreshore area in each epoch has been calculated by considering both the losses due to submergence under a rising sea level and the gains from coastal erosion.



Considering the SMP2 area as a whole, there will be a net loss of rocky foreshore of 4.5ha by 2025. This represents 0.7% of the baseline area. By 2055, the loss is projected to have increased to 22.8 ha, representing 3.5% of the baseline, and by 2105 some 35.9ha, or 5.5% of the baseline, will have been lost.

It should be noted, however, that the uncertainty associated with the medium and longer term epochs increases as projections of climate change and estimates of erosion rates become more uncertain. Due to this, monitoring of climate change and coastal change is important.

6 Where Can I Find More Information?

The Northumberland and North Tyneside Rocky Foreshore 'Coastal Squeeze' Study has produced two technical reports:

- Scoping Study (April 2010)
- Study Report (October 2010)

Both of these reports are available to download from the SMP2 website:

www.northumberland-smp2.org.uk