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REPLACEMENT LYMINGTON TO YARMOUTH FERRIES

SALTMARSH RECESSION APPRAISAL

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C O N T E N T S

1. INTRODUCTION

1.1.1 Lymington lies within a small estuary formed by the Lymington River within the western arm of the Solent. The Lymington channel and estuary are dominated by tidal processes and have limited fluvial inputs of both water and sediment. The upstream reach of the estuary was cut off by the construction of a road causeway in 1731 which resulted in the sluicing of freshwater inputs to the estuary and therefore a reduction in velocity of the freshwater input. The causeway also reduced ebb tidal currants in the main channel and increased sediment rates downstream. More recently the sediment balance of the estuary has been affected by the construction of a 300-berth marina in 1966, and a 450-berth facility in 1972 (1).The tidal curve is subject to a double stand in water levels on the flood tide, which results in a double high water and a shorter duration ebb tide with higher velocities. In the estuary the tidal range varies from 2.3m in springs to 1.2m on neaps (1).

1.1.2 In common with the rest of the Solent area the sites geomorphological evolution since the late Pleistocene, from a costal fluvial valley to a coastal embayment is continuing. Most of the saltmarsh lies in the lee of the Hurst Spit and within the Lymington estuary. The shelter and reduced wave-energy environment which the spit and estuary provide (together with the shelter provided by the Isle of Wight), is mainly responsible for the estuaries existence. (2)

1.1.3 Hurst spit is vital to the continuance of the saltmarsh habitat in the estuary and beach recharge schemes and rock revetments have prevented massive destruction of the saltmarsh to date. However, perceived acceleration of inter-tidal zone narrowing rates (as the edges of the marsh retreat), coupled with saltmarsh losses over large areas as a result of *Spartina anglica* die-back, are of concern. (2)

2. SALTMARSH RECESSION

2.1.1 A review of the historical development of the physical system (3), which was undertaken in 1993, explained both the patterns of sediment and water movement and provided a detailed erosion/accretion overview. This was achieved using aerial photography, map and chart comparison, surficial sediment sampling, topographical and geomorphological surveys, and sedimentological and chemical analyses. In terms of coastal geomorphology the study identified saltmarsh, inter-tidal flats, submerged peat/forest, beach, abrasion platform, clifflet, shingle spit, chenier and tidal-creek features. From this work, the controlling biophysical environment for the inter-tidal zone can be summarised as follows:

(i) The tidal regime comprises an asymmetric tidal curve with flood-tide duration being longer than ebb-tide duration. This results in greater ebb current speeds. Earlier research(4) observed maximum ebb-tidal currents of 1.1—1.5 times greater than flood-tide currents for the western Solent. Strong tidal currents ensure an active water exchange with offshore waters;

(ii) The wind/wave climate is controlled by predominantly south-westerly winds and waves of local origin with a limited significant wave height. However, extreme wave conditions are possible as a result of both easterly winds and a combination of strong winter winds with strong ebb tides;

(iii) Sedimentation characteristics suggest relatively low suspended-sediment concentrations, but high concentrations in the waters along the front edge of the saltmarsh;

(iv) Sea-level rise is accelerating and is reflected in increasingly frequent storm surge events (extreme high waters resulting from wind action on tide coinciding with low pressure systems); and

(v) Saltmarsh vegetation dominates the inter-tidal area at a height of 2.5-2.9 m (above chart datum). Mean water depth over the saltmarsh is 0.2-0.5 m during spring tides, therefore the vegetation serves to decrease current velocity and wave energy. [2]

2.1.2 On the basis of these points it is clear that saltmarshes within the estuary are not compatible with the present coastal hydrodynamics[3]. Overall sediment loss from the coastal saltmarsh system to the western Solent was calculated at an average rate of 10,000-120,000 m^2/annum [3]. This is a result of erosion along the seaward edge and inter-subtidal zones, which is only partially balanced by surface deposition. Tidal currents and waves in the western Solent are estimated to account for 68% of the erosion, with the remaining 32% being attributed to the landward movement of Hurst Spit[2]. Neither the high recreational use of the channel, nor the presence of the ferries, was implicated in the erosion of the marsh in this report. It should be noted that the landward movement of Hurst Spit has not been a factor since 1990, due to the programme of coastal-defence work which has maintained the crest level of the barrier beach, and thus prevented it from rolling back over saltmarsh areas[3].

2.1.3 During the period 1992-94, terminal saltmarsh cliff erosion was quantified at a maximum recession rate of 5-8 m/annum[6]. The tidal range of the estuary is only 2.5m on spring tides (+50% with extreme tidal surges), but there appears to be a strong correlation between exposure to wind/wave attack and rates of erosion. This strong correlation with wave action suggested that the presence or absence of vegetation did not appear to be a factor which influenced erosion rates, although the loss of *Spartina anglica* is often implicated in accelerated saltmarsh loss[2].

2.1.4 More recent figures calculated by the Solent Dynamic Coast Project [7] indicate continuing loss of saltmarsh at increasing rates. Aerial photographs showing the loss of habitat between 1946 and 2001 are contained in Appendix 1.

Year	**Area (Ha)**	**Data Source**	**Period**	**Total Loss**		**Loss excluding reclamation**	
				% loss	**% loss per year**	**% loss**	**% loss per year**
1946	266.3	CCO					
1954	248.7	CCO	**1946-1954**	6.6	0.8	N/A	N/A
1971	207.7	CHaMP	**1946-1971**	22.0	0.9	N/A	N/A
1984	162.2	CHaMP	**1946-1984**	39.1	1.0	N/A	N/A
2001	98.1	CHaMP	**1946-2001**	63.1	1.1	N/A	N/A
			1954-1971	16.5	1.0	N/A	N/A
			1971-1984	21.9	1.7	N/A	N/A
			1984-2001	39.5	2.3	N/A	N/A

Table 1: Saltmarsh Extent and Percentage Loss at Lymington from 1946 to 2001[7]

2.1.5 As shown in Table 1 the percentage loss per year has slowly increased between the start of data records in 1946 and 2001 (the most recently available figures), with the greatest annual increase occurring between the period of 1984 and 2001. The reason for this increased percentage loss is thought to be the increase in sea level, coupled with increased storminess and wave action, and Spartina die-back.

2.1.6 Appendix 1 shows aerial photography of the Lymington estuary between 1946 and 2001, which clearly demonstrates the physical losses outlined in Table 1. It can clearly be seen that the loss of saltmarsh has occurred throughout the estuary, not just in the channels navigated by the ferries and recreational vessels. It is, in fact, apparent that the greatest losses have occurred along the seaward front of the saltmarshes, which supports the fact that wave action is a major cause of saltmarsh loss. It can be seen that the 1984 and 2001 aerial photographs show that losses have also occurred throughout all the saltmarsh channels, in particular to the seaward mouths of these channels. This supports the fact that wave action, a primary cause of saltmarsh erosion, has been exacerbated by increased sea levels and storminess, both of which have increased over the past two decades. These factors are discussed in more detail in section 3, below.

2.1.7 The two factors of wave action and *Spartina* die-back are also implicated in the Natural England SSSI citation which states that "the *Spartina* marshes exhibit extensive die-back and are also receding through wave attack on the terminal cliffs" when explaining the condition of the SSSI [12]. It should also be noted that the condition of the main channel of the Lymington estuary, that are used by the ferries, is noted as being in favourable condition, whereas the remainder of the surrounding area is noted as being in unfavourable, declining condition[12]. The SSSI map for the estuary is shown in Appendix 2.

3. CURRENT FACTORS AFFECTING SALTMARSH HABITAT

3.1 Sea Level Rise and Coastal Squeeze

3.1.1 Hampshire is experiencing the highest rate of relative sea level rise in the UK, recently at 1-5 mm/year[8], but increasing[9], as a result both of climate change and isostatic sinking of the land surface.

3.1.2 While sea level rise causes the low water mark to move inland, coastal and flood defences at the high water mark prevent the landward movement of saltmarsh to compensate for this seaward erosion. 'Coastal squeeze' then occurs, with intertidal shore profiles steepening, mudflats being lost, saltmarsh plant colonisation slowing or ceasing, and erosion rates increasing. Coastal squeeze is most pronounced in south east England (for example, it is estimated that 20% of the saltmarsh resource in Kent and Essex was lost between 1973 and 1988). There are no figures available at a national level, but the best available information suggests that saltmarshes are being lost to erosion at a rate of 100 ha a year throughout Britain, with effects most pronounced in the south.

3.1.3 In Hampshire, the seaward edges of saltmarshes are now eroding at rates of 0.5m to 5m per year[10]. These erosion rates are likely to continue to increase, partly as a result of the large-scale die-back of *Spartina*[13] (see below) and reduced sediment supplies for saltmarsh accretion, and possibly also because of increased storm frequencies (also a result of climate change). A 30% loss of Hampshire's saltmarsh is now anticipated over the next 20 years with losses by 2100 of between 58% and 75% due to coastal squeeze, with many existing areas becoming replaced by mudflats. Losses are predicted to be unevenly distributed and be most severe along the West Solent mainland coast and within the larger mainland harbours[11].

3.1.4 Sea water incursion inland will also change the extent and character of transitional zones between saltmarsh, coastal wet grassland and other semi-natural habitats, particularly in areas where there is no opportunity for all these habitats to move inland or up river valleys. [14]

3.2 Sediment Dynamics

3.2.1 The balance between erosion and accretion of saltmarsh is determined primarily by the local sediment budget, and only secondarily by vegetative processes such as the spread of pioneer species - where of course sea level rise and coastal squeeze permit the latter. This sediment budget may be affected by coast protection works, or by changes in estuary morphology caused by land claim, dredging of shipping channels and flood defence works. Such changes may occur over tens or hundreds of years following the activities that originally caused them. [14]

3.3 Increased Storminess and Wave Action

3.3.1 One of the associated effects of sea level rise is increased frequency, and severity, of storms. The increased wave action associated with these events has been noted to correlate closely with rates of erosion[2]. Storminess has increased over the past 20 years in particular and is considered to be a factor in saltmarsh erosion nation-wide[2]. Increased wave action is also known to have an adverse effect on *Spartina* and it is known that at the seaward edge of saltmarsh wave attack is often the primary cause of recession[3].

3.4 Spartina Die-back

3.4.1 *Spartina anglica* is a very efficient pioneer species that has invaded previously unvegetated mudflats during the past 100 years since originating in Southampton Water. The rapid development of these pioneer marshes to the seaward side of higher level saltmarsh has protected the latter from erosion. *Spartina* is, however, now undergoing a phase of die-back in places. The cause is unclear, though increased storminess, possibly due to climatic change or changing prevailing wind direction, may be implicated *(Spartina* is sensitive to wave action). In some places other saltmarsh communities are succeeding it, but the main effect has been to expose higher level more bio-diverse areas of saltmarsh to accelerated erosion at their seaward edges.[13,14]

4. DISCUSSION

4.1.1 As outlined above in all the reviewed documents (see section 5) the four main causes implicated in saltmarsh recession were listed as being sea level rise, increased storminess, wave action, and Spartina die-back. In no cases was the action of passing recreational boats or passenger ferries implicated in the saltmarsh recession. It is likely that the use of such vessels, in particular motor boats with high velocity, short wave length, bow waves, do have an impact on saltmarsh edges but this factor is not highlighted in any of the reviewed reports to be a contributory factor in the saltmarsh recession. Additionally, the fact that saltmarsh recession is a nationally occurring problem, both in areas with and without boat use, demonstrates that natural causes are largely to blame.

4.1.2 This is supported by the fact that as saltmarsh recession has occurred throughout the Lymington estuary, and is not a phenomenon associated only with the navigable channels, as shown by the aerial photographs contained within Appendix 1. In fact the greatest losses of saltmarsh can be see to have occurred on the seaward faces of the saltmarsh, which supports the argument that wave action, coupled with increasing storminess and sea level rise, is largely to blame for the saltmarsh recession[(7)].

4.1.3 This argument is further supported by the Natural England SSSI designation for the estuary which implicates wave action and *Spartina* die-back as the causes of the saltmarsh recession[(12)]. Further, the SSSI map shows that the channel used by the ferries is recorded as being in a favourable condition, in contrast to the remainder of the surrounding area which is recorded as being in an unfavourable declining state.

4.1.4 Future saltmarsh recession losses are predicted nationwide and are forecast to be particularly severe along the West Solent mainland coast and within the larger mainland harbours[(11)]. The fact that these negative predictions cover the southern coastline and UK as a whole, show that ferry use within the Lymington channel does not mark this area out as one in which greater levels of saltmarsh recession are predicted.

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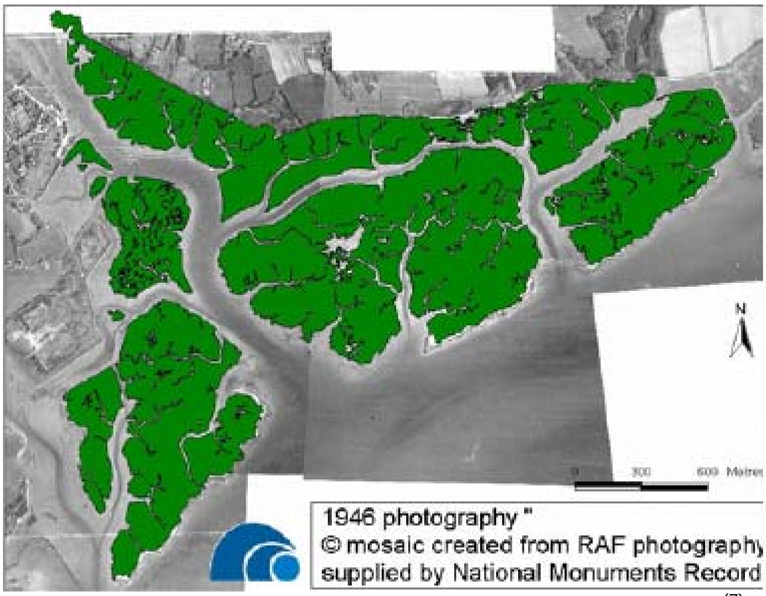
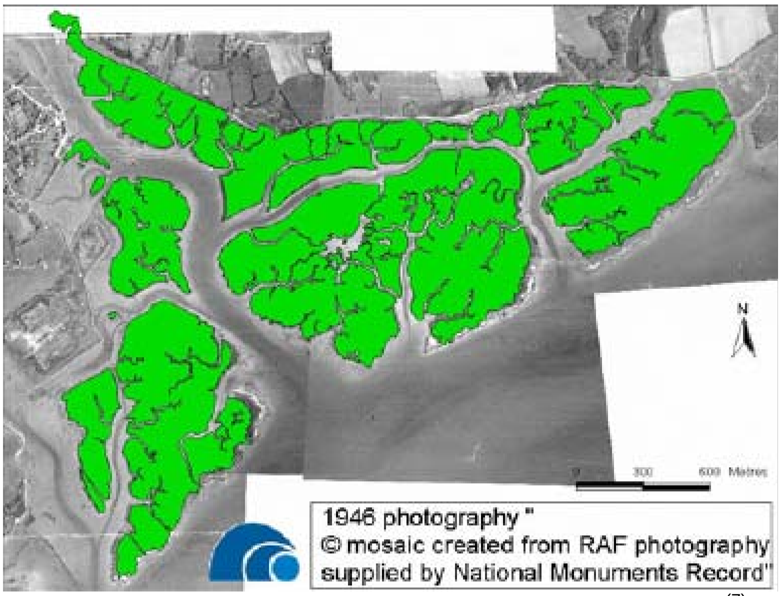
14. Coastal Habitat Action Plan - Biodiversity Action Plan for Hampshire, March 2003. *Hampshire Biodiversity Action Plan*, Volume 2.

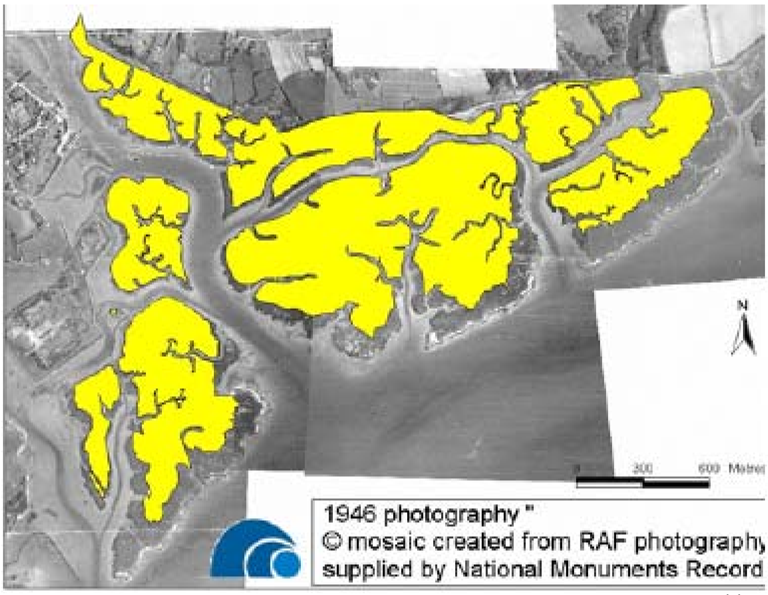
Appendix 1 – Aerial photographs showing the loss of saltmarsh between 1946 and 2001 supplied by the Channel Coast Observatory from the Solent Dynamic Coast Project [(7)]



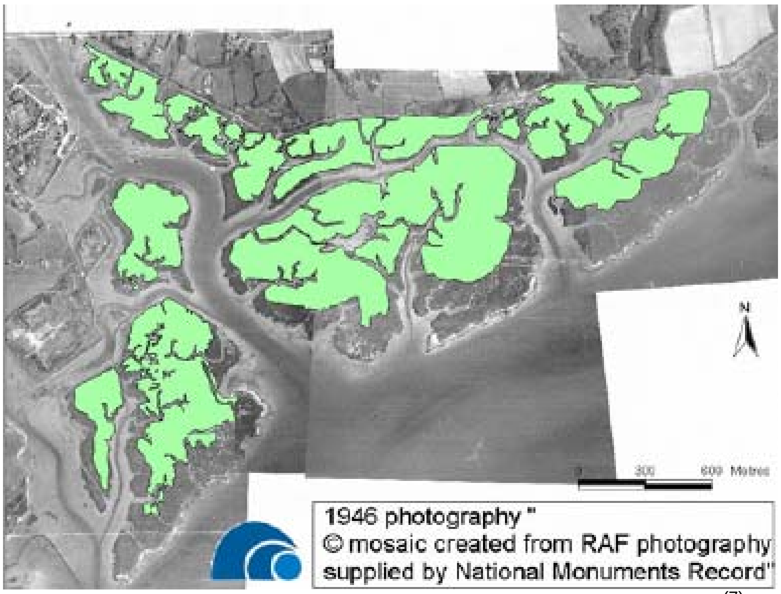
Areas of saltmarsh present in the Lymington Estuary in 1946 [(7)]



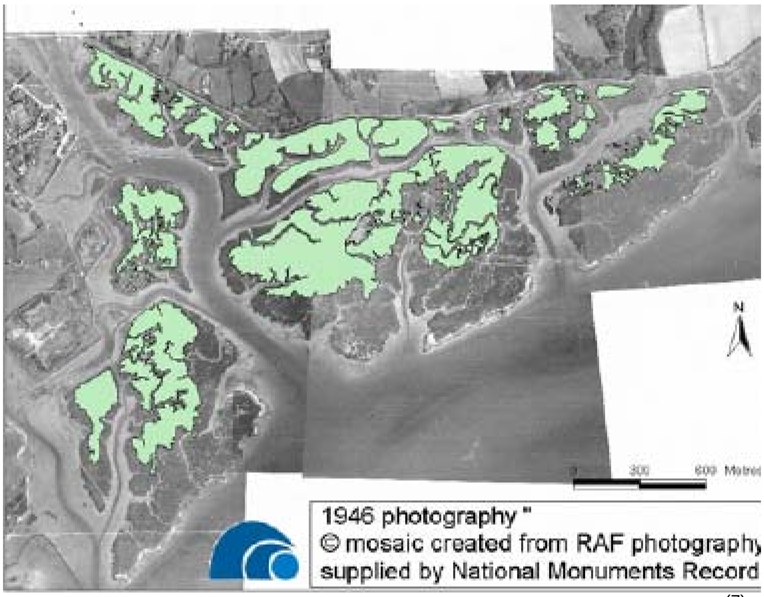
Areas of saltmarsh present in the Lymington Estuary in 1954 [(7)]



Areas of saltmarsh present in the Lymington Estuary in 1971 (7)



Areas of saltmarsh present in the Lymington Estuary in 1984 (7)



Areas of saltmarsh present in the Lymington Estuary in 2001 (7)

Appendix 2 – Natural England Map showing the SSSI designation areas and their condition[12]