

Technical Annex 12M Rabbit Survey of the Triangular Spit
and the Effect of Car Parking on Rabbits and Petalwort

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**RABBIT SURVEY OF THE TRIANGULAR SPIT
AND THE EFFECT OF CAR PARKING
ON RABBITS AND PETALWORT**

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**RABBIT SURVEY
THE TRIANGULAR SPIT**

Survey Date: 29th June 2007

Surveyor: A. Spalding MA, MIEEM

Time spent on site: 1 day

Report compiled by: A. Spalding MA, MIEEM

Report completed: 16th July 2007

Report for: The Environment Practice

SUMMARY

There are extensive populations of the rare liverwort Petalwort on the Triangular Spit, comprising around 20% of the entire U.K. population. Petalwort is protected under Schedule 8 of the Wildlife & Countryside Act (1981) and European legislation. It is considered likely that the population of Petalwort on the Triangular Spit depends at least partly on the amount of rabbit grazing. This study investigates the rabbit population here and the impact that the car parking proposals will have on the populations both of rabbits and Petalwort.

A survey was made on the Triangular Spit on 29th June 2007 to assess rabbit activity on the site. Activity was assessed by observing rabbit movements, by mapping rabbit latrines and by mapping rabbit warrens. In addition, all the scrub on the Triangular spit was mapped to provide the position and area of the patches of scrub on site. Mapping was carried out using a Trimble GEOXT GPS units (with sub-metre accuracy) displayed over an Ordnance Survey digital layer.

Only 2 rabbits were noted; there was considerable dog activity at this time. 212 rabbit dung points were mapped; most rabbit dunging activity appears to be concentrated in the south-western part of the Spit. 6 actual and potential rabbit warrens were noted, all in areas of scrub, all on the northern, western and southern sides of the Spit.

There are 24 discrete patches of scrub, concentrated on the eastern side of the Spit, covering an estimated area of 9368m², with 391 m² of low scrub, giving the ratio of open ground to scrub as 2.1:1 (20285 m² of open ground to 9759 m² of scrub). The open ground consists mainly of open rabbit-grazed lawn or bare ground; these are the areas which contain the Petalwort.

The areas of scrub appear to have increased in recent years, especially in the south-eastern corner of the Spit, as shown by the un-dated aerial photo in Google Earth. Aerial photos in 1946 show almost no scrub on the Spit.

The long-term viability of the rabbit population depends on a range of factors, such as:

- food resource - most grass-covered areas were closely grazed, indicating that the size of the rabbit population here is limited by grazing availability rather than scrub cover for warrens
- amount of scrub providing safe havens - the key rabbit burrows for those rabbits feeding in the main Petalwort area are likely to be in scrub on the southern, western and north-western corners
- absence of disturbance - the site is currently regularly disturbed by dog walkers
- absence of predators - no predators were seen
- connectivity with other nearby populations - it is likely that some element of connectivity with the surrounding areas is essential in maintaining the population here.

The effect of the car parking proposals on the rabbit population depends on a range of factors, including the loss of scrub habitat for warrens and shelter (estimated at 4027 m² of scrub), increased disturbance on the rabbit population, and loss of connectivity. Suggested mitigation for retaining a viable rabbit population on the triangular spit

includes planting scrub on suitable areas on the Spit and especially between the new car park and the main Petalwort area, and also closing the car park at night. There will be a direct loss of 3 populations of Petalwort covering about 893m², representing 6.4% of the total area covered by Petalwort; an estimated 1067 thalli will be lost out of an estimated total population of 227,943 thalli (0.46% of the total thalli). These populations are currently surrounded by scrub and may be lost anyway due to scrub encroachment; these populations could be translocated to suitable sites.

Increased car parking and visitor pressure may have the following indirect effects on the viability of Petalwort on the Triangular Spit:

- Anthropogenic pressures – increased use of pathways, increased eutrophication, and bonfires and rubbish dumping on the site
- A reduced rabbit population leading to increased vegetation heights
- Interference with the site hydrology and increased pollution run-off
- Interference with sand mobility.

However, reduced areas of scrub may reduce the potential for scrub encroachment onto Petalwort areas. In addition, a certain level of visitor use assists in preventing the longer vegetation invading the more open areas.

The key mitigation elements are based on preventing access from the new car park onto the main Petalwort areas, maintaining the rabbit population and translocating the three smaller satellite Petalwort colonies.

1. INTRODUCTION

There are extensive populations of the rare liverwort Petalwort on the Triangular Spit, comprising around 20% of the entire U.K. population (Holyoak, 2005; 2007). These populations were unknown until surveys were carried out in preparation for the harbour development. Petalwort is protected under Schedule 8 of the Wildlife & Countryside Act (1981) and European legislation. The U.K. Government has a clear obligation to protect sites with Petalwort under the EC Habitats Directive and its Action Plan for Petalwort within the UK BAP has the principal target to "Maintain the population size at all extant sites".

Petalwort in the U.K. occurs on sandy areas and on former industrial sites adjoining dunes, preferring sites which are dry in summer; most sites are wet or flooded in winter. It tolerates only light shading, prefers firm or compacted substrata, and prefers sites that remain stable for several to many years. Typical sites with Petalwort have persistently very low vegetation with large areas of bare substrate. Factors maintaining the low vegetation are usually poverty of nutrients and intense grazing by rabbits; light trampling pressure may play a part in some places.

It is considered likely that the population of Petalwort on the Triangular Spit depends at least partly on the amount of rabbit grazing and that the number of rabbits present depends partly on the amount of scrub available as cover for their burrows. This study investigates the rabbit population here and the impact that the car parking proposals will have on the populations both of rabbits and Petalwort.

2. METHODOLOGY

A survey was made on the Triangular Spit on 29th June 2007 to assess rabbit activity on the site. Rabbit activity can be assessed by using spotlight transect counts (e.g. Caley & Morley, 2002), but these can require several visits at night and so are costly and time-consuming. Rabbit abundance can also be estimated by pellet counts (e.g. Taylor & Williams, 1956; Palomares, 2001), but this method is probably of more use when comparing rabbit populations at different sites than estimating activity at a single small site. Calvete et al. (2004) used latrine counts as an effective way of measuring rabbit abundance and this method has been used here to indicate areas of peak rabbit activity. (Note Calvete et al. (loc. cit.) used accumulations of over 100 pellets to compare rabbit abundance between sites but it has not been possible to use this method here due to the smaller accumulations of dung).

Activity was assessed in 3 ways:

- by observing rabbit movements – the position of feeding rabbits was mapped
- by mapping rabbit latrines – accumulations of rabbit droppings were mapped as these indicate peak rabbit activity points. Scattered dung was not mapped.
- by mapping rabbit warrens – these were mapped where they could be found, based on evidence of burrows or rabbit tracks leading into scrub.

At the same time, all the scrub on the Triangular Spit was mapped to provide the position and area of the patches of scrub on site. Mapping was carried out using one of our Trimble GEOXT GPS units (with sub-metre accuracy) displayed over an Ordnance Survey digital layer.

3. RESULTS

3.1. Rabbit activity

Only 2 rabbits were noted during the course of the survey both near scrub on the east side of the Spit. There was considerable dog activity at this time. This surveyor was the only person present without at least one dog.

3.2. Rabbit latrines (see *Figure 1*)

212 rabbit dung points were mapped. In places the rabbit pellets appear to have been scattered by the wind but the accumulations indicate areas of peak rabbit activity. These accumulations are concentrated in the vegetated areas (in many places the dots indicate vegetated areas surrounded by bare ground, especially on the eastern side of the Spit). Most rabbit dunging activity appears to be concentrated in the south-western part of the Spit. Little rabbit activity was noted in the areas of Marram on the western side of the Spit, although at least one warren was situated here.

3.3. Rabbit warrens (see *Figure 1*)

6 actual and potential rabbit warrens were noted, all in scrub, all on the northern, western and southern sides of the Spit. No warrens were found in the open areas.

3.4. Scrub (see *Figure 1*)

There 24 discrete patches of scrub, concentrated on the eastern side of the Spit. There is a large patch of Marram-dominated dune on the western side, covering 2173m². The total area of tall mixed scrub is estimated at 9368m², with 391 m² of low scrub. The total area of the Spit is 31624m², giving the ratio of open ground to scrub (low and mixed scrub combined) as 2.1:1 (20285 m² of open ground to 9759 m² of scrub). The open ground consists mainly of open rabbit-grazed lawn or bare ground; these are the areas which contain the Petalwort.

The areas of scrub appear to have increased in recent years, especially in the south-eastern corner of the Spit, as shown by the un-dated aerial photo in Google Earth. Aerial photos in 1946 show almost no scrub on the Spit.

3.5. Petalwort

The areas of Petalwort have already been mapped, but using a hand-held Garmin GPS with limited accuracy. We estimate the areas where Petalwort occurs as covering a total of 13905 m². These areas are known to be suitable for Petalwort, although they are not be completely covered by the liverwort.

Table 1: Areas of Petalwort on the Triangular Spit; see *Figure 2*.

Area name	Area m ²	Estimated no of thalli
A	236	300
B	403	750
C	464	7200
D	12011	216,000
E	254	17
F	105	600
G	432	2800

4. DISCUSSION

4.1. The long-term viability of the rabbit population on the Spit

The long-term viability of the rabbit population depends on a range of factors, such as:

- food resource
- amount of scrub providing safe havens
- absence of disturbance
- absence of predators
- connectivity with other nearby populations

4.1.1. The food resource

The spread of rabbit pellets indicates that rabbits use large parts of the open ground areas for grazing. All grass-covered areas (apart from areas of long Marram grass) were closely grazed, indicating that the size of the rabbit population here is limited by availability of grazing rather than by the amount of cover for their warrens. Moderate grazing by rabbits tends to encourage maximum plant diversity (Zeevalking & Fresco, 1977) but species diversity here appears low, indicating that grazing levels are high.

The heavy use of the site by rabbits has led in some places to increased eutrophication from the latrines, which leads to an increase in some plants (e.g. common ruderals) and the loss of others. Petalwort itself will suffer from increased soil fertility adjacent to rabbit latrines.

4.1.2. The amount of scrub

Rabbits tend to dig their burrows in the harbourage provided by scrub (MAFF, 2001), which is therefore one of the key features of the Spit affecting the distribution and abundance of rabbits here.

Rabbit activity is extensive across the Spit but especially associated with the south-western corner, where much of the low-growing vegetation is found. Rabbits tend to stay within 50 metres of their burrows (Cowan, 1987) but on an isolated site such as this (there is probably little disturbance early in the morning or late at night), rabbits may range further afield. Rabbits also like to stay within sighting distance of their burrows.

There are likely to be warrens in many of the area of thick scrub throughout the site. However, no warren activity was observed in the south-eastern corner (even though much of the scrub is located here); there was little evidence of feeding activity and any rabbits living here are unlikely to feed in the main Petalwort area as it will be out-of-sight of their burrows. The key rabbit burrows for those rabbits feeding in the main Petalwort area are likely to be in the areas of scrub on the southern, western and north-western corners.

4.1.3. Disturbance and predators

The site is currently regularly disturbed by dog walkers. No predators (apart from dogs) were seen during the present survey, but it is likely that birds of prey (e.g. buzzards) and foxes occasionally take rabbits from the site.

4.1.4. Connectivity

The fragmentation of habitats within the wider landscape has led to the fragmentation of rabbit populations and, where groups are isolated, the lack of recovery of these populations after serious population declines (Palma, et al., 1999). It is therefore likely that some element of connectivity with the surrounding areas is essential in maintaining the population here. Myxomatosis or Rabbit Haemorrhagic Disease on the Spit is likely to wipe out the population here.

4.2. The effect of the car parking proposals on the rabbit population

4.2.1. Loss of scrub habitat for warrens and shelter

It is estimated that 8173m² will be lost to car parking (see *Figure 3*), all at the south-eastern corner of the Spit. This is the area where there is least rabbit activity and is therefore of least value to the rabbit population. However, 4027 m² of scrub will be lost (43% of the total scrub) meaning that considerable loss of cover for burrows will result from the car parking development.

4.2.2. Increased disturbance on the rabbit population

The use of the Spit for car parking is likely to increase visitor numbers. Use of the site by people and especially their dogs has the effect of disturbing rabbits during their feeding behaviour and disturbance will increase proportionately with the loss of scrub.

4.2.3. Connectivity

The use of the land between the Spit and South Quay for car parking will reduce the connectivity between adjacent rabbit populations. If rabbits become locally extinct on the Spit it will be difficult for them to re-colonise the area.

Table 1: Impact of the car parking proposals on the rabbit population of the Spit

Issue	Positive Impacts	Negative impacts	Notes
Reduced scrub	None	Reduced area for shelter and establishment of warrens	
Increased disturbance by people and dogs	Reduced predation by buzzards and foxes etc	Disturbance during feeding	Main feeding activity is at dusk, at night and at dawn, when disturbance is least
Connectivity	None	Reduced connectivity with surrounding areas	

5. MITIGATION FOR RETAINING A VIABLE RABBIT POPULATION ON THE TRIANGULAR SPIT

The key mitigation elements are based on preventing access from the new car park onto the main rabbit-grazing area and the planting of scrub to provide screening and new areas for burrows.

Table 2: Mitigation for retaining a viable rabbit population

Issue	Mitigation
Loss of scrub	Planting scrub on suitable areas on the west of the Spit, e.g. in the Marram grassland and especially on the boundary of the car park.
Disturbance	Disturbance of the site should be limited by the planting of scrub between the new car park and the main Petalwort area. This would discourage access by people and dogs from the car park and screen the rabbit feeding areas from the car park. Disturbance in early morning, at night and at dusk could be limited by closing the car park at these times.
Connectivity	No mitigation; monitoring the population is essential and rabbits would have to be re-introduced if they disappeared from the Spit
Predation	No mitigation necessary; predation might be reduced by loss of connectivity
Eutrophication	No mitigation necessary; eutrophication would be reduced by keeping dogs from the site and possibly reduced rabbit activity
Lighting	Lighting appears not to disturb rabbits. However, we advise that the car park is closed and unlit at night.

6. THE EFFECT OF THE CAR PARKING PROPOSALS ON THE PETALWORT POPULATION

6.1. Direct loss of Petalwort populations

It is estimated that 3 populations of Petalwort covering about 893m² will be lost to car parking, all at the south-eastern corner of the Spit, representing 6.4% of the total area covered by Petalwort. An estimated 1067 thalli will be lost out of an estimated total population of 227,943 thalli (0.46% of the total thalli). These populations are currently in scrub and possibly will be lost anyway due to scrub encroachment. These populations could be translocated to suitable sites which are currently without Petalwort.

6.2. Indirect effect of car parking and increased visitor disturbance on Petalwort

Increased car parking and visitor pressure may have the following effects:

- Anthropogenic pressures
 - Increased usage of pathways through areas of Petalwort leading to erosion of the substrate and the loss of thalli
 - Increased eutrophication e.g. through dog fouling, could threaten Petalwort directly and cause competing plants to grow taller. Petalwort is dependent on very short vegetation persisting at its sites
 - Increased possibility of bonfires and rubbish dumping on the site, both of which will have an impact on the fertility of the soil
- Reduced rabbit population leading to reductions in grazing levels and increased vegetation heights
- Interference with existing drainage patterns during the construction and operation of the car park. Petalwort is dependent on seasonally high water tables.
- Pollution run-off from the car park. Petalwort is dependent on unpolluted water with low nutrient status.
- Interference with sand mobility. Some mobility of sand helps maintain the open vegetation required by Petalwort.
- Reduced areas of scrub leading to potential reduction in scrub encroachment onto Petalwort areas.

However, it should be noted that a certain level of visitor usage assists in preventing the longer vegetation invading the more open areas.

Table 3: Impact of increased visitor disturbance on Petalwort

Issue	Positive Impacts	Negative impacts	Notes
Reduced rabbit population leading to taller vegetation	Reduced eutrophication	Increase in taller rank vegetation shading out Petalwort	Negative impacts greater than positive impacts; viable rabbit population essential in keeping open areas suitable for Petalwort
Increased pathways	Vegetation kept short	Possible increased erosion of substrate	Potential loss of thalli

Issue	Positive Impacts	Negative impacts	Notes
Increased eutrophication from dog fouling	None	Increase in taller rank vegetation shading out Petalwort	
Increased incidence of bonfires	None	Destruction of Petalwort habitat	
Increased rubbish dumping	None	Destruction of Petalwort habitat	
Increased levels of disturbance e.g. by dogs	Slight chance of people and dogs spreading spores by feet	Possible decrease in rabbit grazing	
Interference with site hydrology	None	Possible drying out in winter or flooding in summer	
Potential pollution from the car park	None	Destruction of Petalwort habitat	
Interference with sand mobility	None	Some loss of sand mobility may result from scrub planting	
Reduced area of scrub	Reduced impact on Petalwort	Reduced area for rabbit burrows	

7. MITIGATION FOR RETAINING A VIABLE PETALWORT POPULATION ON THE TRIANGULAR SPIT

The key mitigation elements are based on preventing access from the new car park onto the main Petalwort areas, maintaining the rabbit population and translocating the three smaller satellite Petalwort colonies.

Table 4: Mitigation for retaining a viable Petalwort population

Issue	Mitigation
1. Anthropogenic pressures	
1.1. Increased trampling	Discourage access to the Petalwort area by planting a scrub barrier between the new car park and the main Petalwort area. Disturbance in early morning, at night and at dusk could be limited by closing the car park at these times and not providing overhead lighting.
1.2. Eutrophication by dog fouling	Reduce eutrophication by keeping dogs away from the site (reduced rabbit activity might also lead to reduced eutrophication)
1.3. Increased risk of bonfires and rubbish dumping	Close the car park outside main working hours, limit access to the main Petalwort area and maintain a security presence. Rubbish dumping will be difficult here because of the distance from the nearest public road.
2. Reduced rabbit population	Plant scrub between the new car park and the main Petalwort area and on the western edge of the Spit.
3. Interference with site hydrology	Ensure avoidance of physical effects during constructional and operational phase on grassland areas where Petalwort occurs.
4. Pollution run-off from the car park	Ensure run-off is kept away from the Petalwort area using a low bund.
5. Interference with sand mobility	Ensure no obstruction to onshore sand movement from the estuary by limiting the amount of scrub on the western part of site to low shrubs such as bramble.
6. Recreational use of the area due to lack of knowledge of the presence of Petalwort	Provide educational leaflets and signage in suitable positions to inform the public of the importance of the site for Petalwort and its statutory protection. The main colony here could be established as an official Petalwort reserve and access managed accordingly.
7. Loss of satellite sites	Investigate translocation to new sites in the area.
8. Lack of knowledge about translocations and the viability of the Petalwort population on the Spit	The 6 year gap between planning and development allows a detailed translocation programme to be established and the results monitored. In addition, the present population on the Spit can be monitored to establish whether it is stable, in decline or increasing. An investigation of the hydrology of the site would form part of this programme and the knowledge used could be made available to the scientific community.
9. Statutory situation	Petalwort is fully protected by law and a licence will be required from Natural England to translocate populations. These populations could be kept temporarily in pots prior to translocation to receptor sites.

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Legend

- Mixed scrub
- Low bramble scrub
- Marram grass
- Indicative area of Petalwort
- Rabbit warren
- Key dung area
- Rabbit



