



LORNE GILL/SNH

LUNAN BAY, ANGUS

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*Mark the winds and mark the skies, ocean's ebb  
and ocean's flow. Sun and moon but set to rise,  
round the seasons go.*

**ROBERT BURNS**

Tayside Biodiversity Partnership



**BIODIVERSITY**  
THE VARIETY OF LIFE

# COASTS AND ESTUARIES

For centuries people have used the coasts and estuaries of Tayside as a source of food, for sheltered anchorage and for trade. It is a landscape of great beauty, exhibiting a diversity of features from the muddy shallows of Montrose Basin, the sand dunes of Barry Links and the wide, nutrient-rich Tay Estuary.

The variety of life supported by coastal habitats includes groups of dolphin and porpoise, shoals of commercially important fish, tiny zooplankton, resident seabirds and migrant birds such as pink-footed geese (which are present in internationally-important numbers). The reedbeds in the Tay Estuary are the largest continuous stand of this habitat anywhere in Britain - and they are the only place in Scotland where the rare Bearded Tit breeds. The beds of seagrass and seaweed also provide important nursery grounds for flat fish in the summer and food for ducks and geese in winter.

The coasts and estuaries are under increasing pressure from human activity – commercial fishing, recreational use, the development of urban areas and ports, to name just a few. Marine ecosystems are particularly difficult to access and understand, although more is known about coastal habitats and our influence upon them.

Increased consultation and work between those influencing these habitats has resulted in a better understanding for the value of coasts and estuaries in Tayside. This has engendered a greater willingness to work together to conserve and enhance the habitats, at the same time as managing change. Examples of such co-operation include the management of the rich sand dune flora and fauna at Barry Buddon by the Ministry of Defence and the management of the Tay reedbeds for both the species they support and for commercial harvest.

## Introduction

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THE TAY ESTUARY AT BARRY BUDDON, ANGUS

## DEFINITION

An estuary is a partially enclosed area at least partly composed of soft tidal shores, open to saline water from the sea and receiving freshwater from rivers, land run-off or seepage. An estuary may broadly be divided into three zones: the constantly submerged, the inter-tidal, and the sea-washed. These core areas are associated with a number of significant related habitats such as sub-tidal sandbanks, inter-tidal mud and sand, eel- or seagrass (*Zostera*) beds, shingle, saltmarsh, reedswamps and coastal grazing-marsh.

## KEY SITES

Tay	- 12,265 hectares (LNR, SSSI, SPA, pSAC, Ramsar); south shore to be included in the Fife Biodiversity Action Plan
Montrose Basin	- 842 ha. (LNR, SSSI, SPA, Ramsar)
North Esk Kinnaber (SSSI)	
Lunan Water	
Elliot Water	
Pitairlie Burn	
Buddon Burn	

## CURRENT STATUS AND EXTENT OF HABITAT

About 50% of the UK coastline (9,849 km) is estuarine and of this 2.5% is in Tayside. There are two major estuaries in Tayside - the Inner Tay (12,265 ha., of which 5,720 ha. are inter-tidal) and Montrose Basin (842 ha., of which 739 ha. are inter-tidal). These make up most of the region's estuarine habitat, the remainder being accounted for by five much smaller river mouths – Pitairlie, Buddon, Lunan, Elliot and North Esk - all of which are in Angus.

The Firth of Tay is one of the largest estuaries in Scotland and has the highest freshwater inflow of any estuary in Britain. It can be divided into the strongly marine outer firth (seaward of Broughty Ferry), a middle zone between Broughty Ferry Castle and the rail bridge which exhibits the greatest variation in salinity, and the upper estuarine reaches upstream of the bridge. The influence of spring tides penetrates 50 km inland to about 4 km beyond Perth, but saline conditions occur only as far upstream as Newburgh.

CE1 Estuaries (including saltmarshes and eelgrass beds)

For the purposes of this Habitat Action Plan the upper limit of the estuary is defined by the confluence of the Earn with the Tay – about 8 km downstream of Perth. The lower limit is less easy to define but because estuarine conditions are vital to otherwise coastal species such as Common seal *Phoca vitulina*, Sparling *Osmerus eperlanus*, and Eider *Somateria mollissima*, their ranges within the estuary have been taken into consideration. Consequently, the area between Buddon Ness and Tentsmuir Point Nature Reserve (Fife) is covered by this Action Plan.



P. & A. MACDONALD

THE TAY'S ESTUARINE REEDBEDS

Montrose Basin, at the mouth of the River South Esk, is one of the finest examples of an enclosed estuarine basin in the UK. It is shallow and drains almost completely at low water, exposing a large area of mud and sand flats. 88% of the basin is inter-tidal.

There are extensive estuarine reedbeds in the Tay (over 240 ha.) and smaller areas elsewhere. This specific habitat will be covered by a Reedbed Action Plan. The majority of Tayside's saltmarshes occur at Montrose Basin. The north shore of the Tay estuary holds 47 ha. A further 16 ha. occur at the smaller river mouths along the Angus coast. Compared to the national UK figure of 44,400 ha., the total area of saltmarsh in Tayside is clearly very small, but its ungrazed nature at Montrose is relatively uncommon.

There is also a small area of perched saltmarsh in Angus, splashed by the sea on the cliffs within Rickle Craig Scurdie Ness SSSI, near Montrose. This is discussed in the Maritime Cliff and Slope Action Plan.

KEY SPECIES

2 P = UK Priority species C = UK species of conservation concern

Mammals	Otter	<i>Lutra lutra</i>	P
	Common seal	<i>Phoca vitulina</i>	C
Birds	Shelduck	<i>Tadorna tadorna</i>	C
	Red-breasted merganser	<i>Mergus serator</i>	C
	Goosander	<i>Mergus merganser</i>	C
	Pink-footed goose	<i>Anser brachyrhynchus</i>	C
	Redshank	<i>Tringa totanus</i>	C
	Bar-tailed godwit	<i>Limosa lapponica</i>	C
	Eider	<i>Somateria mollissima</i>	C
	Mute swan	<i>Cygnus olor</i>	C
	Wigeon	<i>Anas penelope</i>	C
	Teal	<i>Anas crecca</i>	C
	Pintail	<i>Anas acuta</i>	C
	Goldeneye	<i>Becephala clangula</i>	C
	Water rail	<i>Rallus aquaticus</i>	C
	Marsh harrier	<i>Circus aeruginosus</i>	C
	Bearded tit	<i>Panurus biarmicus</i>	C
	Reed bunting	<i>Emberiza scheoniclus</i>	P
	Swallow	<i>Hirundo rustica</i>	C
	Sand martin	<i>Riparia riparia</i>	C
Greylag goose	<i>Anser anser</i>	C	

## Estuaries (including saltmarshes and eelgrass beds)

CE1

<b>Fish</b>	Atlantic salmon	<i>Salmo salar</i>	C
	River lamprey	<i>Lampetra fluviatilis</i>	C
	Sparling/smelt	<i>Osmerus eperlanus</i>	C
	Twaite shad	<i>Alosa fallax</i>	P
<b>Higher Plants</b>	Common reed	<i>Phragmites australis</i>	
	Narrow-leaved eelgrass	<i>Zostera angustifolia</i>	
	Dwarf eelgrass	<i>Zostera noltii</i>	
	Marine eelgrass	<i>Zostera marina</i>	C

## NATURE CONSERVATION IMPORTANCE

## Sub-tidal zone

Estuaries have extensive underwater habitats in the sediments supporting a variety of algae (including seaweeds), plants, invertebrates and fish, which in turn support species further up the food chain such as seals and birds. These areas are also important nursery grounds for young fish.

## Mudflats

Mudflats are highly productive areas which, together with other intertidal habitats, support large numbers of predatory birds and fish. They provide feeding and resting areas for internationally important populations of migrant and wintering waterfowl and are also important nursery areas for flatfish. Mudflats are characterised by high biological productivity and abundance of organisms, but low diversity with few rare species.

## Seagrass Beds

Three species of *Zostera* occur in the UK and all are considered to be scarce: Dwarf eelgrass *Zostera noltii*, Narrow-leaved *Zostera angustifolia* and Marine eelgrass *Zostera marina*. All three species are found in Tayside: the largest area being in Montrose Basin. The plants are an important source of organic matter and provide shelter and a surface for attachment by other species. Eelgrass is an important source of food for wildfowl, particularly Brent goose *Branta bernicla* and Wigeon *Anas penelope* which feed on intertidal beds. The shelter provided by seagrass beds makes them important nursery areas for fish, including Pollack *Pollachius pollachius*, Two-spotted goby *Gobiusculus flavescens*, Pipefish species and various Wrasse.



SEAGRASS

SUE SCOTT



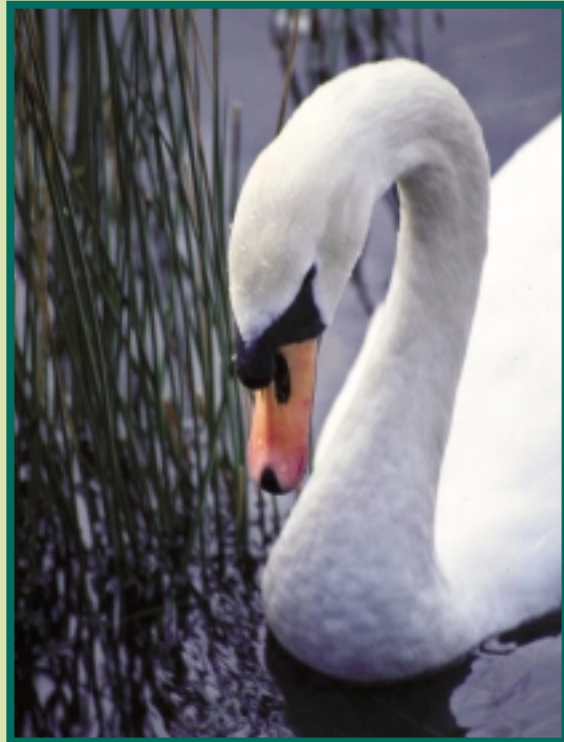
## Case Study

## Swan Management Demonstration Project - Montrose Basin

Mute swans *Cygnus olor* are present in nationally important numbers on Montrose Basin; the wintering flock consists of approximately 260 birds. They feed mainly on the *Zostera* beds in the Basin and move onto the adjacent arable land in December when the density of the *Zostera* is reduced. Attracted to fields of oilseed rape, cereals and grass, they cause damage to these crops by feeding and 'puddling' the fields with their feet.

To keep the swans off the arable land, a Swan Management Demonstration Project was set up in 1998 to provide an area of arable crop adjacent to Montrose Basin as a safe haven for them to feed in. A Swan Scarer is employed for several weeks during the winter to ensure the birds use the correct field.

The Project is a partnership between four of the local farmers, Angus Council, Scottish Executive Environment and Rural Affairs Department and Scottish Natural Heritage, together with the British Association for Shooting and Conservation, the National Trust for Scotland, Scottish Agricultural College and the Scottish Wildlife Trust.



SIMON BROAD

MUTE SWAN

## Saltmarsh

Saltmarshes form the upper vegetated parts of intertidal mudflats. They are built up by a community of salt tolerant plants and are an important resource for wading birds and wildfowl. They act as high tide refuges for birds feeding on adjacent mudflats, as breeding sites for waders, gulls and terns and as a source of food for passerine birds particularly in autumn and winter. In winter, grazed saltmarshes are used as feeding grounds by large flocks of wild ducks and geese.

## Mammals

There is a population of approximately 650 Common seals *Phoca vitulina* in the Tay Estuary which represents over 1% of the total European population and is therefore of international importance. Otters *Lutra lutra* are found in both the Montrose Basin and Tay Estuary, but only anecdotal evidence is available as regards their distribution and population numbers as there is little existing data to call upon.



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COMMON SEAL

## Estuaries (including saltmarshes and eelgrass beds)

CE1

## Birds

The expansive mudflats and tidal nature of the Tay Estuary and Montrose Basin are attractive as safe roost sites for geese. Other bird species are attracted not only by the safety, but also by the food supplies available. Waders feed on a range of invertebrates whilst Wigeon and Mute swans at Montrose feed primarily on *Zostera*. Montrose is a nationally important moulting site for many of Tayside's Mute swans.

Both Montrose Basin and the Tay Estuary support nationally and internationally important populations of wildfowl and waders. This is recognised by their designation as Special Protection Areas (SPA) under the European Birds Directive and as Ramsar Sites under the Ramsar Convention.



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REDSHANK

### Nationally and Internationally important waterfowl populations wintering on Tayside Estuaries

Species	Estuary	International Importance	National Importance
Mute Swan	Montrose Basin		✓
Pink-footed Goose	Montrose Basin Tay	✓ ✓	
Greylag Goose	Tay	✓	
Shelduck	Montrose Basin		✓
Widgeon	Montrose Basin		✓
Eider	Montrose Basin Tay		✓ ✓
Goosander	Montrose Basin Tay		✓ ✓
Knot	Montrose Basin	✓	
Bar-tailed godwit	Tay	✓	
Redshank	Montrose Basin	✓	
Sandwich Tern	Tay		✓
Common Tern	Tay		✓
Arctic Tern	Tay		✓

Species for which the two estuaries are locally important include Oystercatcher *Haematopus ostralegus*, Golden plover *Pluvialis apricaria*, Sanderling *Calidris alba*, and Black-tailed godwit *Limosa limosa*. Montrose Basin holds a large late-summer tern roost which has numbered in recent years over 2,000 mixed terns including Sandwich *Sterna sandvicensis*, Common *Sterna hirundo* and Arctic Terns *Sterna paradisaea*.

## Fish

The Tay Estuary provides nursery grounds for fish such as Dover sole *Solea slea*, Sand eel spp. and Herring *Clupea harengus*. Several species use the estuary to migrate to their freshwater spawning grounds such as Atlantic salmon *Salmo salar*, Sea trout *Salmo trutta* and Twaite shad *Alosa fallax*. The Tay Estuary supports one of only three spawning grounds for Sparling (smelt) *Osmerus eperlanus* in Scotland.

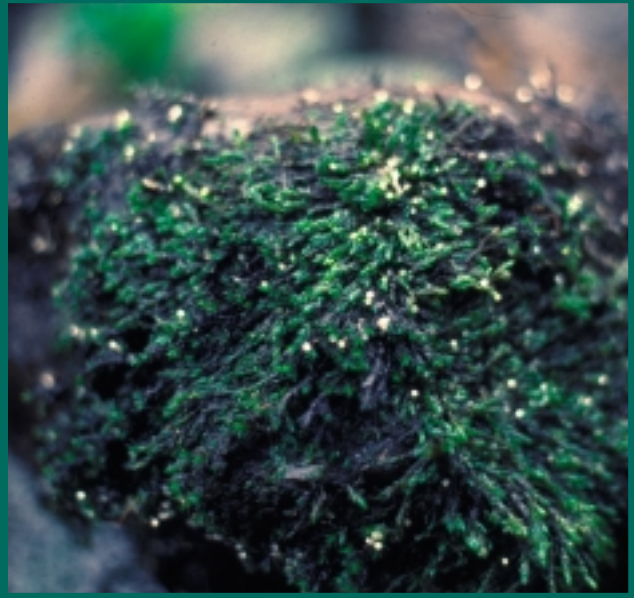
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**Sparling (or smelt) *Osmerus eperlanus***

This inshore migratory fish was at one time widespread in many estuaries. It is now restricted to just three in Scotland - the River Cree, River Forth and River Tay. Its population in the Tay Estuary has been very little studied and its ecology not yet clearly understood. Sparling use gravel beds and areas of small pebbles at the limit of the tidal limit in which to spawn, the prime time for which is triggered by the first full moon in March. As they are very selective in choosing their spawning sites (using only clean estuaries) they were, in the past, very susceptible to pollution.

There are at present three boats on the Tay which fish for Sparling on a small scale between September and early March.



ALASTAIR STEPHEN

**NATIONAL BIODIVERSITY CONTEXT**

There is a UK Broad Habitat Statement for Estuaries. This gives the following conservation direction:

*Maintain and enhance the extent and quality of estuarine habitats in the UK, including the full diversity of estuarine communities.*

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Measures to be considered further include:

- Protect estuaries from coastal development and other activities which cause environmental damage.
- Review the powers and duties of coastal and other authorities for safeguarding this habitat.
- Identify the full diversity of wildlife features and maintain the extent and quality of this resource.
- Promote management within the framework of SACs and other coastal zone strategies which permit the natural functioning of sediment systems.
- Improve water quality via catchment management and other pollution control mechanisms.
- Develop plans for new estuarine habitats to help compensate for losses because of a rise in sea level.
- Reduce the environmental impact of fisheries.

There are UK Habitat Action Plans for Coastal and Floodplain Grazing Marsh; Coastal Saltmarsh; Mudflats (revised); and Seagrass Beds.

**ECOLOGY AND MANAGEMENT**

- Much survey work has been carried out in the Tay Estuary and Montrose Basin as part of the designation processes and ongoing monitoring.
- A full habitat survey of all the estuarine habitats in Tayside is needed in order to set up effective, area-wide monitoring, particularly for the areas not subject to designation.
- Site Condition Monitoring of SSSIs is carried out in a 6 year cycle.

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## CURRENT FACTORS CAUSING LOSS OR DECLINE

- Land claim and development
- Climate change and consequent sea level rise
- Nutrient enrichment from farmland and waste effluent
- Marine pollution
- Human disturbance
- Bait digging
- The introduction of new or non-native species
- Maintenance dredging
- Shipping accidents
- Beam trawlers and scallop dredgers
- Waste tipping
- Laying of cables and pipelines

## MAIN THREATS TO KEY SPECIES

Common seal	- Pollution - Disturbance - Future sea level rise	
	UK importance of Tayside population:	high
Otter	- Pollution - Disturbance - Development	
	UK importance of Tayside population:	moderate
Bar-tailed godwit	- Habitat loss - Disturbance - Future sea-level rise	
	UK importance of Tayside population:	high
Twaite shad	National threats include - Pollution - Overfishing - Habitat destruction Specific threats in Tayside not known. Lack of information makes it difficult to assess types and levels of threat.	
	UK importance of Tayside population:	high
Sparling (smelt)	- Disturbance of nursery areas Lack of information makes it difficult to assess levels of threat.	
	UK importance of Tayside population:	high
Eelgrass ( <i>Zostera</i> )	- Pollution - Mobile fishing gear - Development.	
	UK importance of Tayside population:	moderate

## OPPORTUNITIES AND CURRENT ACTION

- The Tay Estuary Forum is developing a Management Plan for the whole estuary
- The pSAC Tay Estuary, if adopted as an SAC, will require a management scheme for the designated area
- There is a Montrose Basin Management Plan in place
- Inner Tay Local Nature Reserve (LNR): Management Agreements and Prescriptions are in place for landowners who have signed up to the LNR
- All estuarine SSSIs are subject to conservation legislation

## OBJECTIVES &amp; TARGETS

	Objectives	Targets
1	Ensure no net loss in area or reduction in quality of estuarine habitats in Tayside. Where necessary and where possible improve estuarine habitats in order for them to sustain typical estuarine wildlife, especially those of international and national importance.	Encourage land managers and planners to develop policies that will prevent loss of the quality and quantity of the habitat by 2005.
2	Meet and maintain Class A (Excellent) water quality standards in all of the region's estuaries using the Scottish Environment Protection Agency (SEPA) Classification Scheme to monitor chemical and biological quality.	All estuaries to have Class A water quality by 2005.  Class A standard to be maintained beyond 2005.
3	Establish adequate site safeguard policies in relevant strategic and other plans, including organisations' workplans, such that decision-makers and users of estuaries take account of the conservation of biodiversity in all matters relating to estuarine habitats.	Policies to be in all relevant plans by 2003.
4	Maintain and protect the quality and integrity of designated sites. Ensure that a comprehensive set of management plans is completed and that monitoring programmes are put in place. Seek to apply prescriptions and principles to all estuarine habitats in the region.	Management plans to be written for all designated areas by 2003.
5	Set up a five-year programme to raise awareness of biodiversity, its importance and the need for its conservation in Tayside. Include estuaries in this programme.	Set up a public awareness programme by 2003.  Run public awareness programme until 2005.

## Stakeholders

- Landowners, land managers and advisors, fishermen, tourists and local users.

## ACTION FOR BIODIVERSITY

		Action - Estuaries	Deliverers		To take place by								Meets Objective No.
			Lead Partners	Partners	02	03	04	05	06	07	11	16	
LBAP Ref.	A	<b>Policy and legislation</b>											
CEI	1	Assist with development of planning policies aimed at preventing any further loss of estuarine habitat.	PKC AC	TBP				#	#	#	#	#	1,3
CEI	2	Complete SAC and SPA processes and subsequent designations.	SNH	SE EU				#					1
CEI	3	Ensure that all consented discharges meet national and international water quality standards.	SEPA	Dischargers	#	#	#	#	#	#	#	#	2
CEI	4	Ensure that all discharge consents granted minimise impact on biodiversity.	SEPA	SNH	#	#	#	#	#	#	#	#	1,2
	B	<b>Site safeguard and management</b>											
CEI	1	Influence decision-makers to find soft engineering solutions to potential flood problems related to development.	PKC DCC AC	SEPA SNH	#	#	#	#	#	#	#	#	1,3
	C	<b>Species management and protection</b>											
CEI	1	Promote and support the work of species groups such as the Tay Ringing Group and other groups working on species management.	SNH	TBP	#	#	#	#	#	#	#	#	4,5
	D	<b>Advisory</b>											
CEI	1	Identify a demonstration site of managed realignment, possibly at Montrose Basin.	AC SNH SWT RSPB	Landowners	#	#							1,3
	E	<b>Research and monitoring</b>											
CEI	1	Site Condition Monitoring of Montrose Basin and Tay Estuary - on a 6 year cycle.	SNH		#	#	#	#	#	#	#	#	4
CEI	2	Survey of Tay and requisite estuarine sub-littoral estuarine habitats occurring under EU SAC designations.	SNH	Universities	#	#							1,4
CEI	3	Support Mute Swan Management Project at Montrose Basin.	AC SWT	SNH SAC	#	#	#	#	#	#	#	#	4
CEI	4	Continue to support and improve the coverage of the Wetland Birds Survey (WeBS).	WWT	BTO SNH BASC	#	#	#	#	#	#	#	#	4
CEI	5	Estuaries Action Plan review process - ensure that this plan is being delivered annually and reviewed after 5 years.	TBP		#	#	#	#	#	#	#	#	All
	F	<b>Promotion and awareness-raising</b>											
CEI	1	Develop opportunities to raise awareness amongst developers, engineers and decision-makers about estuarine processes.	TBP		#	#	#	#	#	#	#	#	All

## Estuaries

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.







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SEATON CLIFFS, ANGUS

## DEFINITION

Seacliffs form at the junction between the land and the sea where slippage or erosion by the sea causes a break in slope. Gradient varies between 15° and vertical, and in height and geology. Hard rock cliffs are eroded slowly by the sea and are often near vertical, accumulating soil and supporting vegetation on ledges. Soft rock cliffs are more unstable and often form a vegetated coastal slope. The habitat contains an important range of natural features with extensive areas of natural and semi-natural vegetation types - hard cliff with rock face vegetation, cliff crevice and cave, rock exposures, coastal boulders, boulder clay cliffs, scree and vegetated undercliff.

## KEY SITES

There are two main areas of maritime cliff and slope in Tayside. Both of these areas are largely designated sites:

- Whiting Ness (next to Victoria Park in Arbroath) to Ethie Haven – most of this is covered by Whiting Ness to Ethie Haven SSSI.
- Rickle Craig (at the north end of Lunan Bay) to Scurdie Ness (just south of Montrose at Ferryden) which is all designated as an SSSI.

## CURRENT STATUS AND EXTENT OF HABITAT

Over 50% of the cliffs in Britain are found in Scotland, but Tayside has less than 1% of the Scottish total. More than half the Tayside coast is fringed by sandy beaches with only two significant lengths of rock or degraded boulder clay cliffs between Arbroath and Ethie Haven and between the South River Esk and Lunan Bay.

The high diversity of species and plant communities relates to the considerable habitat diversity and to the action and interaction of various ecological gradients. These include variation in geology and soil types, influence of salt spray and degree of exposure (including effects of wind), aspect (duration of exposure to sunlight), grazing intensity and fertilizer inputs from adjacent farmland. The sandstone cliffs of the Angus coast are relatively resistant to wave action, but erosion in places may inhibit the establishment of some vegetation types, whilst other plants are especially adapted to this environment. This erosion also makes the area more interesting geologically.

### Main Areas of Habitat in Tayside

The two main areas of maritime cliff and slope in Tayside are both designated as Sites of Special Scientific Interest and are therefore fairly well documented.

#### Whiting Ness to Ethie Haven

This is the longest continuous stretch of sea cliffs and rocky shore in Tayside. Up to 50m high and stretching about 11 km along the coast, the terrain is very dangerous in places and many parts are inaccessible. The site covers the cliffs and immediate hinterland from Whiting Ness to Meg's Craig just south of Auchmithie, and the cliffs and hinterland from Rumness, north of Auchmithie to Corbie Knowe on the southern edge of Lunan Bay. The cliffs are widely studied as they show a spectacular series of erosion features including sea stacks, blowholes, caves, wave cut platforms and arches. Carlingheugh Bay has a raised beach and relic sea cliff thought to date from the main postglacial transgression approximately 6,000 years ago. This part of the Angus coast is a well-known site for migrating birds in autumn and winter.

- The site is a SSSI because of its unimproved coastal grassland and large numbers of coastal breeding and wintering birds, as well as for its geological interest. Plants include Long-bracted sedge *Carex hostiana*, Maiden pink *Dianthus armeria*, Clustered bellflower *Campanula glomerata*, and Hairy Violet *Viola hirta* and cliff vegetation such as Sea spleenwort *Asplenium marinum* and Pellitory-of-the-Wall *parietaria diffusa*, together with some rare and unusual mosses and liverworts. The site contains the largest breeding seabird colony in Angus with nationally important numbers of overwintering Turnstone *Arenaria interpres* and Purple Sandpiper *Calidris maritima* feeding and roosting on the flat, rocky shoreline. Also present are Kittiwakes *Rissa tridactyla*, Herring Gulls *Larus argentatus*, Fulmars *Fulmarus glacialis*, Puffins *Fratercula arctica*, Guillemots *Uria aalge* and Razorbills *Alca torda*. Moth and butterfly species include Grayling *Hipparchia semele* and Small pearl-bordered fritillary *Boloria selene*, as well as the nationally rare Small blue butterfly *Cupido minimus*. Rare snails and beetles are also present.
- The Scottish Wildlife Trust's Seaton Cliffs Reserve lies at the south end of the SSSI. At 12.1 hectares, it is 8% of the total SSSI.
- Two Geological Conservation Review (GCR) sites within the SSSI have been notified. The first of these is Whiting Ness where the exposures of the irregular unconformity between the Upper Old Red Sandstone and the Lower Old Red Sandstone demonstrate that the stratigraphy of the Midland Valley Devonian consists of two separate episodes of sedimentation with a sedimentary break between, the entire Middle Devonian being absent. Secondly, fine coastal exposures of the Ethie Lavas between Black Rock and East Comb show margins that are commonly pillowed and characterised by complex lava/sediment relationships suggesting extrusion of lava onto wet sediment. This site has important research potential for studies on Lower Devonian volcanic environments.
- The Tayside RIGS Group has named the area from Whiting Ness to Carlingheugh Bay a Regionally Important Geological Site (RIGS).

As well as the cliffs' natural heritage and geological interests, there are a number of ancient forts and castles designated by Historic Scotland. There is also a rich history associated with the cliffs between Whiting Ness and Ethie Haven from Bronze and Iron Age occupation of some of the caves and Maiden Castle to use of the caves at Dickmonts Den by smugglers and wreckers. Places and events associated with the area were used by Sir Walter Scott who described the shipwreck of January 1800 in 'The Antiquary' and renamed Auchmithie as "Musselcraig", home of the "Mucklebacks".

## Maritime Cliff and Slope

CE2

## Rickle Craig to Scurdie Ness

Scurdie Ness to Boddin Point is a continuous length of rocky shore approximately 4km long.

- This rocky stretch of coastline was selected as an SSSI for its geological interest and uncommon species-rich grassland types reflecting the base-rich nature of the underlying rock - notably on and around the old lime kiln on Boddin Point - and on the more friable volcanic rocks. Characteristic plants include the scarce Nottingham catchfly *Silene nutans*, as well as Kidney vetch *Anthyllis vulneraria*, Clustered bellflower *Campanula glomerata*, Fairy flax *Linum catharticum*, Carline thistle *Carlina vulgaris* and Burnet saxifrage *Pimpinella saxifraga*. Small areas of 'perched' saltmarsh are found around the high water line. Over 30 species of snails are known owing to the rich vegetation.
- There are two Geological Conservation Review (GCR) sites within the SSSI. Scurdie Ness to Usan Harbour provides the best section in Scotland through Old Red Sandstone lavas and associated sedimentary rocks of the Montrose Volcanic Formation. These rocks were formed about 410 million years ago with lavas being erupted from a volcano to the north-east (the Montrose volcanic centre). During periods of non-volcanic activity sediments containing pebbles of volcanic rock collected in lakes and rivers flowing over the lavas. After the lavas had been erupted fluids flowing through the rocks deposited silica in cavities, forming agates. The area around Scurdie Ness is a GCR site in its own right for its mineralogy because of the presence of these agates, some of which are gem quality, within the lavas.

## KEY SPECIES

P = UK Priority species C = UK species of conservation concern

Birds	Shag	<i>Phalacrocorax aristotelis</i>	C
	Herring gull	<i>Larus argentatus</i>	C
	Turnstone	<i>Arenaria interpres</i>	C
	Purple sandpiper	<i>Calidris maritima</i>	C
	Kittiwake	<i>Rissa tridactyla</i>	C
	Fulmar	<i>Fulmarus glacialis</i>	
	Rzorbill	<i>Alca torda</i>	C
	Puffin	<i>Fratercula arctica</i>	C
	Guillemot	<i>Uria aalge</i>	C
Invertebrates	Small blue butterfly	<i>Cupido minimus</i>	C
	Small pearl-bordered fritillary	<i>Boloria selene</i>	C
Higher Plants	Kidney vetch	<i>Anthyllis vulneraria</i>	
	Pellitory-of-the-wall	<i>Parietaria judaica</i>	
	Maiden pink	<i>Dianthus deltooides</i>	
	Nottingham Catchfly	<i>Silene nutans</i>	
Lower Plants	Moss and liverwort spp.		C

## NATURE CONSERVATION IMPORTANCE

## Mammals

Bat species may use the caves and clefts for roosting, breeding and hibernating.

Tayside Biodiversity Partnership



## Birds

## Sea Birds

The Angus coast contains important habitats for breeding sea birds and is renowned for attracting migrating birds in autumn and winter.

The cliffs support large breeding colonies of Puffin, Razorbill, Herring gull and Shag. Razorbill, Guillemot and Puffin are auks that are mainly summer visitors, although a small number remain through the winter. However, Puffins are far less commonly encountered in the winter than other auk species. The Shag and Herring gull are common visitors to the area and nest on cliffs between Arbroath and St. Cyrus. Fulmars also breed in abundance along the rocky cliffs.

The area supports Turnstones which are noisy shorebirds equipped with a stout pointed bill ideal for turning over stones in the search for food. They winter along rocky coasts and generally breed on the rocky ground of coastal islands in Arctic regions.

Kittiwakes are common summer visitors to their nesting sites on the sheer cliffs between Arbroath and Scurdie Ness; large numbers are also seen at the mouth of the River North Esk where they bathe in the fresh water. They are less commonly seen in winter. Tiny numbers of Purple sandpiper also winter in the inter-tidal zone of rock coast.



PUFFIN

LORNE GILL/SNH



KITTIWAKES

LORNE GILL/SNH

## Higher plants and vegetation

The largely south-easterly facing cliff and slope areas of the Angus coastline comprise a diversity of environments. These support some very diverse habitats from exposed hard rock communities with rock face vegetation to softer rock cliffs, cliff crevice and cave, from rock exposures and coastal boulders to scree and vegetated undercliff.



### Nottingham Catchfly

Nottingham Catchfly *Silene nutans* is a perennial plant with drooping creamy-white flowers that have rolled back. Some populations have flowers that are yellow or pink-tipped. The deeply cleft petals open fragrantly at night. Its leaves have downy undersides and sticky upper surfaces. Specimens grow to a height of 25 - 80 cm. It has a very scattered distribution within Britain, but is locally common from North Britain to Wales. It is found in the North East of Scotland and grows locally in Angus where it favours grassy, base-rich sea cliff habitats.



LORNE GILL/SNH

NOTTINGHAM CATCHFLY

### Invertebrates

Important populations of Small blue butterfly, Grayling and Small pearl-bordered fritillary *Boloria selene* are found among the cliff-top grassland of the Arbroath cliffs. The area is also important for its snails and beetles.

### NATIONAL BIODIVERSITY CONTEXT

There is a UK Habitat Statement for Maritime Cliff and Slope which has the following main objective:

*Maintain and manage in a natural state, taking into account the great range of variation in habitat, hard rock cliffs and extensive soft rock cliff systems, whilst taking into consideration the need for any essential coastal defence works.*

Measures to be considered further include:

- Evaluate the existing measures for conserving and managing maritime cliff and slope and the habitats it supports
- Protect cliff habitats of conservation importance from inappropriate uses or impacts
- Implement strategies for managing the coastal zone at local, regional and national levels
- Review the powers and duties of coastal authorities for safeguarding this habitat
- Encourage further survey work and research into the ecology of this habitat type

### ECOLOGY AND MANAGEMENT

#### Whiting Ness to Ethie Haven

It is probable that most of the cliffs were grazed in the late 1800s, though there has been no grazing since World War II - with the exception of Ethie Mains where Soay sheep graze the grassy slopes.

The Scottish Wildlife Trust manages part of the site's southern section as a Nature Reserve. Its nature trail is open to the public and is especially popular for informal recreation.

SNH has carried out a detailed vegetation survey and will use the information to help in the management of the site over the next few years. The site's cliff vegetation was monitored by SNH in 2000. This confirmed that there has been some increase in coarser, more dominant grasses. This may arise from the use of pesticides, herbicides or fertilisers from fields adjacent to the SSSI at the cliff edge and run-off of fertilisers in gullies and field drains passing through the SSSI. Vegetational changes will continue to be monitored using the baseline study for comparison.

### Case Study

#### Soay sheep

Soay sheep are a small hardy breed originally from the Hebrides. They are dark brown with a white belly. A flock of them has long grazed both the cliffs and the shore at Ethie Mains on the Angus cliffs.

Walkers have noted that the sheep help control the level of scrub, including brambles, on the cliff top thus enhancing accessibility. The sheep are contained by freestanding electric fences. Grazing Animal Projects such as this are not suitable for all sections of the cliff tops as they would generate extra work for arable farmers, but grazing with traditional breeds is acknowledged as one of the management methods gaining popularity to enhance biodiversity.



KEN WILSON

#### Rickle Craig to Scurdie Ness

Grazing takes place in the fields adjacent to the shoreline with cattle free to go onto the shore and hence also the SSSI. Some cliff stabilisation has been done in the past and there is also a harbour and basic sea defences within the site. Gem collecting is still common here, but was especially so in the 1970s and 1980s. There has also previously been some dumping and vegetation burning.

The site was Site Condition Monitored in 2000 as part of an SNH 6-year programme. A full survey of the habitat is required in order to set up effective area-wide monitoring and assessment in the future.

### CURRENT FACTORS CAUSING LOSS OR DECLINE

The nature of the cliffs in Tayside has ensured that they remain amongst the least modified of terrestrial habitats. There are, however, several factors affecting them:

#### Coastal protection work

- Coastal protection structures at the base of cliffs are rare in Tayside and therefore natural erosion is the main influence upon the physical structure of the cliffs. Coastal protection works are designed to prevent the removal of eroded material by the sea. Their erection would therefore be likely to be detrimental to the plant and invertebrate communities dependent upon the unstable surface, as well as obscuring important rock exposures.

## Maritime Cliff and Slope

CE2

## Agriculture

- Cultivation of the cliff top vegetation has truncated the natural zonation between maritime and terrestrial vegetation resulting in some loss of plant species diversity as well as the loss of large areas of cliff top vegetation.
- As well as a loss of area due to agriculture, spray drift and run-off of pesticides, herbicides or fertilisers from adjacent fields can also affect cliff-top vegetation communities which can lead to a loss of species diversity.
- Cultivation close to the cliff edge could potentially lead to increasing erosion and slippage on the cliff tops.
- Although grazing by rabbits is an obvious feature in places along the coastal cliffs and slopes, a general lack of grazing has caused some scrub encroachment and a loss of some comparatively coarse and species-poor maritime grassland communities. Whilst some scrub (for example small areas of hawthorn, bramble or gorse scrub) can add to habitat diversity and is of value for many bird species, the diversity of species and vegetation types is generally enhanced by the right level of grazing.
- Tipping and dumping occurs in places along the coast. Locally this activity can have a profound impact on the flora and bird life. Maritime grassland is vulnerable and where large quantities of earth have been dumped succession is likely to occur to other vegetation types supporting tall bulky grasses and nettles.

## Recreation

- The cliffs are popular for their scenic value, rich history and culture and many cliff-top footpaths are heavily used. Unless well managed, vegetation trampling can reduce plant species diversity and the creation of access paths from cliff top locations to the shoreline can increase erosion and may adversely affect nesting birds.
- The southern area of cliffs comes under the heaviest recreational pressure because of its proximity to Arbroath, the existence of footpaths, including a nature trail (within the SWT Reserve) and the suitability of the site for walking, jogging, mountain biking, bird watching, botanising and angling. The northern section is notably less used. Litter is a continual problem creating a potential hazard for seabirds, invertebrates and small mammals. Angus Council is currently considering the possibility of a coastal trail which would run through the whole site; this could considerably increase the number of walkers within the SSSI.
- Burning by vandals regularly occurs between Whiting Ness and Carlingheugh Bay, especially in areas of thick grass or gorse and has resulted in the loss of an important plant species, the Maiden pink *Dianthus armeria*. Some of the burns have been so hot that loss of the humus part of the soil has occurred thus leaving areas highly prone to erosion, especially on slopes. Small blue butterflies *Cupido minimus* are dependent upon Kidney vetch *Anthyllis vulneraria* as a larval food plant so if fires should occur on a site on which it is present - or other rare species are known to occur - local populations could be lost.
- Theft of plants often occurs when Thrift *Armeria maritime*, Campion *Silene spp.* and other plants are in flower. SWT volunteer wardens stopped two people in 1993 which resulted in one of the individuals being charged. Theft of Herring gull eggs is also known to take place. There have also been incidents concerning the shooting of seabirds. There is currently no volunteer warden.

- In the 1980s the area between Whiting Ness and Carlingheugh Bay was used by off-road motorcyclists which resulted in unsightly tracks, damage to vegetation, erosion and noise pollution. Barriers now discourage motorcyclists, but there are sporadic incidents around Carlingheugh Bay.
- Angus College, Abertay University and Dundee University, as well as local schools, all use the Seaton Cliffs SWT Reserve as part of their ecological and geological courses. SWT Project and Training teams have also used the Reserve for training purposes.

Natural impacts

- Natural slumping and erosion occurs throughout the site, especially areas of softer rock. However, the geological interest of the site is well exposed and is not threatened in any way with erosion providing fresh exposures.

MAIN THREATS TO KEY SPECIES

Long-bracted sedge, Kidney vetch, Pellitory-of-the-Wall, Maiden Pink	- Recreational erosion - Trampling - Fire and theft	
	UK Importance of Tayside populations:	unknown
Shag, Herring gull, Turnstones, Kittiwakes, Fulmars, Razorbill, Purple Sandpipers, Puffin, Guillemots	- Litter - Disturbance, including dogs - Theft of herring gull eggs is known to take place	
	UK Importance of Tayside populations:	moderate
Small blue butterfly	Fires occurring in areas of Kidney vetch could result in populations being lost	
	UK Importance of Tayside population:	moderate

OPPORTUNITIES AND CURRENT ACTION

- Management plans for all designated sites to be kept current.
- Site Condition Monitoring programme being carried out by SNH monitors all SSSI notified interests on a 6-yearly basis. This could potentially be supplemented in between by work by other organisations.
- A Shoreline Management Plan is being prepared by Angus Council with input from other bodies.
- Integrated Coastal Zone Management is being considered by the Tay Estuary Forum; this would bring together the Shoreline Management Plan and the Tayside Biodiversity Action Plan.
- The Scottish Wildlife Trust's Seaton Cliffs has a reserve management group on which SNH is represented owing to the site's status as a SSSI.



## Maritime Cliff and Slope

CE2

## OBJECTIVES AND TARGETS

Objectives		Targets
1	Protect Tayside's existing maritime cliff and slope resource and the variety of habitats present from further losses to anthropogenic factors; to ensure conditions are suitable for the variety of species found within the habitat, especially the breeding and wintering birds and rare invertebrates, allowing for natural processes and replacing deterioration with positive conservation.	No net loss in area or reduction of quality of habitat (except from natural erosion).
2	Where conditions allow manage the coast in sympathy with natural processes, allowing cliffs to function as part of the natural coastal defences.	Allow the natural functioning of the coast where possible.
3	Continue to determine in detail the area, extent and condition of maritime cliff and slope habitats in Tayside.	Complete survey of all maritime cliff and slope habitat by 2004.
4	Maintain and protect the quality and integrity of designated sites. Ensure that the current set of management plans is completed and that monitoring of sites continues. Seek to apply prescriptions and principles to all maritime cliff and slope habitats in the region.	Keep up-to-date management plans for all designated areas.
5	Set up a five-year programme to raise awareness of biodiversity, its importance, the fragility of the coast, and the need for its conservation in Tayside. Include maritime cliff and slope in this programme.	Set up a public awareness programme by 2002. Run public awareness programme until 2006.
6	Ensure that any work carried out is in accordance with the aims and objectives of the Tay Estuary Forum and the Angus Shoreline Management plan.	Continue liaison with Angus Council Roads Department and Tay Estuary Forum.

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## Stakeholders

- Landowners, land managers and advisors, developers, tourists, and local users.

## ACTION FOR BIODIVERSITY

		Action - Maritime Cliff and Slope	Deliverers		To take place by							Meets Objective No.	
			Lead Partners	Partners	02	03	04	05	06	07	11	16	
LBAP Ref.	A	Policy and legislation											
CE2	1	Contribute to the development of Angus Council's Shoreline Management Plans and land use planning policies to preventing any further loss of natural cliff and slope habitats.	AC	TBP	#	#							1
CE2	2	Assist Tay Estuary Forum in the development of an Integrated Coastal Zone Management plan.	TEF	TBP			#	#					
CE2	3	Encourage the use of policies to safeguard existing cliff and slope habitats when Structure and Local Plans are reviewed.	DCC AC	SNH FC TBP	#	#	#	#	#	#	#	#	1

Tayside Biodiversity Partnership

CE2	4	Develop/promote agri-environment schemes which will encourage restoration and sustainable management of cliff top habitats.	FWAG SAC	SNH	# # #	1,2,3
	<b>B</b>	<b>Site management</b>				
CE2	1	Consider system of wildlife sites.	SWT		# # # # # # # # #	1,2
CE2	2	Use positive management agreements where appropriate to encourage sustainable grazing on cliff and slope SSSI and others where possible.	FWAG SEERAD	SNH	# # # # # #	1,2,3
	<b>C</b>	<b>Species management</b>				
CE2	1	Promote volunteer wardening of cliff tops.	SWT	TBP	# #	1,5
	<b>D</b>	<b>Advisory</b>				
	<b>E</b>	<b>Research and monitoring</b>				
CE2	1	Site Condition Monitoring of Whiting Ness to Ethie Haven and Rickle Craig to Scurdie Ness on 6 year cycle.	SNH		# # # # # # # # #	4
CE2	2	Maritime Cliff and Slope Action Plan review process– ensure this plan is being delivered annually and in detail after 5 years.	TBP		# # # # # # # # #	All
	<b>F</b>	<b>Promotion and awareness-raising</b>				
CE2	1	Raise public awareness of the importance of cliff and slope habitats through guided walks, talks, publications, press releases and environmental education opportunities.	TBP	SWT, AC, FE SNH, REEF	# # # # # # # # #	6

Maritime Cliff and Slope

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.





LORNE GILL/SNH

BARRY LINKS

## DEFINITION

Sand dunes can develop where an adequate supply of dry, wind-blown sand (often from a low-lying coastal plain where sand can accumulate and dry out at low tide) is blown by onshore wind and trapped by an obstacle in its path (tidal litter, shingle or vegetation). Of these, vegetation is often the most important since specialist dune-building grasses such as marram grass trap sand and encourage further deposition through which they can then grow. These stabilising grasses make the growing dunes more hospitable for other plants and animals to colonise. Moving inland, the amount of blown sand reduces and the dunes are more stable and provide easier conditions for more grasses and herbs to form a grassland or heathland. Sand that is moved from the upper, drier area of the beach may be replenished by wave action on the lower shore. Sand dunes are an important natural form of sea defence, preventing storm waves from flooding areas of low-lying land.

## KEY SITES

There are four main dune areas within Tayside. Within two of these areas there are several designated sites:

- The northern part of **Charleton and Kinnaber Links to Montrose** is included within the St Cyrus & Kinnaber Links SSSI
- The **Arbroath to Broughty Ferry** area contains Elliot Links SSSI, Easthaven SSSI, Barry Links SSSI and Monifieth Bay SSSI. Barry Links is also notified as a cSAC and is part of the Inner Tay SPA. Broughty Ferry Local Nature Reserve (LNR) is also in this section of coast.

## CURRENT STATUS AND EXTENT OF HABITAT

The ongoing sand dune survey of Scotland indicates that there may be as much as 33,000 hectares of dune in Scotland (almost three times that of England). Tayside is thought to hold 2,196 ha. of this dune resource. Of this land 1,728 ha. is vegetated and only 9 ha. bare; 92 ha. is under arable or fallow land and 368 ha. has been developed.

In Tayside, the largest habitat on windblown sand is fixed acidic dune grassland which covers 27%. Acidic soils are also shown by small amounts of dry dune heath (2%) and wet dune heath (1%). Fixed calcareous dune is locally extensive, often occurring seaward of acidic conditions. Bare sand and mobile dune is uncommon (under 2%), with more semi-

fixed (or yellow) dune covering 7%. Dune wetland is locally extensive, covering about 6%. Scrub is locally common (4%) and woodland locally important (5%). Improved grassland is the second largest category, dominating the dune interior in parts of Lunan Bay and Arbroath to Broughty Ferry. Arable land is locally extensive at 4%.

There are four main dune areas in Tayside:

- **Charleton and Kinnaber Links to Montrose.** This large 479 ha. bay dune and spit complex extends 6km from River North Esk to Montrose Basin where nature conservation interest is high. It consists of foredune, spit, sand-covered shingle, conifer plantations, acidic dune grassland, patches of heath, amenity grassland and offshore stone barriers to halt retreat.
- **Lunan Bay** is a moderately sized bay dune and dune spit site located to the north and south of the Lunan Water. It has a coastal frontage of 3.5 km which is excellent for walking. Ungrazed semi-fixed dune vegetation dominates the foredune zone. Much of the interior is improved grassland. Overall, nature conservation interest is moderate.
- **East of Arbroath.** This small bay dune system of 13 ha. is located behind 1.5km beach frontage below a raised beach cliffline. The interior is developed as mown amenity grassland. A seawall is extensive beside a promenade and road restricting any new dune development. Nature conservation interest is very low.
- **Arbroath to Broughty Ferry.** This open coast and ness (foreland) system is one of the largest sites on the east coast at 1,641.4 ha., extending for almost 23km. For much of this distance it forms a narrow belt of open dune coast up to 400m wide. Fixed dune habitat is locally extensive at Elliot Links. Further fixed and semi-fixed dune habitat occurs at East Haven. At its widest the site is almost 4km where a very large foreland system has developed at the mouth of the River Tay. This area, **Barry Links**, is owned by the MoD and is used for training. It has two dune types – fixed dunes and dune heath - which are regarded as a priority under the EU Habitats Directive. Most nature conservation interest is concentrated at Barry Links.

## KEY SPECIES

P = UK Priority species    C = UK species of conservation concern

Birds	Shelduck	<i>Tadorna tadorna</i>	C
	Ringed plover	<i>Charadrius hiaticula</i>	C
	Little tern	<i>Sterna albifrons</i>	C
	Arctic tern	<i>Sterna paradisaea</i>	C
	Common tern	<i>Sterna hirundo</i>	C
Amphibians/Reptiles	Adder	<i>Vipera berus</i>	C
	Smooth newt	<i>Triturus vulgaris</i>	C
Invertebrates	Small blue butterfly	<i>Cupido minimus</i>	C
	Northern brown argus	<i>Aricia artaxerxes</i>	P
Higher Plants	Greater yellow rattle	<i>Rhinanthus angustifolia</i>	C
	Coralroot orchid	<i>Corallorhiza trifida</i>	
	Meadow saxifrage	<i>Saxifraga granulata</i>	
	Rush-leaved fescue	<i>Festuca arenaria</i>	
	Baltic rush	<i>Juncus balticus</i>	
Sea pea	<i>Lathyrus japonicus</i>		
Lower Plants	a lichen	<i>Cladonia uncialis ssp uncialis</i>	C
	a lichen	<i>Cladonia mitis</i>	C
	Sea bryum	<i>Bryum warneum</i>	P
	Matted bryum	<i>Bryum calophyllum</i>	P

## NATURE CONSERVATION IMPORTANCE

Dune systems generally comprise several distinct features:

- **FOREDUNES.** These are the youngest actively building dunes – often the most attractive for recreation, but also the most susceptible to erosion. A few well-adapted plants grow here such as Marram *Ammophila arenaria* and Lyme-grass *Leymus arenarius*. Many invertebrate species utilise the warm varied habitat provided by these dunes, especially spiders, butterflies, hoverflies and moths.
- **YELLOW (SEMI-FIXED) DUNES.** Species such as Sand sedge *Carex arenaria*, Hawkweed *Hieracium spp.*, Creeping thistle *Cirsium arvense*, Rush-leaved fescue *Festuca arenaria*, Sea holly *Eryngium maritimum* and Sea bindweed *Calystegia soldanella* begin to colonise the dry sand between grass clumps, thereby progressively stabilising the dunes.
- **FIXED DUNES.** Dune grassland occurs as a more stable dune develops. Sand trapping plants give way to sand “fixing” plants such as mosses and lichens (often *Cladonia* lichens) which raise the humus content of the soil, creating a carpet through which sand is unable to escape. Sand sedge forms a loose turf, accompanied by species like Wild thyme *Thymus praecox*, Sand fescue *Festuca rubra* L. subsp *arenaria*, and Birdsfoot trefoil *Lotus corniculatus*. Click beetles may occur.
- **LANDWARD DUNE EDGE.** Where dunes are fairly stable ranker grasses and scrub species might seed in, shading out some of the more interesting low-growing vegetation. Some invaders, such as Sea buckthorn *Hippophae rhamnoides* leave an enriched soil which changes the nature of the vegetation. Where grazing predominates, grassland may persist – otherwise scrub or woodland is typical. Where the soil is acid, heather dominated heath may develop. Willow or birch dominates scrub on wetter dune slack areas.
- **DUNE SLACKS.** These are low-lying wetland areas between dune ridges. Dragonflies and damselflies, as well as molluscs are found. Succession is largely determined by whether the soil remains waterlogged and becomes increasingly acidic where rushes and bog moss can dominate. If the soil dries out seasonally shrubs like Creeping willow *Salix repens* may occur which provide a useful source of nectar and a foodplant for invertebrates.

## Mammals

Small mammals include several species of voles (Bank and Common), mice and Rabbits *Oryctolagus cuniculus* whose grazing is important in maintaining the varied vegetation structure and consequently the diverse range of habitats for plants and other animals. Small mammals and shore-nesting birds attract predators such as Foxes *Vulpes vulpes*, Weasels *Mustela nevalis* and Stoats *Mustela erminea*. Roe deer *Capreolus capreolus* have also been seen, as have Brown hares *Lepus europaeus*. Sheep graze the dune grassland at Barry Links.

## Birds

Shore-nesting birds include Terns and Shelduck *Tadorna tadorna*. In the summer Skylarks *Alauda arvensis*, Meadow pipits *Anthus pratensis*, Linnets *Carduelis cannabina* and Stonechats *Saxicola torquata* are abundant. Birds of prey (including Short-eared owl *Asio flammeus* and Merlin *Falco columbarius*) hunt the dunes and slacks, whilst passage birds - including Fieldfares *Turdus pilaris* and Redwings *Turdus iliacus* - winter among Sea buckthorn where they feed on the berries. On fixed dunes and dune heaths and grasslands, species such as Skylark and Meadow pipit are typical. Barry Links and Monifieth Bay SSSI both support nationally and internationally important populations of wildfowl and waders and this is recognised by their designation as part of the Inner Tay and Eden Estuary Special Protection Areas (SPA) under the European Birds Directive.



### Amphibians and Reptiles

Common toad *Bufo bufo*, Adder *Vipera berus* and Common lizard *Lacerta vivipara* often favour the warm, dry and open sandy habitats provided by the dunes.

### Invertebrates

The variety of coastal dune habitats supports a variety of invertebrates, including grasshoppers, earwigs, many beetles, butterflies and moths. Sand-burrowing hunting wasps and bees may be abundant on open dunes, with bumblebees inhabiting older dunes. Crane fly grubs destroy marram grass shoots. Wolf and jumping spiders occur. Dragonflies, mayflies and caddis flies live in the wetter slacks. Pond skaters, water boatmen and whirligig beetles remain in or on the water. The Common banded snail *Cepaea nemoralis* and Garden snail *Helix aspera* are also frequently found. Small pearl-bordered fritillaries *Boloria selene* are often seen.

#### Small blue butterfly

The Small blue, the smallest of Britain's butterflies (with a wingspan of just 16 - 25 mm), has been in decline in the UK since the 1950s. The males have distinctive smoky-black wings with a silvery blue dusting of scales which they keep half-open to the sun during the breeding season. Breeding occurs where plant cover is sparse and the soil crumbly and fine, making the more sheltered sand dunes along the Angus coast where its sole foodplant the Kidney vetch grows, a favoured habitat.

Colonies are typically small and up to 30 adults will gather to roost at night on tall vegetation. Females lay eggs on the Kidney vetch flowers where the resulting grey-pink caterpillars later burrow into the buds and eat the developing anthers and seeds. By the end of July they begin hibernation within a crevice under soil or moss. The following spring they seek a pupation site and the butterflies emerge from mid-May; only a few survive into the summer.



PAUL KIRKLAND

### Higher plants

The rarest plant known from the sand dunes of the Angus coast is Greater yellow rattle *Rhinanthus angustifolius* found at Easthaven; it grows nowhere else in Scotland. The Sea pea *Lathyrus japonicus* has also occurred in a few locations, but in recent years only small numbers have been found at the mouth of the Barry Burn.

#### Greater yellow rattle

Easthaven is the only location in Scotland for the Greater yellow rattle. It is an annual plant best seen in July and August. It is hemi-parasitic and gains its food partly from other plants. Bees and possibly butterflies pollinate the flowers throughout the summer.

At Easthaven it grows mainly within tall open vegetation on the dune grassland. SNH is currently undertaking research to improve knowledge of this species and to ensure its future management is safeguarded.



LORNE GILL/SNH

## NATIONAL BIODIVERSITY CONTEXT

There is a UK Broad Habitat Statement for sand dune habitat, which has the following main objective:

*Maintain the extent and enhance the habitat quality of sand dune systems, and ensure the natural processes that create them are not unduly prevented by human influence.*

Measures to be considered further include:

- Protecting sand dune habitats of conservation importance from inappropriate uses.
- Implementing strategies for managing the coastal zone at a local, as well as regional and national level.
- Reviewing the powers and duties of coastal authorities for safeguarding this habitat.
- Reducing the impact of sea level rise (and the resulting increase in wave attack and dune erosion), including replacing unavoidable losses.
- Reducing the damage resulting from the introduction of non-native species.
- Encouraging appropriate levels of grazing on sand dune systems.

## ECOLOGY AND MANAGEMENT

- Much survey work has already been carried out on the designated sites.
- A full survey of the habitat is required in order to set up effective, area-wide monitoring and assessment in the future.
- Site Condition Monitoring of Sites of Special Scientific Interest is carried out according to a 6 year programme.

## CURRENT FACTORS CAUSING LOSS OR DECLINE

## Erosion

Unless artificially constrained seaward dune edges can be highly mobile. Few dune systems are in overall equilibrium and generally the coast of Tayside demonstrates net erosion. Limited natural erosion helps regenerate dune systems, but the survival of the biological interest and the actual structure may be at risk if it increases excessively.

## Recreation

The coast and its sand dune systems offers easy access by local residents and visitors and provides opportunities to watch wildlife, pursue outdoor sports such as golf, or simply walk, contemplate and seek inspiration. However, such a major land use causes damage to vegetation, exposes the underlying sand to the wind and rain and results in the loss of vegetation and sand. Rehabilitation of such areas can be carried out, but it often takes years for the natural diversity to become re-established.

Grazing

Whilst continued grazing is necessary to maintain the grassland and to prevent scrub development, overgrazing can have damaging effects. Undergrazing is more widespread, allowing vegetation to be invaded by coarse grasses and scrub.

Development

Pressure, especially on the older dune systems, continues with further developments proposed leading to the destruction of this habitat. Many dune links are now golf courses where fertilisers, herbicides and irrigation are used for 'improving' the vegetation. Car and caravan parks widen access and increase trampling, fires and disturbance.

Sea defences

Many dune systems are affected by coastal defence works that arrest the formation of new dune systems and affect the dynamism of dune systems.

Non-native species

Whilst the invasive Sea buckthorn scrub stabilises the dunes at Barry Links, it also alters the dunes' nutrient status.

Afforestation

Over the years afforestation, often with non-native pines, has restricted dune development causing changes in dune vegetation and lowering water levels. Felling and permanent removal of trees means that native vegetation can be restored in a relatively short time.

Natural changes

Sea level rise and increased storms forecast as global climates change may cause foreshore steepening, thus allowing increased wave attack at the base of the dunes

MAIN THREATS TO KEY SPECIES

Sea pea	- Lack of ground disturbance on the dunes on which it grows. Its remaining population at Carnoustie, Barry Burn, is "squeezed" between the golf course and the dune edge.
	UK Importance of Tayside population: <b>high</b>
Greater yellow rattle	- Lack of habitat management and potential erosion of the dunes on which it grows.
	UK Importance of Tayside population: <b>high</b> – globally threatened: this is the only population in Scotland

## Sand Dunes

CE3

Little tern	- Disturbance and erosion of nesting sites. - Habitat loss due to development.	
	UK Importance of Tayside population:	moderate
Skylark	- Loss of grassland habitat. - Disturbance. - Reduction in abundance of insect food.	
	UK importance of Tayside population:	unknown - this is a UK Flagship Species and in decline nationally.
Small blue butterfly	- Loss of its foodplant, the Kidney vetch.	
	UK importance of Tayside population:	unknown - this species is in decline nationally

## OPPORTUNITIES AND CURRENT ACTION

- Management plans for all designated sites to be kept current.
- Broughty Ferry LNR Management Plan is on a five year cycle.
- Site Condition Monitoring programme being carried out by SNH.
- SNH also monitors all SSSI notified interests on a 6-yearly basis. This could be supplemented in between by other work (potentially by others).
- Conservation Group involving MoD at Barry Links (large proportion of Tayside's sand dune resource).
- Tay Estuary Forum and overall plan for Integrated Coastal Zone Management.

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## Case Study

## Tern Project, Barry Buddon

During the 1950s Barry Buddon was home to five different species of tern consisting in total several thousand breeding pairs. Today no terns breed on the site. The decline in the breeding population may have been the result of habitat disturbance and the subsequent reduction in suitable nest sites. Such a decline in tern numbers probably began before the Ministry of Defence increased activity on the site over a decade ago. However, the area's increased usage has led to a public access restriction to Saturday evenings and Sunday afternoons, perhaps making it once more suitable for terns.



COMMON TERNS

ERIC VAN POPPEL

Members of the Tayside Biodiversity Partnership are working together to encourage the terns back to this important site. Clay bird 'decoys' have been made, mostly using Carse of Gowrie clay, and some have been fired in the Dundee College pottery kilns. The local community, including local schoolchildren, have helped paint the models in readiness for siting near the lighthouse. Shelters and 'tern calling-tapes' may also be used to further attract the terns to breed on the site. It is hoped local volunteers will keep the site suitable for terns and long term planning, together with site monitoring, will assess the various management approaches used.

Tayside Biodiversity Partnership

## OBJECTIVES AND TARGETS

Objectives		Targets
1	Protect the existing sand dune resource in Tayside from further losses to anthropogenic factors, allowing for natural processes and replacing deterioration with positive conservation.	No net loss in area or reduction of quality of habitat beyond 2005.
2	Where conditions allow manage the coast in sympathy with natural processes, allowing soft-sediment coasts to function as natural coastal defences.	Allow the natural functioning of the coast where possible.
3	Where conditions allow attempt to restore areas of sand dune lost to forestry, agriculture or other human uses.	Restore degraded sand dunes, where realistic, by 2010.
4	Continue determining in detail the area, extent and condition of sand dune habitats in Tayside.	Complete survey of all sand dune habitat by 2003.
5	Maintain and protect the quality and integrity of designated sites. Ensure that the current set of management plans is completed and that monitoring of sites goes ahead. Seek to apply principles of management plans to all sand dune habitats in the region.	Keep up-to-date management plans for all designated areas.
	Set up a five-year programme to raise awareness of coastal biodiversity, its importance, the fragility of the coast and the need for its conservation in Tayside. Include sand dunes in this programme.	Set up a public awareness programme by 2002.  Run public awareness programme until 2007.

## Stakeholders

- Landowners, managers and advisors, developers, tourists and local users (including golfers).

## ACTION FOR BIODIVERSITY

		Action - Sand Dunes	Deliverers		To take place by							Meets Objective No.	
			Lead Partners	Partners	02	03	04	05	06	07	11	16	
LBAP Ref.	A	<b>Policy and legislation</b>											
CE3	1	Contribute to the development of Angus Council's Shoreline Management Plan and land use planning policies to safeguard sand dune habitats.	AC	TBP	#	#							1
CE3	2	Where Tay Estuary Forum responsibility includes sand dunes of Barry Buddon, ensure that ICZM (TEF) policies and proposals complement those of the Shoreline Management Plan.	TEF	AC MoD	#	#	#	#	#	#	#	#	1
CE3	3	Complete SAC, SPA processes and subsequent designations.	SNH	SE EU	#								1
CE3	4	Encourage use of policies to safeguard existing sand dune habitats when Structure and Local Plans are reviewed.	PKC DCC AC	SNH FC NGOs	#	#	#	#	#	#	#	#	1



## Sand Dunes

## CE3

CE3	5	Develop/promote agri-environment schemes which will encourage restoration and sustainable management of dune habitats.	FWAG SAC	SNH	#	1,2,3
<b>B</b>		<b>Site management</b>				
CE3	1	As part of the review of the Barry Buddon Management Plan (by Defence Estates and SNH) encourage additional conservation and enhancement measures that support the natural heritage importance of the site, taking account of MoD operations and requirements.	MoD SNH		# # # # # # # # #	1,2,3
CE3	2	At Broughty Ferry Dunes undertake habitat improvement: dune stabilisation work, restoration of plant ecosystems, fencing to protect from disturbance, and habitat improvements for relevant species.	BFEP		# # #	1,2,3
CE3	3	Encourage golf course management policies and practices which are sympathetic to the flora and fauna of sand dune systems (see also the Golf Courses HAP)	SNH	TBP	# # # # # # # # #	1,2,3
<b>C</b>		<b>Species management</b>				
CE3	1	Tern Project to encourage Little and Common terns back to Tayside coast at Barry Links.	SNH	TBP SWT MoD	# # #	1,5
CE3	2	Tern wardening, as done before, if the terns nest at Elliot Links.	SNH		#	1,5
CE3	3	Study on potential of re-colonisation of dunes by Sea Pea at Elliot Links.	SNH		#	1,5
CE3	4	Grazing Animals Project at Barry Links to ensure best possible management.	MoD	SNH	#	1,5
CE3	5	Work on Easthaven (Greater Yellow Rattle) to research best future management.	SNH		#	1,5
CE3	6	Cutting, burning and scarifying ground at Easthaven to make a more favourable habitat for, and at least maintain the current population of, Greater Yellow Rattle.	SNH	Dundee Naturalists	# # #	1,5
<b>D</b>		<b>Advisory</b>				
CE3	1	Sharing Good Practice workshop, 6.4.02, Battleby. Sand dune Stabilisation – W. Monifieth dunes being used as an example.	SNH		#	1,6
CE3	2	Promote and develop demonstration sites for the restoration of dune vegetation on dune systems.	BFEP SNH	MoD	# #	1,6
CE3	3	Encourage best practise management of sand dunes by preparing and disseminating updated guidance material.	SNH		#	1,3,6
<b>E</b>		<b>Research and monitoring</b>				
CE3	1	Complete study of sand dune sites, using findings to prioritise work and possibly to feed into any local wildlife sites.	SNH	SWT, PKC DCC, AC TBP	#	All
CE3	2	Site Condition Monitoring of Elliot Links, Easthaven, Barry Buddon, St Cyrus/Kinnaber Links – on 6 year cycle	SNH		# # # # # # # # #	4
CE3	3	At Broughty Ferry dunes carry out habitat surveys to monitor dune movement; survey plant species; explore dune fauna; relate dune, foreshore and marine habitats; review water quality measures; monitor leisure use of dunes; geodiversity; and to generate maximum participation from the community.	BFEP	DCC	# # #	4
CE3	4	Sand Dune Action Plan review process – ensure this plan is being delivered annually and in detail after 5 years.	TBP		# # # # # # # # #	All

	F	Promotion and awareness-raising				
CE3	1	Involve local community in Tern Project.	DCC	MoD SNH	#	6
CE3	2	At Broughty Ferry Dunes, provide seating produced (using driftwood) by local workshops with information about habitat and cultural information; produce leaflet/postcards from survey information; local storytelling linking people and biodiversity.	BFEP	TBP	# # #	6
CE3	3	Raise public awareness of the importance of sand dune habitats through guided walks, talks, publications, press releases and environmental education opportunities.	BFEP	SWT AC FE SNH REEF TBP	# # # # # # # # #	6

Sand Dunes

This illustrative map shows a few key examples of the habitat. Please note that many sites of interest are privately owned and owners' permission should be sought for any access.

