INVESTIGATING SKOMER

an educational guide to Skomer Island and its surrounding seas.

By

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INTRODUCTION TO THE GUIDE

This guide offers an introduction to the natural history of Skomer Island National Nature Reserve and Marine Nature Reserve. The information is structured around a number of stopping points showed on the accompanying map. At each stopping point there are also a number of activities, which you might find interesting to try if you are fortunate enough to be on the Island as you read this.

WHO IS THE GUIDE FOR?

This guide is for anyone with an interest in the natural history of this beautiful Island and the surrounding sea. It should be especially useful for teachers who wish to lead groups of students around the Reserve; the material is aimed at secondary level but hopefully would be of use to those teaching any age group.

The activities we have included are designed to promote a variety of skills, which are described below. This guide is not just for biologists or even just scientists; it is for teachers and students with an interest in the environment.

HOW TO USE THE GUIDE.

All of the activities are based around stopping points, any combination of which can be covered by a number of routes. The choice of route is flexible depending on the weather, time available and the requirements of the participants. We haven't specified a particular age level because Skomer Island is visited by people of all ages, there should be something in here for everybody.

At each point some relevant background information for the site and a number of suggestions for activities are provided. Approximate timings for each activity are included. The activities may be carried out on Skomer or they may be completed at a later date. Suggestions for further work are included at the end of each section where appropriate.

If each student is given a photocopy of the base map, they can fill in their route as they go round the island. They might like to take pictures as they go round, they could include the pictures' position on their map and incorporate them into a Skomer work file later on.

AIMS AND OBJECTIVES/ SKILLS AND PROCESSES.

The activities for students that are suggested here have been designed to fulfil a number of Aims and Objectives.

1. To promote an awareness of living organisms and their environment and to develop an interest in and enjoyment of the same.
2. To encourage an attitude of curiosity and scientific enquiry.
3. To get the most out of what Skomer has to offer in an educational and aesthetic sense.
4. To develop a range of communicative, observational and manipulative skills, both scientific and artistic in nature including, for example, the ability to:
    - make and record accurate observations,
    - formulate and test hypotheses,
    - analyse, interpret and draw inferences from a variety of forms of information,

- select and organise information relevant to particular ideas and communicate this information in a variety of ways, i.e. the spoken and written word, painting and drawing,
- demonstrate knowledge and understanding of biological (and other) facts, terminology, concepts and principles,
- demonstrate knowledge and understanding of the applications of biology (and other subjects) to problems of a personal, social, economic and environmental nature,
- demonstrate knowledge, understanding and application of safety precautions.

KEY IDEAS.

Skomer is a beautiful example of an island ecosystem. This booklet will help students and teachers to use the island to explore a number of key ideas namely those of :

- conservation and ecosystem management,
- island ecology, marine ecology and the links between the two,
- mans effect on the environment,
- respect for living organisms,
- relationships between living organisms and their environment,
- effects of human activities on these relationships,
- agriculture - prehistoric to the present day,
- changes in land use, historic perspective,
- geology and man,
- environmental awareness for all,
- sustainability – the use of solar panels, wind turbines and compost toilets.

VALUES AND ATTITUDES.

We hope that the experience gained from a visit to Skomer will promote environmental awareness in teachers and students alike. As people are made more aware of the natural environment we hope that they will develop an interest in and an enjoyment of living organisms. We also hope to encourage a respect for all forms of life and an awareness of peoples various effects on living systems.

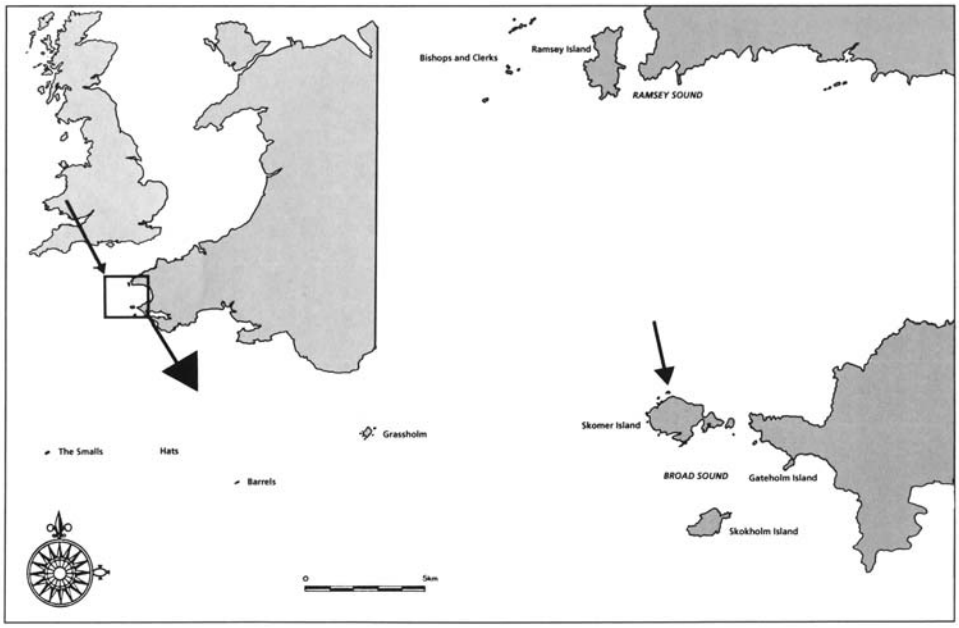
RELEVANCE TO EDUCATIONAL NEEDS.

GCE and equivalent Specifications and the National Curriculum change, Skomer is always an educational gem! The latest incarnations of our biological education pigeonholes favour themes of conservation, human interaction with the environment and biodiversity; even classification has become popular again.. Your specific needs will vary but there will be a wealth of material that will be useful and relevant gained from a visit to the Island.

Skomer is also an excellent opportunity to study Education for Sustainable Development and Global Citizenship Not only is it possible to see the links between humans and biodiversity, but this unique environment makes sustainable living compulsory. The new renovations have included the installation of compost toilets, solar panels and wind turbines which provide working examples of the successful use of renewable energy.

AN INTRODUCTION TO SKOMER ISLAND AND THE MARINE RESERVE.

INTRODUCTION - The Pembrokeshire off-shore islands in context.



The Pembrokeshire offshore islands of Skomer, Skokholm, Ramsey and Grassholm are of international conservation importance. Each is managed as a reserve for its breeding seabird colonies. Skomer and Skokholm have about one half of the worlds known breeding population of Manx shearwaters between them, as well as large numbers of breeding auks (puffins, guillemots and razorbills) and gulls (including kittiwakes). Grassholm is the second largest gannetry in the world (after St. Kilda) with around 32,000 breeding pairs.

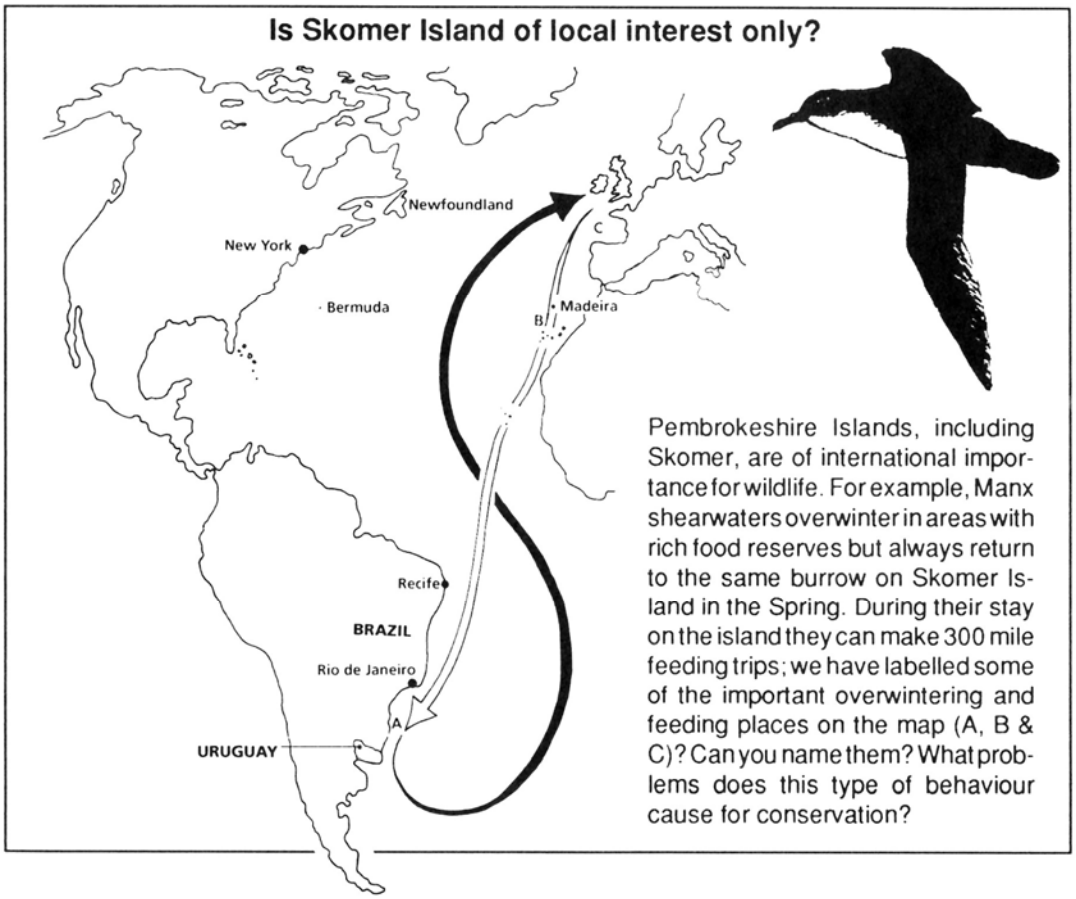
Grassholm

Marine scientists have found an exceptionally rich variety of species in the seas around Skomer. This variety is partly due to the strong tides and water currents, which bring new supplies of food and nutrients daily. The parts of the Island that are exposed to strong currents are known as high energy sites, those protected from waves and currents are known as low energy sites. High-energy sites are scoured clean and support a totally different set of animals and plants from the low-energy sites where sand, shell fragments and other deposited material builds up. Hence there are many different types of home (or habitat) around the Island, which adds to its species richness.

Large numbers of grey seal pups can be seen around Skomer. As seals and seabirds spend most of their lives at sea, marine conservation is essential to their wellbeing. To help give protection to both the marine wildlife and the breeding seabirds, a statutory Marine Reserve around Skomer was declared in 1990.

All the Islands mentioned above and the surrounding seas are included in the “Pembrokeshire Marine” Special Area for Conservation (SAC). SACs and SPAs (Special Protection Areas, which are set up to protect wild birds) are part of a European (Natura 2000) network of exceptional sites whose designation is to promote the conservation of Europe’s biodiversity.

Whilst reserves are essential, conservation of seabirds and other marine life should not stop at reserve boundaries. The marine life is swept in from other areas by currents and the seabirds spend most of their lives at sea, far removed from the islands.



CONSERVATION AND MANAGEMENT - THE AUTHORITIES INVOLVED

THE CONSERVATION MAZE.

There are many different organisations involved with conservation in Britain. Some of these are Governmental Organisations (GOs; e.g. the Countryside Council for Wales (CCW); others are private or non-governmental organisations or NGOs (e.g. the Wildlife Trust South and West Wales (WTSWW). A list of the main organisations involved in the Skomer area is given in the Ownership Table below.

Skomer and Middleholm: A National Nature Reserve (NNR) since 1959, owned by CCW. The island is leased to the Wildlife Trust of South and West Wales who employ a warden and have a management committee made up of local WTSWW members and representatives from other bodies. A warden, assistant warden and voluntary workers make up the staff. CCW maintains a research base, which provides laboratory space and accommodation. Research and long term monitoring are very important on Skomer. The work is not only important for management of the island, but it is also of benefit to our understanding of species and habitats elsewhere. The volume and quality of research work pursued at Skomer is outstanding. Parliament always intended that NNRs should provide special opportunities for research, and Skomer has been a leader in this respect. Skomer is also a Site of Special Scientific Interest (SSSI); was designated a Special Protection Area (SPA) for its breeding seabirds in 1982; is listed in the Geological Conservation Review (GCR) and lies in the Pembrokeshire Marine Special Area of Conservation (SAC). The surrounding seas, including much of the area around the Marloes peninsula, were designated as a Marine Nature Reserve (MNR) in 1990 to become Wales' first (and the UK's second) conservation area of this kind. Virtually the whole Island, outside the area of the central farm, is a scheduled Ancient Monument. Middleholm is owned by the National Trust and is also designated as part of the SPA under EU legislation.

Skomer Marine Reserve (SMNR): It includes the seabed and foreshores around Skomer, Middleholm and the Marloes peninsula up to the Highest Astronomical Tide (HAT) level (SEE MAP). SMNR is managed by CCW but the ownership and management is complex.

- **Marloes Peninsula**: Most of the coastal strip and peninsula is under National Trust ownership but some is privately owned.

- **The seabed and foreshore (below mean high water mark)**: Owned by the crown and under the jurisdiction of the Crown Estate.

- The foreshore of the Marloes Peninsula: Leased to Pembrokeshire County Council and subject to Pembrokeshire Coast National Park byelaws.

- The seabed is owned and governed by the Crown Estate. CCW manage the seabed and foreshore around Skomer, and the tip of the Marloes peninsula, as a Marine Nature Reserve (MNR). Fisheries byelaws however are the province of the South Wales Sea Fisheries Committee (SWSFC). Any byelaws CCW wish to see imposed on the fisheries around Skomer must be created by the SWSFC.

Ownership and conservation management of the Skomer area

(See below, and the accompanying table for an explanation of the acronyms!)

SITE	STATUS	OWNERSHIP		CONSERVATION MANAGEMENT
		GOVERNMENT/CROWN	PRIVATE	
SKOMER	SSSI: down to MLW (including foreshore of Middleholm between MLW and MHW). NNR. SPA:(with Middleholm and Skokholm). MNR (Foreshore to HAT). Part of PCNP.	CCW. CE leases the foreshore to CCW (MLW to MHW).		WTSWW managed, under agreement with CCW.
SKOMER (MNR)	MNR. Part of PCNP.	CE lease the seabed and foreshores (MLW to MHW) of Skomer and Middleholm to CCW. The foreshore (MLW to MHW) of the mainland is within the MNR but is leased by CE to PCC and has PCNP byelaws. (The MNR extends to HAT. This complicates matters as the CE lease stops at MHW!)	A private farm and NT own the parts of the MNR between MHW and HAT on the Marloes Peninsula (a very narrow strip of land!).	CCW manages the MNR via a code of conduct and a variety of byelaws. Fisheries byelaws within the MNR are made by the SWSFC. PCNP byelaws apply to the foreshore of the mainland. There is a Preseli Pembrokeshire District Council byelaw governing speed within Martin's Haven. The EA is responsible for water quality within the coastal zone.
MIDDLEHOLM	SSSI. SPA (with Skomer and Skokholm). Part of PCNP.	CE owns the foreshore and leases it to CCW.	NT	Managed by NT.
MARLOES PENINSULA	MNR (between MLW and HAT along the coast of SMNR). Part of PCNP.	CE owns the foreshore and leases it to PCC; PCNP byelaws apply.	A private farm and NT	SSSI on Deer Park. Much of area managed by NT and their tenants.
GATEHOLM	SSSI (down to MLW). MNR between MLW & HAT. Part of PCNP.		NT	Managcd by NT.
GRASSHOLM	SSSI. SPA (independent of Skomer SPA). Part of PCNP.	CE lease foreshore to PCC.	RSPB.	Managed by RSPB.
SKOKHOLM	SSSI. SPA (with Skomer and Middleholm). Part of PCNP.	CE lease foreshore to PCC.	WTSWW. (lighthouse to TH).	Managed by WTSWW.
SMALLS	Part of PCNP.	CE own foreshore	TH above MHW.	

MLW= MEAN LOW WATER; MHW= MEAN HIGH WATER; HAT= HIGHEST ASTRONOMICAL TIDE.

Authorities and acronyms

CCW Countryside Council for Wales. Formed in April 1991 under the Environment Protection Act 1990. CCW has the duties formerly undertaken by the Nature Conservancy Council (NCC) and the Countryside Commission (CC), who before 1991 acted for England, Scotland and Wales. Wales now has CCW, Scotland has Scottish Natural Heritage (SNH) and in England NCC has become English Nature and CC is retained. To complicate matters further, there is a Joint Nature Conservation Committee (JNCC), which is responsible for conservation advice, and research at national and international levels.

CCW has statutory responsibilities for both advising on and carrying out the conservation policies of the government and European Union in Wales. Included in their responsibilities are the recognition and designation of Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs), National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs). These conservation sites are usually on private land, although some National Nature Reserves such as Skomer are owned by CCW. The management of these sites may or may not be carried out by CCW. Skomer for instance is owned by CCW but managed under agreement by the Wildlife Trust South and West Wales (WTSWW). The seabed within Skomer MNR on the other hand is owned by the Crown Estate (CE) but is managed by CCW. Designation of a site (e.g. as an SSSI) does not mean that CCW controls the management of private land.

CE Crown Estate. The landlords of the reigning King or Queen's estates. CE own most of the foreshore and seabed around the UK.

PCC Pembrokeshire County Council.

WTSWW Wildlife Trust South and West Wales. An NGO and one of the many county trusts throughout the UK which manage conservation in the local area on a voluntary basis and linked in partnership by the Royal Society of Wildlife Trusts. WTSWW own over 90 nature reserves and manage Skomer on behalf of CCW.

MNR Marine Nature Reserve. A statutory designation of an area of seashore (below HAT) and seabed for conservation purposes under the Wildlife and Countryside Act 1981. The legislation and designation of MNRs is complex, and only two MNRS were designated between 1981 and 1993 (Lundy and Skomer).

NNR National Nature Reserve. A statutory designation of an outstanding conservation area, of national or international interest. Most NNRs are also SSSIs. Most are leased to other responsible bodies, such as WTSWW in Skomer's case.

EA Environment Agency. A statutory body with the role to ensure maintenance of water quality of rivers and the coastal zone. The EA also regulates fisheries of migratory species.

NT The National Trust is a NGO and the largest heritage and conservation body in Britain. It owns a variety of sites including historic buildings, estates, woodlands, moorland and coastal sites such as sand dunes and sea cliffs.

PCNP Pembrokeshire Coast National Park. PCNP Authority is a branch of Pembrokeshire County Council (PCC). It is one of 14 National Parks in England and Wales created under the National Parks and Access to the Countryside Act, 1949. The Parks were created on the basis of their scenic and natural beauty coupled with the opportunity for open-air recreation. PCC lease most of the foreshore around Pembrokeshire and PCNP byelaws apply.

RSPB Royal Society for the Protection of Birds. The largest voluntary conservation body in Britain, concerned with the conservation and protection of birds. It owns, leases or manages 110 reserves in Britain.

SPA Special Protection Area. These are designated in accordance with the EU 'Directive on the Conservation of Wild Birds' (EEC/79/409) for the specific protection of wild birds, especially migratory species. Within the UK, the implementation of this designation is through the existing SSSI notification system.

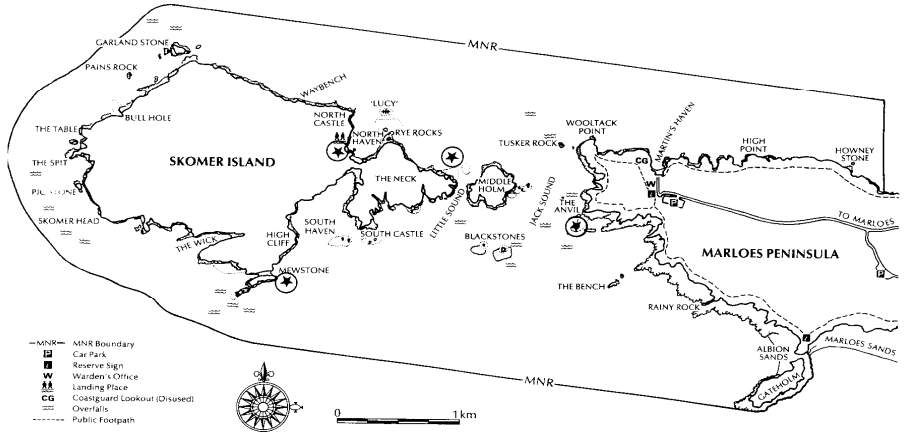
SSSI Site of Special Scientific Interest. These are sites notified under the National Parks and Access to the Countryside Act 1949 and subsequently under the Wildlife and Countryside Act, 1981. The legislation states that there is a "duty to notify as a Site of Special Scientific Interest, any land which is of special interest by reason of any of its flora, fauna, geological or physiographic features". It is the responsibility of CCW to notify SSSIs.

SWSFC South Wales Sea Fisheries Committee. A statutory body with the role of promoting and regulating fisheries in the South Wales Area. All byelaws relating to fisheries, even within SMNR must be drawn up by SWSFC.

TH Trinity House. A NGO responsible for the lighthouses in England and Wales. Most of their funding comes from light dues collected by the Department of Transport. There are light houses owned by Trinity House on Skokholm and the Smalls.

GEOLOGY AND LANDSCAPE.

The rocks of Skomer are volcanic in origin and are thought to be Lower Silurian in age, thus making them 420 to 430 million years old. People are often impressed to find they are walking over old lava flows and ash beds produced by an ancient volcano. The weathered top of a basalt lava flow can be seen as a red layer in the Anvil by Jack Sound. The oldest rocks are to be found by the Garland Stone to the north of the Island and they get progressively younger as you move south towards the Mew Stone.



Map of Skomer Island

The top of the island is fairly flat in common with much of the south Pembrokeshire mainland. This 60m (200 ft) high platform was cut by the sea and then raised up about 50 million years ago in the Tertiary period as a result of earth movements associated with the creation of the Alps. You are in effect walking over an ancient seabed as you walk around Skomer and the adjacent mainland. Rhyolite lava pebbles representing an ancient volcanic beach can be seen embedded in the rock by the boat landing at Martin's Haven.

Sea level has varied tremendously over Skomer's 400 million year history. Estimates vary but the sea may have been up to 183m (600 ft) higher and 91m (300 ft) lower than at present. During the last ice age the sea level was 50m (150 ft) lower than today; Skomer and the whole of St Brides Bay would have been dry land. Pembrokeshire' s offshore islands only became separated from the mainland following rises in sea level associated

with post-glacial melting of the ice sheets. For a useful review of the geology of the coastline see Steers (1964).

HISTORY.

What follows is only a brief summary of the available information. We highly recommend the booklet “Prehistoric farmers of Skomer Island” by J.G. Evans (available on the Island). Skomer may have supported farming communities as long as 5000 years ago (although the Romano-Celtic period, about 2000 years ago, is favoured by most people) and a great deal of evidence still exists about their life style and farming methods. When the early farmers settled on Skomer it was already cut off from the mainland, separated by a rising sea level around 8000 years ago. Prospective settlers arrived by boat, possibly from Ireland and mainland Europe rather than Britain.

The farm in 1889

The natural vegetation of the interior of Skomer some 5000 years ago is likely to have been low scrub deciduous woodland consisting of oak with some elm, birch and hazel with willow and alders in wetter places. However, the only evidence for this is from the present day vegetation which contains a large number of typical woodland species e.g. bluebells, woodsage and ground ivy. Unfortunately, no deep deposits of peat (which usually contains preserved plant material) have been found to support or deny this hypothesis - any peat deposits were probably used as fuel by the early settlers).

The relatively fertile (but thin) soil and a mild oceanic climate with frost-free winters meant that Skomer had a great deal to offer these early farmers. Locally derived wood may have been useful for animal fodder, fuel and building materials and the coastal grassland would have provided good grazing material for domesticated stock. There was, and is, a permanent supply of fresh water (for example, in the North and South Stream valleys and the Wick stream).

Domesticated stock would have included sheep and cattle along with goats, pigs, hens and geese. The stock and crops were separated by a system of stone walls, the remains of which are clearly visible on the southwestern quarter of the island.

The houses (of which 40 have been identified) were built singly or in groups of two or three. The walls were built of stone and turf and the gaps between the stones were plugged with domestic refuse. Roof timbers were fashioned from the surrounding woodland or may have been collected as driftwood. The frames were covered with turf or some kind of thatching and a hole was left in one end of the roof so that smoke from the fire could escape.

It is highly likely that the sea and shore were exploited for food and fuel; cliff and ground nesting birds would have been taken for their flesh, eggs, feathers and oil.

Information about the early settlers' population size and length of stay is very unclear: a population between 100 and 200 has been suggested and it seems likely that the island was only settled for a few hundred years. Why the settlers left is another mystery; contributory factors may have been unfavourable harvests, a reduced fuel supply or a generally deteriorating climate. The exodus whenever it occurred seems to have been quite rapid.

PLANTS.

Flowering Plants and ferns. Skomer has beautiful displays of wildflowers, which change with the seasons and vary with habitat type around the island. Many species are those associated with woodland such as bluebells, ground ivy and wood sage (a relic woodland flora from Skomer's postglacial past) and Pembrokeshire's ubiquitous red campion puts in a welcome appearance in the spring and on through the summer. Valleys and damp areas have their own specialists like purple loosestrife, hemlock water dropwort and water mint. Old walls and outbuildings are a haven for another Pembrokeshire stalwart, navelwort (or wall pennywort). Skomer, North Haven, has a significant bed of the marine angiosperm *Zostera marina*, an eelgrass, which is a species of limited distribution in southwest Britain.

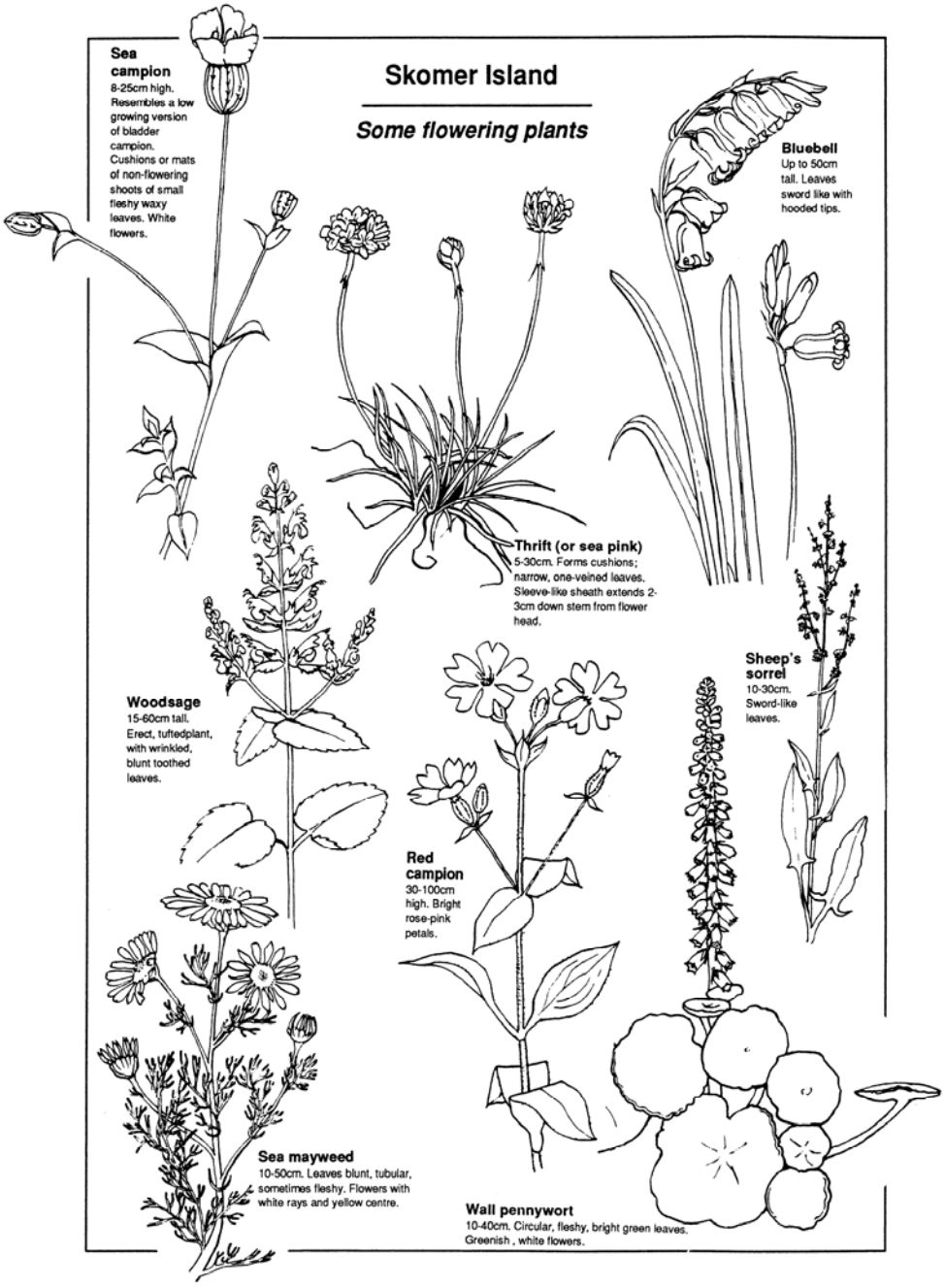
Bluebells (Hyacinthoides nonscripta) on Skomer

On the cliff face, just by the track where the introductory speech is given, there is a small, but thriving, colony of the delicate fern, lanceolate spleenwort, a scarce south-western species with a fondness for sheltered rocks and old walls on or near coastlines.

Halophytes

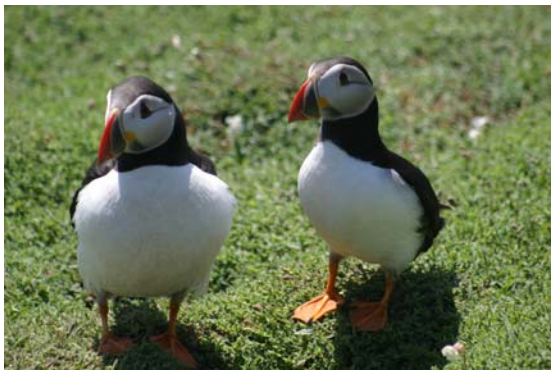
Marine Algae. The marine flora is particularly rich due to the high diversity of habitats available. There is a mixture of both Mediterranean/Atlantic species at their northern distributional limits (e.g. *Stenogramme interrupta*, a red seaweed) and northern species at their southern most limits (e.g. *Cladophora pygmaea*, a green seaweed). Some species (e.g. *Schmitzia neopolitana*, a red seaweed) are of special interest being very limited in their habitat preferences and some species new to science have been discovered (e.g. a large form of *Rhodophyllis*, a red seaweed).

Lichens. The supra-littoral communities of lichens, (those at the top of the rocky shore), on Skomer are rich, beautiful and contain a number of rather rare species which are mainly found in south-western Europe (e.g. *Ramalina polymorpha*). Of particular note is the golden-hair lichen (*Teloschistes flavicans*), which is one of the most pollution-sensitive species in Britain and as such is specially protected under the Wildlife and Countryside Act.



ANIMALS.

Seabirds. The international importance of Skomer as a breeding seabird colony is well documented. Manx shearwaters, fulmars, great black-backed gulls, lesser black-backed gulls, herring gulls, kittiwakes, razorbills, puffins and guillemots are all present (see ‘Skomer Island seabirds’ later on for more information).


Puffins (Fratercula artica) on Skomer by Gwyn Thomas

Land birds. Skomer is probably the richest small island off the UK coast for land birds. Birds present include chough, short-eared owls, ravens and peregrine falcons; many other species, including some rare migrants, have been recorded.


Chough (Pyrrhocorax pyrrhocorax)

Mammals. Although Skomer can only boast five land mammals (rabbits, long-tailed field mice, common and pigmy shrews) one of them, the Skomer vole, is unique to the island. There are a number of bat species occasionally seen during the summer months. Skomer is the second most important grey seal pupping area in southwest Britain (after Ramsey Island). Other marine mammals, namely dolphins, porpoises and whales are regularly recorded from this area.


Common Dolphin (Dephinus deplhis)


Young seal (Halichoerus grypus)


Skomer vole (Clethrionomys glareolus skomerensis)

Marine Invertebrates. The invertebrates living in or on the seabed are of particular importance to the Marine Reserve. These include species at the geographical limit of their range (e.g. the broad sea fan *Eunicella verrucosa* and the scarlet-and-gold star coral *Balanophyllia regia*); species with localised habitat preferences (e.g. *Parazoanthus axinellae*, a colonial anemone); some rarities (e.g. *Onchidoris sparsa*, a sea slug) and commercially important species, the subject of long term monitoring, such as the scallop.


Eunicella verrucosa


Parazoanthus axinellae

Fish. The waters around Skomer support many species of fish. Some are residents over much or all of the year and may set up territories. Other species occur seasonally or simply migrate through. Resident and territorial species are known to be important components of the seabed community; these include pollock, saithe and several species of wrasse (especially corkwing wrasse, rock cock, cuckoo wrasse, ballan wrasse and goldsinny wrasse).


Bosherton fish

Pelagic and migratory species are sometimes present in large numbers e.g. mackerel. In late summer, large numbers of juvenile fish are in evidence. The ecological importance of these non-resident but regular visitors to the locality is unknown. Commercial fisheries are important in Skomer's surrounding seas (although Irish Sea catches are only 40% of those in the North Sea). The most important commercial species are whiting, sole, flounder and brill. Sand eels are numerous in North Haven and South Haven as well as the St. Bride's Bay area in general and are a staple food for puffins and the other auks.

Some unusual visitors turn up in Skomer's waters; these include basking sharks, John Dory and sunfish.

THE STOPPING POINTS.

The pages that follow describe fourteen different ‘stopping points’ which could become the focus of attention for a visit to Skomer Island. You will find notes and suggestions for activities to be carried out at each of the stopping points. The accompanying map shows the sites and other features, which are referred to in the notes, it may be printed and copied and given to students.

THE THREE ROUTES.

ROUTE ONE. Would take you right around the Island. To walk this at a moderate pace, with no stops, would take approximately two hours. Timings for the activities are given in each section and these will have to be added on to the walking times as appropriate. To complete all the activities on Route One and walk right round would take at least six and a half hours, so you may well have to be selective in what you want to achieve on the island.

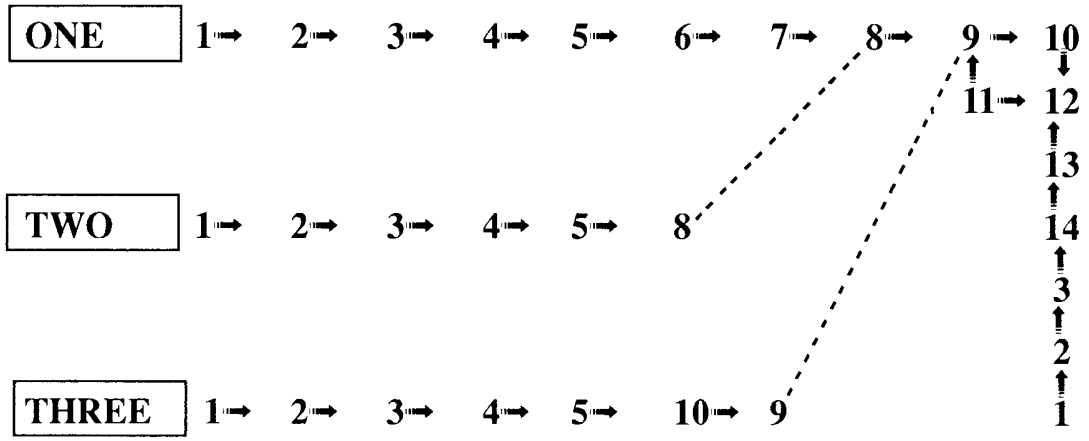
ROUTE TWO. Walking time approximately one and a half hours.

ROUTE THREE. Walking time approximately an hour.

Although the shorter routes may well be more convenient for certain parties or in certain weather conditions, we feel that it would be a great pity for people to miss the Garland stone and Skomer Head if time allows otherwise.

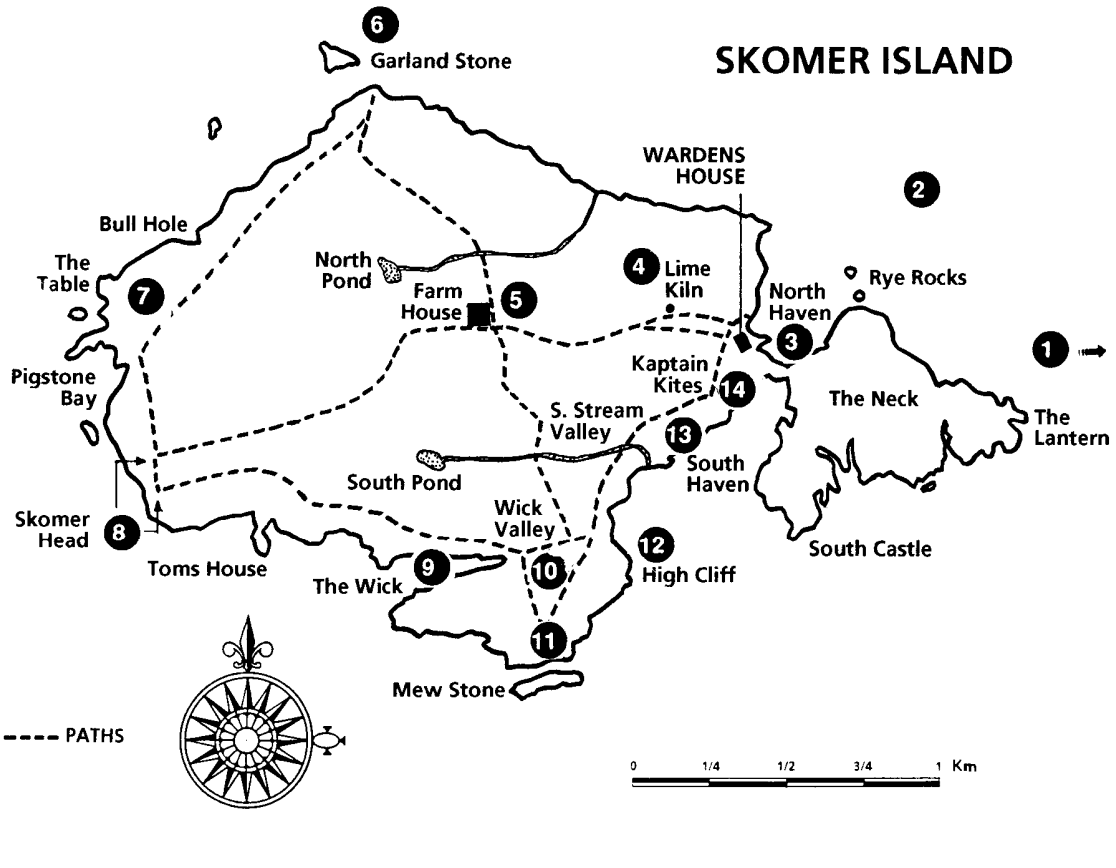
PLEASE READ THE CODE OF CONDUCT AND HEALTH AND SAFETY SECTIONS OF THIS GUIDE.

The three routes



Note: it is a good idea to get to site 6 at around low water (if possible) to see seals basking on the rocks. This may involve doing route one in reverse.

The Skomer Island base map



I. MARTIN'S HAVEN **Time taken: whilst waiting for the boat**

Martin's Haven is the main gateway to Skomer Island and the Marine Reserve. (On occasions you may have to wait up to an hour here for the island ferry.) There is usually plenty of activity, especially during the summer, and time can be spent either on the beach or making observations from the jetty, (to avoid losing your place in the queue).


Martins Haven

In the past fishing boats from Marloes used to use this site. You can still see the winches, now old and rusty, that the fishermen used to haul their boats up the beach with. Today there are only a few fishermen using Martin's Haven and they are mostly potting for lobsters and crabs. Methods have changed, the old rowing boats have been replaced by motorboats with powerful winches and this allows today's fishermen to exploit these shellfish much more intensively.

Commercial fishing for mackerel also occurs in July and August between Martin's Haven and Jack Sound.

Fishing within the Marine Reserve is an activity that some people feel is inappropriate. There is evidence to suggest that many of the fragile marine species are damaged when lobster pots are lowered to and retrieved from the seabed (experiments carried out by the authors, 1987), these are the very species that the Marine Reserve is designed to protect. Sacks full of discarded angling line and accompanying hooks and weights have been removed from the seabed by volunteer divers and the MNR team.

A recent (2004) report by the Royal Commission on the impact of commercial fishing in UK waters has recommended "…. **The UK government should develop selection criteria for establishing a network of marine protected areas (MPAs) so that, within five years, a large-scale, ecologically coherent network of marine protected areas is implemented within UK waters. This should lead to 30% of the UK's exclusive economic zone being established as marine reserves closed to commercial fishing**."

We (the authors) feel that Skomer MNR, in total, should be a highly protected marine reserve where **all** damaging human activities are banned on principle, as far as is practical and sensible. As such it would be a key research area within a broader (30%) local area where the balance is finally reversed such that "applicants for fishing rights……..should

have to demonstrate that the effects of their activity will not harm the sea's long term environmental sustainability."

There is an opportunity here for Skomer MNR (specifically) and Wales (more generally) to lead the way to where our whole approach to the marine ecosystem has to go, in the very near future. Alternatively we can wait until the changes are imposed on us from outside.

Many recreational divers launch their boats from Martin's Haven or dive directly from the shore. You may have spotted the sign at the top of the beach, which informs divers that they are entering a Marine Reserve. It also tells them about the Code of Conduct. Leaflets about the Marine Reserve and safety notes for divers are available at the CCW offices and Interpretation Centre (in the Fishermen's Cottages at Martin's Haven). A member of staff may also be present to talk to divers about the Marine Reserve, especially during busy periods.

Martin's Haven provides one of the best shore dives in Pembrokeshire. Not only is the marine life rich and varied, but also the seabed slopes steeply to below 20m within easy swimming distance. This is unusual for a shore dive and very popular with dive groups. The sides of Martin's Haven are rocky and support many interesting and attractive species, especially near the mouth of the bay.

As you may imagine, a mixture of divers in the water and the Ferry (which you are probably waiting for) is a potentially lethal one. Divers are asked to keep to the sides of the bay and use Surface Marker Buoys to mark their position in the water.

Scallop dredging used to occur in this part of the Reserve, the effect on the seabed was a little like ploughing a field and not surprisingly destroyed the benthic communities that happened to be in the way. A SWSFC byelaw banned this fishing method and the improvement to the scallop population and seabed in general has been marked.

MARINE CONSERVATION.

Martin's Haven is an ideal place to discuss Marine Conservation; you might like to consider some of the topics we have outlined below.

Fishing in the Marine Reserve.

1. In what ways could fishing affect the Marine Reserve?
2. How could you discover if fishing causes damage?
3. If overfishing is a problem what could be done about it?
4. If fishing was banned in the Skomer MNR what effect might that have on the fishermen?
5. If fishing was banned what advantages might there be for fishermen, scientists and conservationists?

Alerting the Public.

1. Why do the public need to be informed about the Marine Reserve?
2. Should there be a limit on the number of visitors?

3. Where is the Marine Reserve notice? Is it in a good place? Can you think of a better position?
4. What are the main points the notice attempts to convey to visitors? Could it be improved? How?
5. What other information is available to visitors and where is it kept? Is the information useful and accessible?

Recreation.

1. Should divers have the freedom to dive anywhere in the Reserve?
2. How would you monitor the effects of different types of activity within the Reserve area?

2. THE BOAT TRIP — time taken: during boat trip

The boat journey between Martin's Haven and Skomer North Haven takes approximately 20 minutes. It can be an exciting trip if a tide is running or the wind is up.

The Dale Princess (Photo by Gwyn Thomas)

Skomer is one of a number of igneous rocks and islands stretching out from St. Ishmael's (on the mainland) to the Smalls rock 17 miles away to the west. This outcrop is known as the Skomer Volcanic Series and it includes, Middleholm, Skomer, Grassholm, the Hats and Barrels reef and the Smalls. During the last ice age these outcrops were all joined to the mainland. When the ice melted, around 10,000 years ago, rising seawater created the present-day islands. This series of obstacles affects the massive North/South tidal movement of the Irish Sea and as water is squeezed between the rocks and islands it accelerates producing spectacular tidal races. Jack and Little Sounds are shallow with rocky bottoms; this further accelerates the flow and produces rough water at the surface, a fact you may be well acquainted with by this stage of your journey.

To the north of Jack Sound the seabed descends steeply to over 40m. Water passing through the sound on a north going tide spills over the edge of the shallows like an undersea waterfall.

The Neck is joined to Skomer by a narrow isthmus of softer sediments and rock. North and South Havens have both been formed by erosion and in time the isthmus will be breached leaving two separator islands.

At the end of The Neck there is an archway called the Lantern. This was also formed by the erosive action of the sea exploiting weaknesses in the rock. One day the Lantern will become a ‘Sound’ in its own right.

The birds.

In spring and early summer the boat trip can be an excellent opportunity to get close to many of the seabirds. They can be seen both at sea and on their nesting sites on the cliffs.

On the north coast of Middleholm breeding shags are common on the rocks. Razorbills, guillemots and kittiwakes are seen at their cliff nesting sites north of The Neck.

The Marine Reserve code of conduct asks all boats to stay at least 100m offshore from the cliff nesting areas. Repeated disturbance by boats can cause breeding failure, parent birds may kick eggs and chicks off the ledges into the water or leave them vulnerable to predation by gulls.

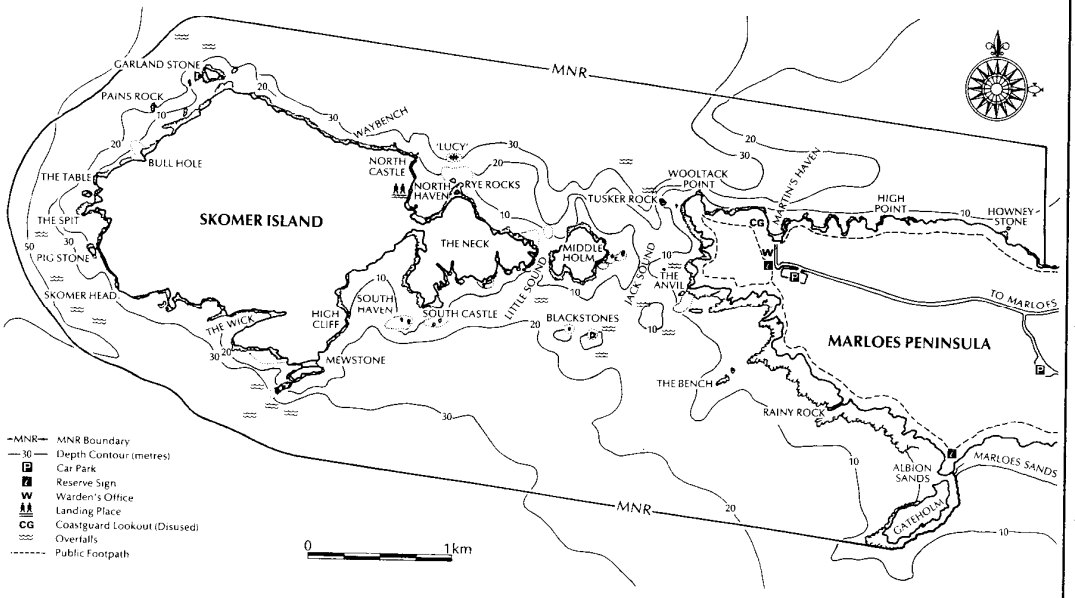
Marine life.

Although not visible from the boat the changes in the marine life along the journey are dramatic. The north coast of the Island is relatively sheltered from the prevailing south-westerly storms and swells, whereas the sounds are very exposed to strong currents. The current can be very beneficial to those species able to cling on as it brings with it an abundant food supply. As a result the seabed of the sounds is teeming with life, common species include soft corals, sea anemones and hydroids, all of which kill live prey with stinging cells. Bryozoans (filter feeding colonial animals) are also common.

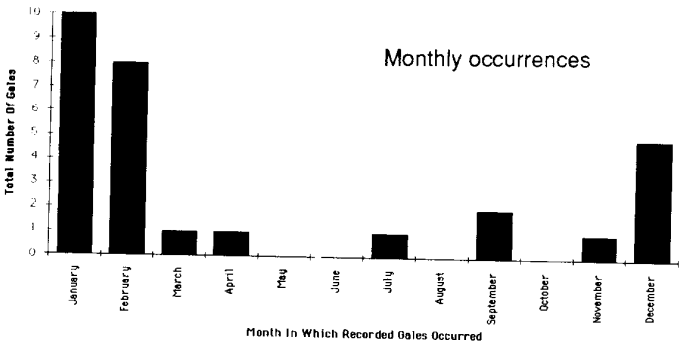
To the north of The Neck soft sediments predominate. Many burrowing species can be found including anemones, sea cucumbers, polychaete worms and scallops. It was here that the most intensive fishing for scallops took place before the practice was banned by a SWSFC byelaw after the MNR was designated.

Charting the waters

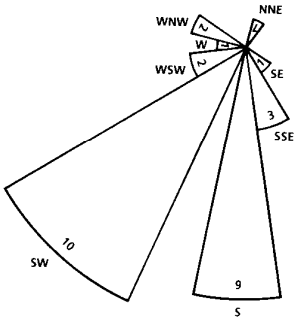
The admiralty chart shows the underwater 'seascape' around Skomer Island. You could draw a cross-section of the boat trip between Martin's Haven and the landing place at North Haven. If you travelled directly between the two points how far would it be? The boatman will be able to tell you how fast the boat is travelling through water. Does the time taken for the trip make sense; if not, why not? What does this tell you about the tides?



Graph To Show The Total Number Of Recorded Gales In Each Month Between 1st January 1987 and 1st March 1992



Direction of gales



Until earlier this century, farmers used to transport larger livestock to Skomer by tethering them to a boat and making them swim. What problems could you encounter? The graphs shows the numbers of gales encountered each month around the Pembrokeshire islands. Which route would you take?What times of year are particularly dangerous?

3. NORTH HAVEN time taken: 30 minutes

This, the only official access point to Skomer, is one of the finest study sites on the island. Sheltered from prevailing currents and all but strong northerly winds, it is a haven for boats and wildlife alike. When Skomer closes to visitors in the autumn the beaches become a favoured haul-out site for grey seals. Over 100 individuals have been seen on the beach on occasions and pups are frequently born here.

In summer rafts of puffins, guillemots and razorbills are a common sight and this is one of the best places to study these birds. Early in the year territorial behaviour, courtship rituals and mating can be seen.

A raft of puffins

North Haven is one of the best places to see choughs and peregrines. A kestrel sometimes nests at the head of the bay. The grassy cliffs around North Haven are riddled with puffin and shearwater burrows; you often see the puffins going to and fro or just standing on the grassy banks. Watching the social behaviour of the puffins as they gather in North Haven is one of Skomer's many pleasures.

Another notable resident of this area is the Manx shearwater. As dusk approaches thousands of these birds congregate on the sea in St. Bride's Bay. After dark, they fly to their burrows filling the air with their cries. They leave at dawn and by the next morning they will be far out to sea shallow diving for fish under the surface of the water.


Manx shearwater (Puffinus puffinus)

The "Jetty" Beach in North Haven is one of the few sheltered rocky shores on the island and as such it has several features of interest. Many common rocky shore species are present but some deserve a special mention.

- The oceanic influence is indicated by the presence of thongweed (*Himanthalia elongata*) and dabberlocks (*Alaria esculenta*) near low water. On the mainland these species are confined to exposed headlands and bays.

- South-western species like the toothed (common) topshell (*Osilinus lineatus*) and the volcano barnacle (*Balanus perforatus*) are present. Their presence indicates the influence of the North Atlantic Drift whereas dabberlocks is a northern species and an indicator of cold water.

- There is a breeding colony of Cornish suckerfish (*Lepadogaster lepadogaster*) a species rarely found on local shores. It is probably a stable breeding colony as it was recorded as long ago as 1946.

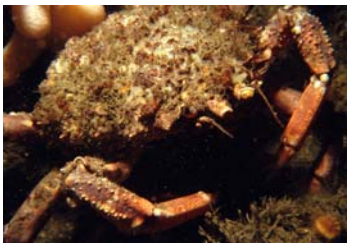
- Also recorded here is a subtidal bed of a seagrass (*Zostera marina*), which is another rarity in Wales. It is one of the special species that the Marine Nature Reserve was set up to protect. North Haven is sheltered from strong currents and as a result it is a depositing ground for sedimentary material. Both the shelter and the sediment provide ideal conditions for the sea grass, which in turn supports a whole host of other species. North Haven is also a favoured anchorage for passing yachts and anchor damage is a potential problem for the seagrass bed. To avoid this yachts are asked not to anchor over the bed and visitor moorings are provided as an alternative.


Zostera marina

- The North Haven sediments also provide the habitat for another important local species, the sand eel (*Ammodites* spp.) a staple food of the puffin. Here as much as anywhere on the island the marine and terrestrial parts of the Skomer ecosystem are linked together.

- The large spiny spider crab (*Maia squinado*) congregates in North Haven, probably for breeding. This species is not eaten in Britain but it is highly prized by the French and Spanish who have overfished their stocks. This previously unfished species has been taken from the Marine Nature Reserve in large numbers (since 1985) and this provides another conservation problem associated with potting (see Martin's Haven.)

Spider crab (Maia squinado)



Above the water (depending on the tide!)

Can you see the horizontal bands of colour (orange, black, light brown) above the water on the far side of the bay? If you can, try to estimate the height of each band and the total height of the first flowering plants above the water. Compare the height of these 'biological zones' with those on Skomer Head and you will appreciate the difference between a relatively sheltered bay like this one and an exposed shore open to the full fury of the Atlantic Ocean. You may even wish to produce a field sketch of the bay to aid your comparison. An OS map might help the accuracy of your estimates.

4. THE LIME KILN **time taken: 30 minutes**

There are two limekilns on Skomer. The lower limekiln, situated at the top of the steps, is the older. It was possibly used to make the lime mortar for building the farmhouse. The volcanic nature of the Island's rocks has given rise to acidic soils. The limekiln, a relic from the last century when farming prospered on Skomer, was also used to make the soils less acidic. The limestone and coal were imported from mainland Pembrokeshire to North Haven and were moved up to the kiln by horse and cart.

The Lime Kiln by D. Millborrow

How a limekiln works.

Getting a limekiln to work requires using the correct fuel (fine or 'slash riddled' anthracite), the right sized stones (about 15cm diameter), and a properly regulated air flow. The procedure would have been as follows:

1. Place wood in the base of the kiln.
2. Cover with a 7.5cm layer of anthracite.
3. Follow this by a 30cm layer of limestone.
4. Continue layering anthracite and limestone for 6 layers.
5. Light kiln.
6. Over the next 4 days build up more layers of anthracite and limestone until the kiln is full.
7. After 4 days, extract the first lime from the base until the level has dropped about a metre.
8. Fill every day and extract lime as required.

Airflow was regulated using shuttering on the two lime extractor holes either side of the base of the kiln, too much air and the kiln would flare up too quickly, too little and it would go out.

Some kilns were kept going continuously, but this depended on demand for lime. Lime was not only used for spreading on fields, but also (before cement) for building mortar. Use of kilns in Pembrokeshire died out in the early 1950s.

Lime kilns, a closer look.

1. Looking at the upper limekiln, can you find any evidence to suggest that it was once used as an oven?

2. Where did the coal and limestone come from?

3. How do farmers put lime on their fields today?

The power of the sea.

Pigstone Bay

This stopping point also provides a good opportunity to look at the impact of the sea on the coastline.

1. On the base map mark the areas you think the sea might be eroding.

2. What do you think is likely to happen between North and South Haven? Is this how Skomer might have been separated from the mainland?

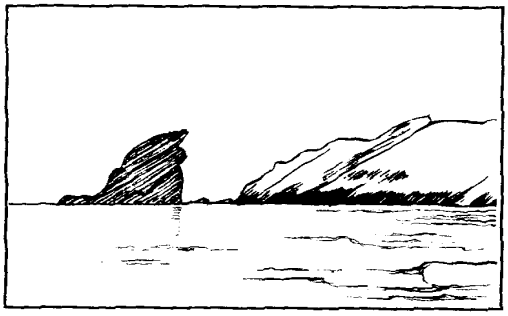
Can you see areas that might be significantly affected by a rise in sea level?

Crumbling around our feet?

The destructive action of the sea has exploited areas of weakness in the rocks, especially along fault zones, and has created caves, bays and inlets around the island.

The illustrations below show a selection of the different types of landforms that you will encounter on Skomer Island. Mark on your base map on page 21 the locations of these and other similar landforms as you encounter them, and fill in the site names here (these features are marked with an asterisk on the map on page 20).

Can you interpret what has happened in each case?



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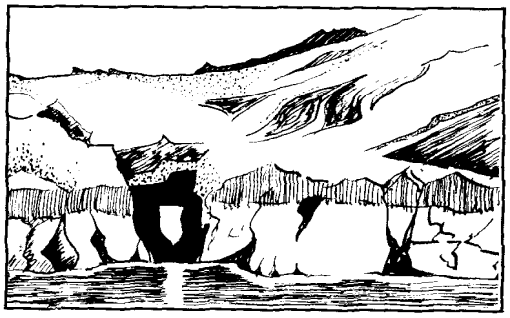

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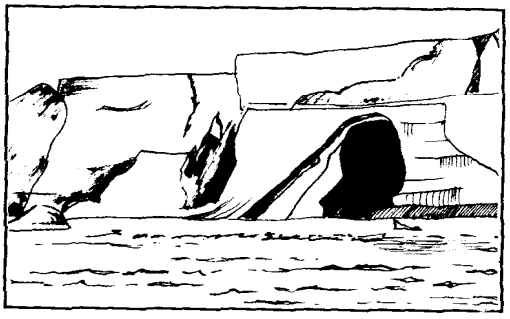


5. THE OLD FARMHOUSE **time taken: 40 minutes**

Imagine how impressive this building must have looked in its prime. There used to be a ‘verandah’ along the tiled wall to the north of the grassy courtyard. Here on suitable days, housemaids used to serve afternoon tea from silver teapots. When the farmhouse roof was constructed there were no trees on the island so the timber struts were ordered specially from the mainland. Unfortunately the roof was destroyed in a ferocious storm in 1954.

The other buildings in this complex have been renovated beautifully thanks to a £3.2 million Heritage Lottery grant. As well as paying great attention to the look of the building, so that the complex is in sympathy with what went before and the surrounding landscape, priority has been given to minimise use of fresh water (compost toilets have been installed for day visitors to use) and to maximise efficient energy usage. There are solar panels and a wind generator to meet the needs of overnight visitors. Priority has also been given to educational needs and the new Interpretation Centre excels in this respect.

In the 19th century seed corn was the main crop on Skomer. Despite frequent gales the oceanic influence on the climate gave frost-free winters and this must have been a considerable advantage to the island farmers. Even though the soils were fertile and the climate mild, farming eventually came to a halt in 1949. This was due mainly to family reasons but also to economic pressures. The coming of modern road and rail links to the mainland made Skomer produce too expensive compared to mainland competitors. Also, bad weather could prevent Skomer farmers gaining access to markets when prices were favourable. It is also possible that the young people didn't want to stay in such an isolated place where they may have been marooned for days on end by storms. The problems associated with getting farming machinery and livestock from the mainland must have been enormous. Some cattle and ponies were transported across by boat, but larger animals had to swim across Jack Sound tied behind a clinker built rowing boat (using an outboard motor from 1930 onwards). This was a hazardous undertaking at the best of times, and presumably, was only possible at slack water.

Behind the barn to the west there is a feature of special interest: an old horse course. The barn contained machinery for threshing and chaff making and this was horse-driven by a shaft passing from the horse course to the barn interior. Note also the special wheel (spade lug) on the 1942 Fordson tractor. This special wheel was used for ploughing on

slopes where the extra traction was useful and when rubber was scarce during the Second World War.

Skomer was farmed for centuries. Cattle and sheep grazing were important at certain times but from 1300 until at least the 17th century Skomer was effectively a gigantic rabbit farm. When rabbits were first introduced to Skomer they were uncommon in Britain. In the fourteenth and fifteenth centuries rabbit fur and meat were luxuries and pure white and black fur was particularly favoured by royalty. Rabbit produce was exported to the port of Bristol. Rabbit catching continued until 1954/55.

At one time seabirds were also exploited for food, local people harvested them for their eggs and meat and farmers would plough burrowing Shearwaters into the ground for fertiliser!

Another interesting feature of this area are the short-eared owls (*Asio flannmeus*). Up to eleven pairs have nested on the Island, which represents the highest population density in Wales. The owls often nest near the farmhouse, usually in the heather, and this is an excellent vantage point from which to watch them hunt Skomer voles amongst the vegetation. The short-eared owl is one of the few that hunts during the day; it is an opportunistic predator and has large broods. This means that it must hunt during the day and night to provide enough food for so many hungry mouths. In times of plenty, chick survival is high but when food is in short supply many chicks perish.

Owl hunting.

Try to get a look at the short-eared owl as it hunts to the north of the farmhouse. Look for a light brown bird, about the size of a gull, flapping its wings fairly slowly as it patrols the vegetation for Skomer voles.

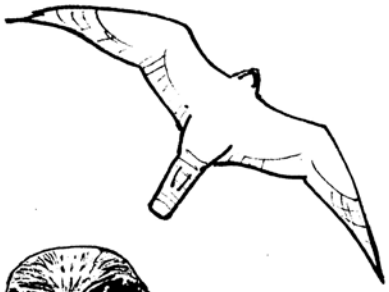
Short-eared owl
A small but dense population...will you see it?

Kestrel
One of the birds of prey on the Island ....can you tell it apart from the peregrine falcon? The distinct dark bar at the tip of the tail should help. It is also browner than its relative.

The chough
Another interesting inhabitant, mainly restricted to the coast and mountains in the west of the British Isles. But can you tell it apart from the other 'black' birds, the ravens and jackdaws for example?

Ragged wings, curved upwards in flight

Squared tail



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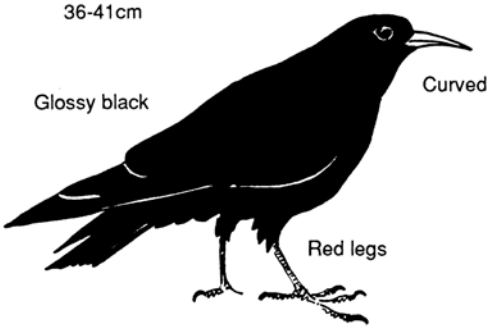


Curved red bill

Glossy black

Red legs

Peregrine falcon
Another of the birds of prey; compare it with the kestrels

Physical isolation from the mainland has had significant effects on some of the resident species. The Skomer vole (*Clethrionomys glareolus skomerensis*) is a case in point. This animal is related to the bank vole on the mainland but is a different sub-species (or Island race) and differs from it in a number of ways. It is larger than the bank vole and has different fur colouration and dentition. The Skomer vole eats bracken, which is avoided by most herbivores because of the carcinogenic (cancer inducing) chemicals it contains (it presumably must taste rather nasty too). How the Skomer vole copes with these chemicals is the subject of current research, which could contribute to cancer cures of the future.

The Skomer vole seems quite docile when handled by humans. Its reaction to danger is to freeze rather than to run away, hence the apparent docility. This behaviour gives it a survival advantage as aerial predators (mainly the short-eared owl) rely on movement to locate their prey. Remaining motionless might be a disadvantage if there were land predators but since the Island has none the strategy is ideal.

The bracken dilemma.

Bracken by Philip Precey

In recent years Bracken has taken over much of the island, encroaching from field edges following the cessation of farming. Limited experiments in Bracken control are now in progress but this provides a conservation management dilemma.

Consider the following bits of information:

- Skomer voles eat bracken (as well as sorrel and bluebell shoots and bulbs).
- Bluebells may need the shelter of the bracken to survive (in the absence of a woodland canopy which normally protects the bulbs from drying out in the soil). An example of this can be seen on the slopes of North Haven, between the house and the landing place. There is a band of bracken, which is all that remains from a spraying experiment in 1984. This is the only patch where bluebells survived and they used to be over most of the slope.
- For the bluebells and the Skomer vole, the relationship with bracken is a positive one.
- Bracken can out compete many other plant species.
- Bracken reduces the amount of grazing land available for rabbits.
- Puffins favour bracken free areas in which to dig their burrows.
- Bracken provides cover for nesting lesser black-backed gulls.

How would you tackle this problem if you were Reserve manager here?
THE DECLINE OF FARMING ON SKOMER.

For this activity look at the information below and then try to answer these questions.

1. WHEN WAS SKOMER FIRST FARMED?
2. WHAT WAS THE MAIN EXPORT FROM SKOMER IN THE 1300s?
3. WHEN WAS THE FARMHOUSE BUILT? WHEN WAS THE BARN BUILT?
4. WHAT HAPPENED IN THE 19th AND EARLY 20th CENTURIES ON SKOMER?
5. WHEN DID FARMING FINISH ON SKOMER? WHY?
6. WHEN DID SKOMER BECOME A NATURE RESERVE?

Facts and figures.

- In 1909 Neales, the tenant of the time, prohibited visitors and photography on the island as they were disturbing the seabird colonies.
- Nobody is certain but the first farmers may have come to Skomer some four or five thousand years ago (about the time the Egyptian pyramids and Stonehenge were built).
- Rabbits were introduced to the island by 1300. They were caught and skinned for export to the mainland as meat and fur. At this time rabbits were rare in Britain and very valuable
- It is believed that the farmhouse was built in early eighteenth century and was enlarged and improved from time to time.
- The barn was built in 1843 and the farmhouse was enlarged and modernised by Charles Philipps of St. Brides who then owned the island. He also improved the quay in North Haven so ships could bring in limestone for the limekiln.
- During the nineteenth century farming on Skomer was a big success. Corn was exported and horses were bred on the island.
- In the early twentieth century there was very little farming activity. Cattle and sheep were grazed and the main crop for export was seed corn.
- Farming eventually came to a halt in 1949.
- The problems of exporting crops to the mainland made farming on the Island uneconomic.
- Skomer was bought by the Nature Conservancy (as was) in 1959 and they declared it a National Nature Reserve. It was leased to the West Wales Field Society, later to become the Wildlife Trust South and West Wales who now manage it.

6. THE GARLAND STONE. time taken: 30 minutes

SAFETY REMINDER: CLIFFS CAN BE VERY DANGEROUS DON'T GO NEAR THE EDGE.

The Garland stone marks the most northerly point on Skomer. The view from here can be truly stunning on a good day. You may be able to see the whole of St. Bride's bay, with Ramsey Island and the St. David's peninsula to the north. The lighthouse on the rock to the west of Ramsey is known as the South Bishop light and it marks the southerly tip of a treacherous group of rocks called the Bishops and Clerks. Six miles to the west of Skomer is the island of Grassholm and if visibility is particularly good you may be able to pick out the Smalls lighthouse another ten miles beyond.

Lighthouses are essential to seafarers who are navigating at night or in poor visibility. Each lighthouse has its own light and sound pattern, the details of which are given on the Admiralty charts, for example, the Smalls flashes in a group of three every fifteen seconds.

Ramsey And Grassholm.

Both of these islands are owned by the RSPB. Despite its size, Ramsey Island does not now have large ground-nesting populations of birds, unlike Skomer and Skokholm. This is largely due to the presence of a very efficient ground predator, the rat, which eats the eggs and chicks. If rats, stoats, weasels or even dogs were to get on to Skomer the effects could be disastrous. However the RSPB has gone to extraordinary lengths to eradicate the rat population and at the time of writing (2007), courtesy of specialists from New Zealand, they seem to have succeeded. Hopefully new ground-nesting colonies will establish themselves in the near future. Ramsey Island supports the largest breeding colony of grey seals in the area.

In contrast, Grassholm has no ground predators at all; it boasts about 32,000 pairs of Gannets making it the second largest colony in the world.

Gannets

The Smalls rocks mark the western approach to St. George's Channel. Between the Smalls and Grassholm are a treacherous line of shallow rocks called the Hats and Barrels. Skomer's worst pollution incidents were the result of oil tankers going aground here while taking a short cut. Following the Bridgeness oil spill in 1985, when an estimated 5,000 Seabirds were killed, tankers are now asked to avoid going between the Smalls and the Hats and Barrels. Their insurance is invalid if they do so.

The Garland Stone itself is separated from Skomer by a narrow, shallow channel. Tidal races are fast and strong around this rock and water plunges down into very deep water to the north. The underwater scenery is very dramatic here and the sea life is very rich due to the strong currents, which bring in a plentiful supply of food.

Large predatory great black-backed gulls nest on top of the Garland stone and can usually be seen from here. These gulls are a top predator on Skomer and they are capable of swallowing puffins and young rabbits whole.

At around two hours either side of low water grey seals haul out on the outlying skerries to the east of the Garland Stone: 30 or more can sometimes be seen, and this is usually the best place to watch for these animals.

Along Skomer's coast, just to the east of the Garland Stone, the seabed is shallow and stony. The stones are colonised by a wide variety of seaweeds, some of them quite rare. This area has been a biological monitoring site since 1984 and divers keep a check on the seaweed populations. There is another monitoring site, further along the north east coast towards North Haven, on a vertical cliff, which descends to a depth of 40m. Studies of these sites help us to understand more about the underwater world and help ecologists to monitor the health of the sea.

While you are here it is worth a look to the south along the north west coast of Skomer, towards the Table, the grassy slopes of which are often decorated with cliff top flowers. Puffins, guillemots and razorbills nest here in large numbers and you will often see them rafting on the water along this stretch of coast. This area is only accessible to most pleasure boats in calm weather. Inshore by Bull Hole, where there is some shelter from the southwest gales but a fair degree of current, the seabed supports some of the richest marine life around Skomer; sea fans and Ross corals are common here and cuckoo Wrasse breed amoungst the boulders.

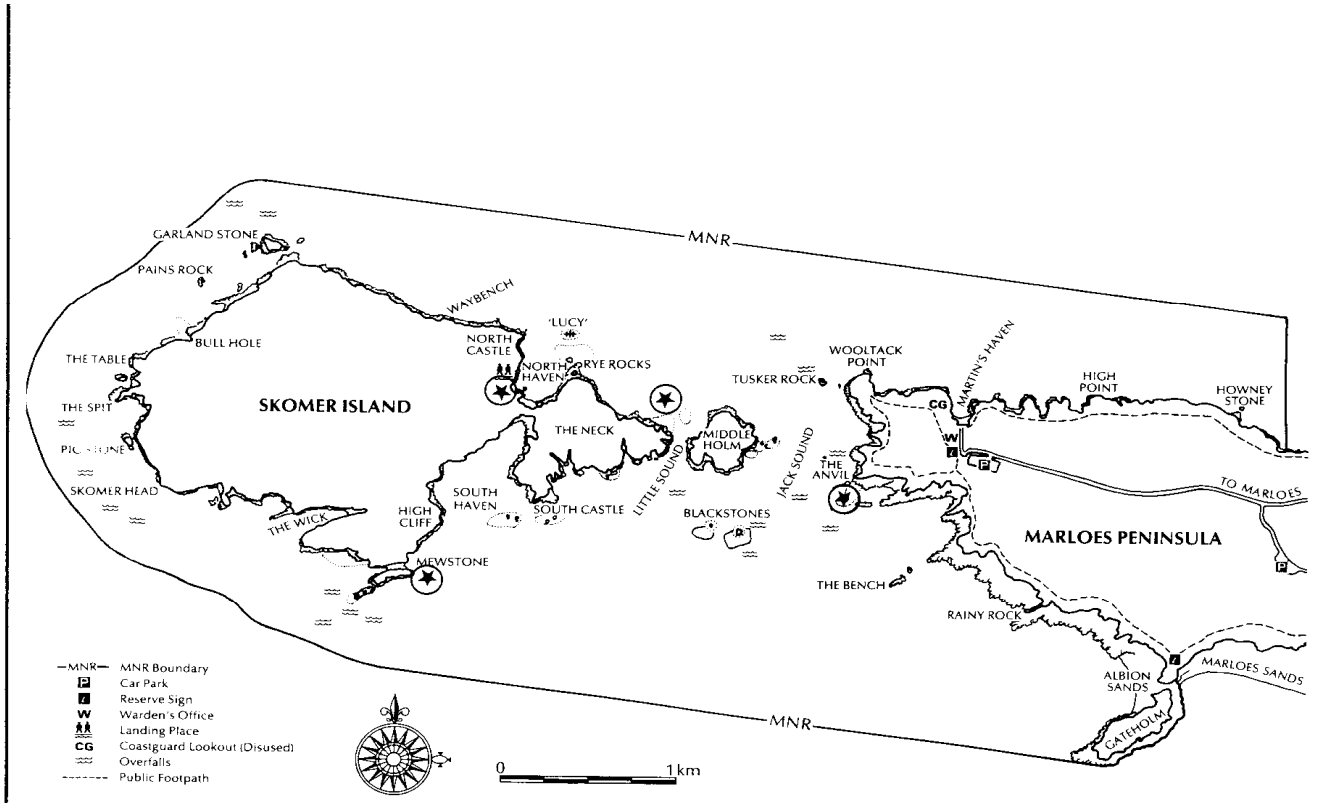
Stopping for lunch.

The Garland stone is a good place to stop for lunch but do not stray off the path as the cliff slopes are dangerous. Try these activities:

1. Map/Chart interpretation. Sketch the islands and rocks to the north of St. Bride's Bay and label the sketch with their names from the chart.

2. Can you identify any visible flashing lights from the chart.

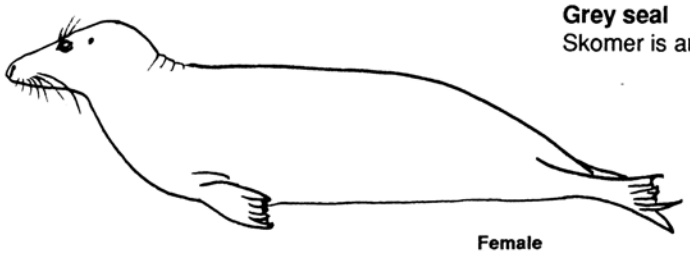
3. How many grey seals can you see from this vantage point? What distinguishes the males (bulls) from the females (cows)?



Map of Skomer Island

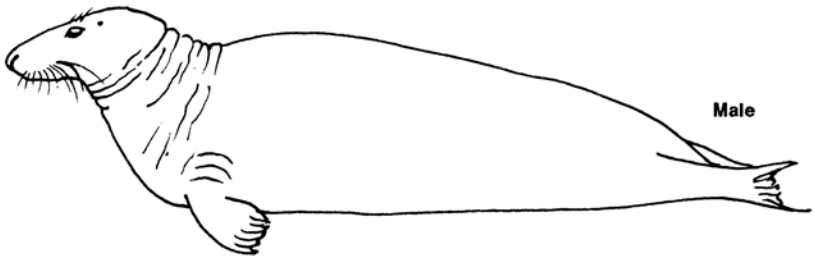
Skomer Island

Some important animals (some may be difficult to see!)



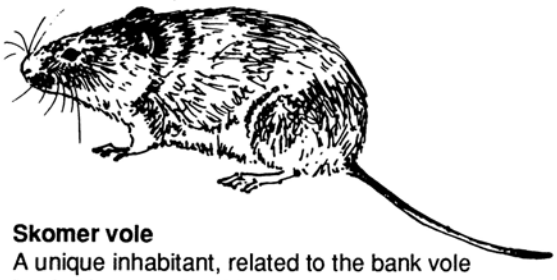
Grey seal
Skomer is an important pupping area

Female



Male

Pup



Skomer vole
A unique inhabitant, related to the bank vole but is bigger and redder than its mainland relative

Rabbit
Not unusual! But they do play a major role in the Island's ecology

7. ABOVE BULL HOLE. **time taken: 20 minutes**

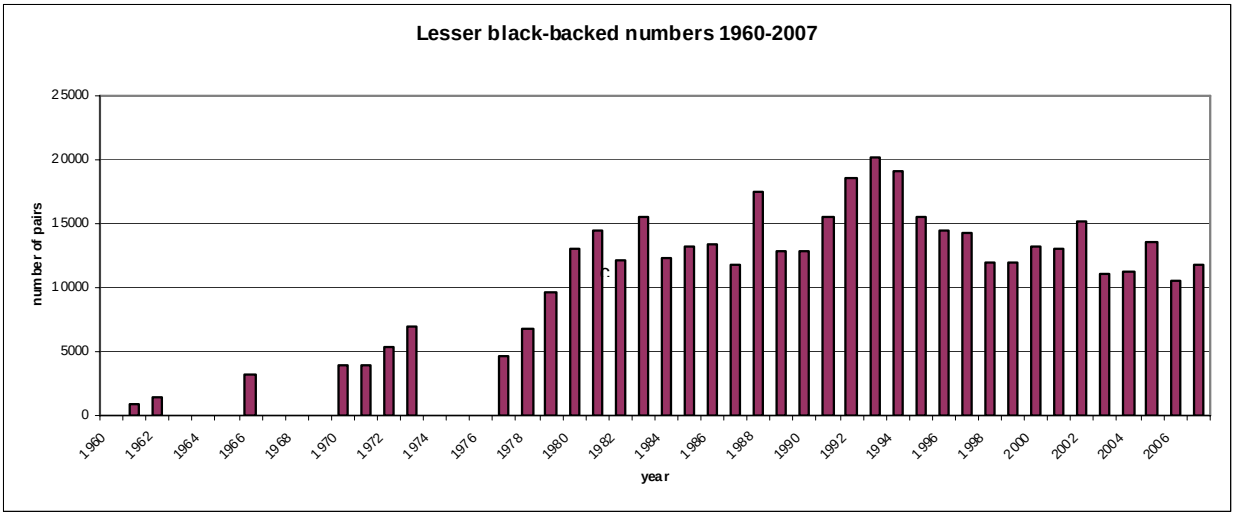
From this site the panorama of the north of the island can be studied. The North Pond is an important site for birds such as breeding wildfowl. During the spring and summer much of the land is occupied by a very large breeding colony of lesser black-backed gulls. These gulls nest on the ground. If you look on the tops of the scattered rocky outcrops you may be able to see a few pairs of their larger relatives, the great black-backed gull.

Numbers of lesser black-backed gulls increased to over 17,000, pairs by 1988. This growth may have been due to a rise in feeding opportunities especially from fishing boats. This trend was worrying because the lesser black-backed gulls are thought to be competing with other island bird species for space. Also, dense colonies of this species can kill vegetation locally due to a combination of over nitrification, trampling and vegetation pulling. As a result an experimental cull was carried out for a few years. This policy was controversial and culling as such ceased: colony control was subsequently achieved by nest raking techniques. However since 1989 this species has suffered repeated breeding failure (possibly due to the decline in the numbers of local fishing boats, whose scraps were a vital food source for parent birds hoping to feed their chicks) and culling is no longer necessary.

Population control: a controversial conservation issue.

Look at the accompanying graph and consider the facts above. Use the information to tackle these questions.

1. Do you think culling lesser black-backed gulls was appropriate in a Nature Reserve?
2. What would you suggest if you were asked to solve a similar problem where one species on a Reserve was doing well at the expense of others?
3. Are there parallels with the bracken dilemma we discussed earlier?



8. SKOMER HEAD. time taken: 30 minutes

Rabbit Exclusion Zone.

This area was fenced off in 1976 effectively preventing rabbits from grazing the vegetation. The net result is a virtual monoculture of red fescue grass (*Festuca rubra*) which is a very competitive, drought resistant, salt tolerant grass ideally suited to the site. It is also very 'tasty' to rabbits. Outside the area a combination of summer drought, salt inundation during severe gales and rabbit grazing has occasionally led to the virtual death of the vegetation. Inside the rabbit ‘exclosure’ the vegetation survived due to lack of grazing pressure.

Outside the exclosure and when conditions are suitable, species which are unpalatable to rabbits can survive e.g. scentless mayweed (*Tripleurospermum maritimum*), sea campion (*Silene uniflora*), woodsage (*Teucrium scorodonia*), sorrels (*Rumex* spp.) and Yorkshire fog grass (*Holcus lanatus*).

It is likely that moderate grazing pressure and a favourable climate produces a diverse ground flora, as any one species is unable to take over and produce a monoculture. But if the climate deteriorates and/or there is overgrazing, most of the plant species are unable to survive. Birds burrowing into the soil will exacerbate the problem as more soil is exposed to the air and loses moisture. Some workers suggest that grazing is beneficial to burrowing birds. However, in a recent count there were 230 Manx shearwater burrows in the ungrazed rabbit exclosure. (No-one counted them before 1973).

In recent years the vegetation outside the exclosures has recovered to, probably because the summers have been predominantly wet and miserable! It will be interesting to see what will happen in future years.

There are obviously a great number of factors, which can alter the vegetation. Any one of these factors can affect the vegetation positively or negatively depending on its strength and/or combination with other agencies.

Skomer Head.

Here is an excellent viewing point for one of the most exposed parts of the island. You may well see gannets from Grassholm plunge diving into the sea and if you are able to watch for a few minutes you may see porpoises fishing as well.

Notice how far the lichen zone is extended up the cliff face here, almost to the top. Flowering plants cannot tolerate the salt spray any further down the cliff, whereas lichens can and so they are able to exploit this available space. The higher plants that are present at the top of the cliff can only survive because they are tolerant of quite a large amount of salt spray. Many of the species represented are commonly found on saltmarshes, for example scurvy grass (*Cochlearia* spp.), so called because it is a rich source of vitamin C.

The clumps of vegetation on top of the headland, looking rather like an invasion of green hedgehogs, are of thrift (*Armeria maritima*), which is another common saltmarsh plant.

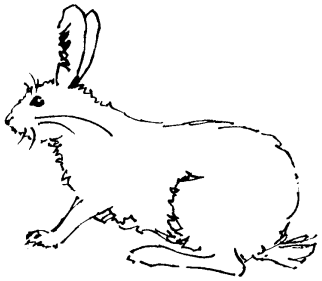
Thrift (Armeria maritima)

On the grassy slopes to the north there used to be a large colony of herring gulls. Of the Island's original colony of some 3000 pairs in 1979 less than 550 remain. The reason for the decline is thought to be food poisoning (Botulism) from the rubbish tips on the mainland. There are signs that the population may be recovering.

The impact of rabbits.

The impact of rabbits

Look at the chart below. On it we have listed some of the main constituents (solid line boxes) and processes (dotted line boxes) which play a part in the Skomer Island eco-system. Rabbits form part of this. Using this information produce a flow chart showing how rabbits may influence the ecology of the island. Don't worry if it begins to look very complicated!



Predation (gulls on rabbits)

Soil formation (through enrichment with droppings)

Burrowing (rabbits in ground)

Soil erosion (by over grazing)

Grazing (rabbits on grass)

Nesting (Birds [including gulls] in holes and burrows)

RABBITS

PLANTS (Including grass)

GULLS

SOIL

Above the waterline: Skomer Head.

You may have looked at the biological zones in North Haven. How does the height of the zones compare with this site? Can you explain the differences?

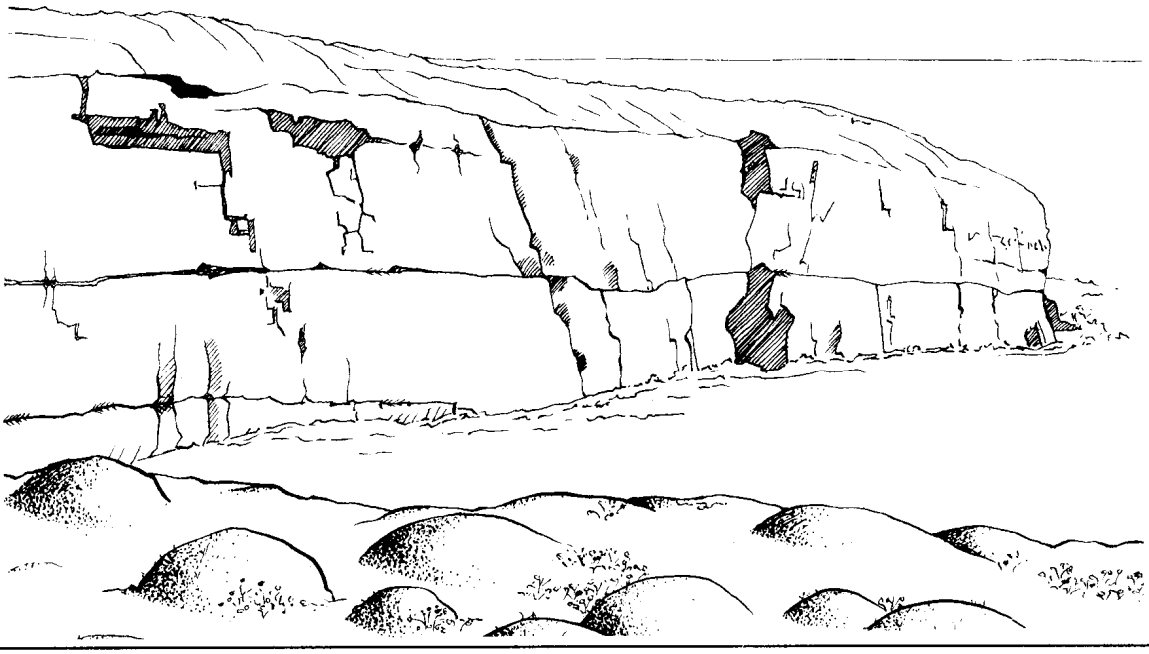
9. THE WICK. **time taken: 30 minutes**

This is one of the most spectacular sites on Skomer Island, an area where the sea has eroded volcanic rocks along a fault line. The sloping surface exposed to the north of the Wick is the junction between two lava flows. The horizontal lines in the vertical cliff to the south of the Wick are not bedding planes (these are not sedimentary rocks); again they are the junctions between lava flows. The rocks here slope approximately 40 degrees to the south, as do all the rocks on the island.

The grassy slopes above the cliffs support one of the puffin colonies of the island. On the vertical rock face the seabirds each occupy different habitats. Local people from Dale, Marloes and St. Ishmaels used to come out by boat, climb along the ledges and take guillemot eggs. The eggs would be sold as a delicacy to the aristocracy, or to egg collectors, back on the mainland.

Finding some living space

Use the identification chart on pages 44 and 45 to identify the birds seen nesting on the cliffs; map the sites on the base sketch below. Are the species distributed randomly? If they aren't can you think of any reasons why not? The notes given at the bottom of the page may help - but don't look unless you have to! What would the main threats be to the different species?



Fulmars live in the deep horizontal cleft on the top left corner of the rock face. **Guillemots** nest along the horizontal ledges. The main **kittiwake** colony is located in the bottom left quarter of the vertical face. **Razorbills** are a bit more difficult to spot; they nest in clefts in the rock face in ones and twos. A good place to look is approximately in the middle of the long axis of the vertical cliff, a little way above the midline where the guillemots are.


Fulmar


Guillemots


Kittiwakes


Razorbills

10. THE WICK VALLEY. time taken: 30 minutes

In this valley there are the remnants of an old stone house, a legacy left by one of the earliest farming communities. Although very little remains from those days, it is likely that the building looked something like the drawing below (a reconstruction based on local clues and evidence available from the mainland).

It is difficult to imagine what it must have been like on Skomer Island 5,000 years ago. Most of Wales and northern Britain was still wooded and this would have been true of much of the interior of Skomer, the remaining woodland plants are evidence for this. Conditions would have been harsh but the climate was probably warmer (and maybe wetter) than it is now. For a small community freshwater would have been plentiful (it still is, except during summer droughts). Although the seafaring skills, and boats would have been rudimentary travel between the mainland and neighbouring islands would have been perfectly possible, weather permitting.

Food crops were grown, although the thin soils and exposed conditions may have limited useable sites and suitable species. Hunting and gathering from nearby sites and especially the seashore (seaweeds and snails for example!) would have supplemented the diet of these early settlers. Livestock were brought along as well and the need to keep animals off crops is the same as in the modern era, hence the numerous lines of old field boundaries visible over many parts of the island but particularly from the western end of the Wick valley. What remains of these boundaries is a pale shadow of the original structures; when the farmhouse was built in the 1700s the builders, quite understandably, used stones from the old field boundaries rather than pay for material to be brought over from the mainland at great expense. All that remains of the boundaries are the large foundation stones but these are easily good enough to give the present day viewer an idea of the size of field they used and roughly how many there were. In this way Skomer is an immensely valuable indicator of the lifestyle these early farmers ‘enjoyed’.

Should I stay or should I go?

Imagine that you are a settler who has just arrived on Skomer Island 5,000 years ago. What would conditions have been like? Do you that you would have stayed? Look at the history section early on in this guide and see if you can answer the questions below.

- Where am I going to get building stone?
- What is the roof going to be made out of?
- Where would I get wood?
- What are my main food supplies?
- Where is my water supply?
- Could I cultivate plants?
- Could I use domestic animals?
- Would I be better off on the mainland?
- How do I cook?

11. THE MEW STONE. **time taken: 15 minutes**

This marks the southern point of the island and is joined to the South Plateau of Skomer at low water. Weaknesses in the rock have been exploited here and a channel eroded through. This is similar to what has been happening at the Wick (see map).

A series of reefs can be seen to the west of the Mew Stone which are in reality like other Mew Stones but with the greater part submerged. These mighty reefs make a spectacular dive descending to over 35m eventually bottoming out on a gravely seabed covered with brittle stars. A tidal race rushes around the Mew Stone much of the time and dangerous up and down currents occur. This is another of Skomer's sites that divers must tackle with care.

Various seabirds nest on the Mew Stone but peculiar to this site are Cormorants. About 20 pairs nest here annually. Peregrine falcons also frequent this location and are worth watching out for. Jackdaws are common here and may be confused with chough when flying by.

The island of Skokholm can be seen to the south. Skokholm is made of Old Red Sandstone and is not part of the Skomer volcanic series. The light on Skokholm flashes red every 10 seconds. On occasions the St. Anne's Head lighthouse on the mainland can be seen from here. This flashes white then red every 5 seconds. These lights can be compared with those of South Bishop and The Smalls (see Garland Stone, point 6).

Skokholm lighthouse

Between Skomer and Skokholm is Broad Sound. The seabed here is mostly rocky and current swept. A look at an Admiralty chart shows a pinnacle called The Knoll. This pinnacle rises from below 30m to within 7m of the surface and is in fact a huge, steep sand dune, which is probably maintained by sediment deposition as a result of interacting tidal currents. The position of The Knoll is frequently marked by breaking waves in choppy seas.

On the rocks.

One of Skomer's conservation interests is its lichen communities, some of which are very rare. Some species thrive in the presence of sea bird guano (bird droppings). Lichens are sensitive indicators of air quality; the lack of air pollution and agrochemicals promotes the growth of many species. The rocks at the Mew Stone are covered with lichens of various sorts, they grow little more than one or two millimetres per year and soon die off in unfavourable conditions. Pembrokeshire's lichen flora is very rich due to the prevailing southwesterly winds and clean air from the Atlantic. This site is an ideal spot for looking at a selection of these lichens but do be careful, don't venture away from the paths.

- How many different lichen species can you find?
- What is lichen?
- In what sort of places are they found; in sunny places; in damp places; on top of the rocks?
- What might be causing these differences?

12. HIGH CLIFF. time taken: 20 minutes

This is another important site for cliff nesting birds. If you reach this point before THE WICK it will be useful to get some practice in seabird identification. See **Skomer Island seabirds, an identification guide**, for help.

How many of the seabirds shown in the guide have you spotted since your arrival? This is an ideal site to see most of the cliff nesting species; guillemots, razorbills (April to late July), kittiwakes (well into August) and fulmars (much of the year) should be visible on the cliff face. Puffins should be below your feet (April to late July) and there will be herring and lesser black-backed gulls up the slope to the north. You may see the great black-backed gull patrolling around looking for a feeding opportunity, it is only when you see this gull close to one of the other species that you appreciate its size, it has a 170cm wing span.

Looking towards South Haven, this is one of the major seal breeding areas on the island. The sheltered inlets and caves are particularly important in this respect. The seals living around Skomer are grey seals and they have their pups in the autumn/ winter of each year. The island's beaches and caves provide undisturbed refuges, away from the pressures of the mainland, for the seals to give birth to their young and to feed them till they are old enough to look after themselves (only a matter of three weeks in this species).

South Haven is a popular place for yachts to drop anchor in the summer. However all boats are asked to keep their distance from the breeding Seabird colonies on High Cliff.

Boating matters.

We have already seen that various activities off the island, such as fishing and diving, may affect the Skomer Island birds. The questions below look at the possible impact of boats. They could become the basis for a role-play exercise where participants play at being boat owners, ornithologists, tourist operators, etc,

1. What effect might boats and yachts have on the birds and seals?
2. Is there a time of the year when the birds and seals will be particularly vulnerable?
3. Are there any rules and regulations that you would apply?
4. Would these apply all year round and to everybody? Would they be voluntary?
5. How would you publicise these measures?

SKOMER ISLAND SEABIRDS, AN IDENTIFICATION GUIDE.

1. Puffin (*Fratercula arctica*). Brightly coloured bill and bright orange legs. Rapid, stiff wing beats.

- Clutch size: normally one egg (capable of incubating two)
- Average lifespan: 25 years
- Incubation period: 39-43 days
- Age of first breeding: mostly in 5th year, some as early as 3rd.
- Wintering area: for Irish Sea populations, mainly southwards to Bay of Biscay, Atlantic Iberian coast and western Mediterranean.
- Wing span: 53-58cm
- Food: fish (sandeels) and marine invertebrates
- Feeding: surface dive and swim to 30m
- Approximate Skomer population: 10500 individuals

Puffin by Gwyn Thomas

2. Kittiwake (*Rissa tridactyla*). Small, graceful looking gull. Grey back, black wing tips and black legs.

- Clutch size: normally two eggs (sometimes 1 or 3)
- Average lifespan: up to 21 years
- Incubation period: 28 days
- Age of first breeding: mostly in 4th and 5th years.
- Wintering area: not truly migratory. Most British birds found in European waters but some European birds cross north Atlantic.
- Wing span: 90-92cm
- Food: small marine fish (sandeels), invertebrates and offal from trawlers
- Feeding: surface feeder
- Approximate Skomer population: 2300 pairs

3. Great black-backed gull (*Larus marinus*). Largest gull on the island, very dark black back, fleshy pink coloured legs.

- Clutch size: normally 2-3 eggs
- Average lifespan: up to 20 years
- Incubation period: 27-28 days
- Age of first breeding: mostly in 4th and 5th years.
- Wintering area: most British birds not truly migratory.
- Wing span: 152-167cm
- Food: Anything! Including Manx shearwaters
- Feeding: predator, scavenger, pirate, opportunist
- Approximate Skomer population: 85 pairs

4. Herring gull (*Larus argentatus*). Similar size as lesser black-backed gull. Pale grey back and fleshy pink coloured legs.

- Clutch size: normally three eggs
- Average lifespan: up to 31 years
- Incubation period: 28-30 days
- Age of first breeding: 3-7 years.
- Wintering area: in Britain, not migratory.
- Wing span: 138-155cm
- Food: omnivore. Trawler scraps and rubbish tips
- Feeding: scavenger/predator/pirate
- Approximate Skomer population: 400 pairs

5. Lesser black-backed gull (*Larus fuscus*). Same size as (to slightly smaller than) herring gull. Dark grey back with bright yellow legs.

- Clutch size: normally three eggs
- Average lifespan: up to 26 years
- Incubation period: 24-27 days
- Age of first breeding: most in 4th year.
- Wintering area: for British population, Portugal, southwest Spain.
- Wing span: 135-155cm
- Food: omnivorous
- Feeding: scavenger, predator
- Approximate Skomer population: 10500 pairs

6. Fulmar (*Fulmarus glacialis*). Grey backed but with a short torpedo-like body. Very distinguishable flight, wings held stiff with occasional flaps and then long periods of gliding.

- Clutch size: 1, sometimes 2 eggs
- Average lifespan: up to 32 years
- Incubation period: 52-53 days
- Age of first breeding: 6-12 years.
- Wintering area: most British birds move southwards to Bay of Biscay, Atlantic coast of Iberia and western Mediterranean.
- Wing span: 102-112cm
- Food: fish (sandeels) and marine invertebrates
- Feeding: surface dive and swim to 30m
- Approximate Skomer population: 550 pairs

7. Guillemot (*Uria aalge*). Similar to a razorbill but chocolate brown not black on top. Beautifully streamlined head with long pointed beak. Flight as for puffins.

- Clutch size: 1 egg
- Average lifespan: up to 32 years
- Incubation period: 28-37 days
- Age of first breeding: mostly in 4th and 5th years.
- Wintering area: many birds stay all year in seas close to colony (dispersive) and northwest Africa.
- Wing span: 53-58cm
- Food: crustaceans, cephalopods, small fish and offal from trawlers
- Feeding: surface feeder
- Approximate Skomer population: 17000 individuals

8. Razorbill (*Alca torda*). Black back with white front. Heavy, blunt black beak with distinctive white lines near the end. Flight similar to puffins.

- Clutch size: 1 egg
- Average lifespan: up to 20 years
- Incubation period: 32-39 days
- Age of first breeding: mostly in 4th and 5th years.
- Wintering area: for Irish Sea populations, Iberian coast, but some reach Moroccan coast and western Mediterranean.
- Wing span: 63-66cm
- Food: fish (sandeels), sprats and some invertebrates
- Feeding: surface dive and swim usually to 7m but up to 170m!
- Approximate Skomer population: 5000 individuals

9. Manx shearwater (*Puffinus puffinus*). Black back and white front, thin streamlined bill similar in structure to the fulmar's. Characteristic flapping then gliding flight close to the water surface.

- Clutch size: 1 egg
- Average lifespan: 13-27 years
- Incubation period: 55 days
- Age of first breeding: mostly in 5th or 6th year, some as early as 3rd.
- Wintering area: south Atlantic off coast of Argentina and Brazil.
- Wing span: 76-89cm
- Food: fish, cephalopods and crustaceans
- Feeding: surface feeder
- Approximate Skomer population: 128000 pairs

13. ABOVE SOUTH STREAM VALLEY. time taken: 30 minutes

This is one of the best sites for viewing gulls and studying their behaviour. The gradually sloping grassy banks are nesting sites for lesser black-backed, and herring gulls which can be readily identified (see Point 12).

Both species lay their eggs in May. By June the chicks have hatched and they will have fledged by August. These gulls show similar, fascinating and easily observable behavioural repertoires, which can make entertaining viewing. The behaviour includes courtship rituals, territorial and chick rearing behaviour. Some of the more easily recognisable pattern are described below.

Breeding pairs of herring and lesser black-backed gulls establish territories in which they nest. Once established this territory is defended from other birds and territorial fights between individuals are sometimes seen. Birds will grip beaks, push and pull, flap their wings and jump in the air. Eventually the loser will back off submissively. When not directly wrestling a gull may feign attack on the ground or pull at grass on the edge of its territory. Gulls give a familiar yodelling call. This yodelling is a territorial song. When in aggressive mode a gull will posture with its head up and the wings will be folded but thrust forward.

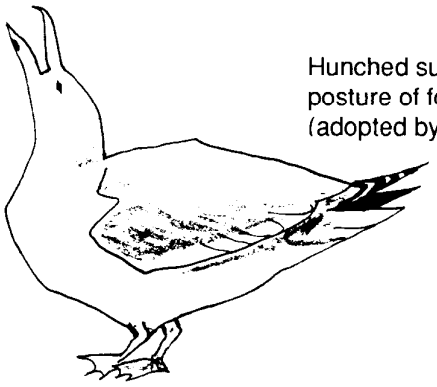
Female gulls are attracted to male territory holders. At first a male may attack the female as an intruder but she will appease him by adopting a hunched, submissive posture and tossing her head. (Head tossing is the food begging behaviour of a chick). The male will lead the female to a nest site within his territory by mewing and posturing. Then, he performs a rhythmical head-bobbing movement, which is reciprocated by a mate when the nest site is agreed. Once a pair is established they cry single long calls to repel intruders. Sometimes pairs of birds can be seen strutting along side by side with their heads forward, emitting eerie moans or mewing sounds. During copulation the female head-tosses from a hunched position and the male may remain mounted for several minutes. Female cooperation is essential to mating success (contrary to some species), if she doesn't keep biting the male bird's neck, to signal her agreement, copulation will fail.

Another behavioural pattern, which you may see, is the familiar 'ha-ha' and 'keow' alarm call of birds in flight. This looks distinctly like a bird having hysterics on the wing.

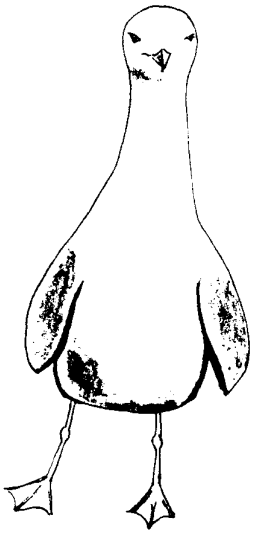
When chicks are present, they are difficult to spot, being so well camouflaged. If you look hard, you may eventually get your eye in and see one. The red spot at the base of a herring gulls beak attracts the chick to peck at it stimulating regurgitation of food.

Poses and postures

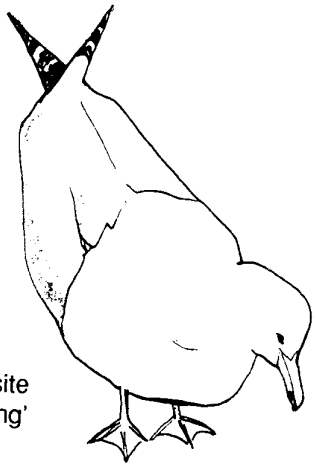
The drawings show a range of herring gull behaviour and poses which can be seen at this site. How many can you see? In what situations do they occur?



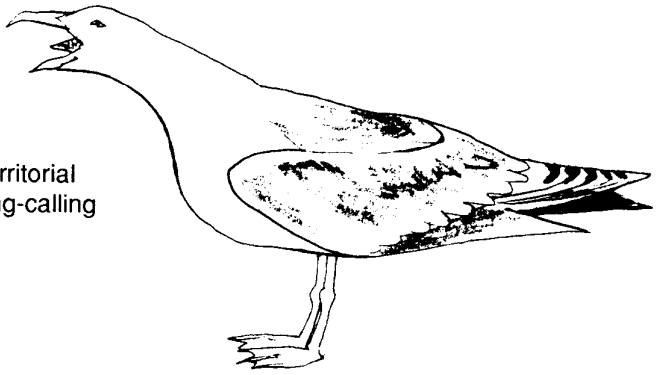
Hunched submissive posture of food begging (adopted by the female)



Aggressive upright threat posture



Nest-site 'choking'



Territorial long-calling

14. CAPTAIN KITES. **time taken: 30 minutes**

From this vantage point you can see the part of Skomer Island called The Neck. This part of the nature reserve is not open to the public; it is intended as a quiet and undisturbed area set aside for research and the birds and other animals which live there.

On the grassy slopes above South Castle there are the remains of a promontory fortification, which probably dates from the Iron Age, or earlier. It may have been defensive; if an attack was imminent all the livestock and people would shelter behind a defensive bank and ditch, hopefully until the attack was repelled. Alternatively it may just have been an animal pound.

In the area to the north west of the Warden's house there is one of the largest concentrations of Manx shearwater burrows on the island. There are thought to be over 120,000 pairs of these birds on Skomer, yet visitors rarely see them. Manx shearwaters live on Skomer from about March to October (although most leave in September) but they only leave or return to their burrows after dark. They are rather clumsy on land as the feet are set far back on their rather long body, (an adaptation to their oceanic lifestyle) thus they have to struggle to get safely back in their burrow. If they attempted this during daylight hours, or even when there is moonlight, they would be set upon and eaten by the various species of gull that inhabit the island (great black-backed gulls in particular). Unfortunately the only sight you are likely to get of a Manx shearwater is of a pair of wings and a breastbone, the aftermath of a predatory attack.

When Manx shearwaters leave Skomer they will fly 6,000 miles to "over winter" off the coast of Brazil, Uruguay, and Argentina. In February of the following year the birds will fly north again to take up residence, not only on the same island but also in the same burrow as the year before. In common with many marine birds the Manx shearwater is long lived, one bird returned to the same burrow, on nearby Skokholm Island, for over 30 years and it was unlikely to have taken up residence much before its fifth birthday! In an early experiment on bird migration a Manx shearwater was taken from its burrow on Skokholm and taken to Nova Scotia, Canada. Apparently the bird made it back to its burrow in twelve and a half days; far quicker than the ship-bound naturalists who had still to get back home.

Manx shearwaters and fulmars belong to a group of birds called the tubenose family (Procellariidae). The nostrils are incredibly sensitive to the smell of a gas called di-methyl sulphide, which is given off by members of the phytoplankton (free floating, microscopic plants that drift near the ocean surface). Where there are phytoplankton there will be zooplankton (animal drifters) and where they are there will be fish. Hence these birds use their incredible sense of smell to locate fish and crustaceans to eat.

HEALTH AND SAFETY INFORMATION.

In case of emergency get help immediately from where you had your introductory talk or the Warden's house in North Haven.

- Cliffs can kill. Keep away from the edge, especially on wet and windy days.
- Keep to the paths. There are many burrows on Skomer Island, if you go off the path you may tread on a burrow and strain or break your ankle. Even worse you might kill a bird or break an egg.
- Wrap up warm. Carry/wear a set of warm and waterproof clothes. Skomer can be wet and windy.

CODE OF CONDUCT ON SKOMER.

Don't forget that Skomer is a National Nature Reserve.

Please.....

- Keep to the paths.
- Don't drop litter.
- Don't drop cigarettes; they could start a fire.
- Avoid making loud noises.

FURTHER INVESTIGATIONS AND QUESTIONS.

This question sheet is designed to give you an overview as to why Skomer is important as a Nature Reserve above and below the water.

If you didn't manage to cover all the numbered stopping points or the suggested activities this will help fill the gaps.

1. Who owns Skomer? Who manages the island? What is the conservation status of the island? What is the conservation status of the Marine Reserve?

2. What is the significance of Martin's Haven to the Skomer NNR and MNR?

3. What activities occurring around Skomer might be harmful to marine life?

4. What boating activities might be harmful to the seals and seabirds? At what time of year will these animals be particularly vulnerable? What measures are being taken to prevent this occurring?

5. Where are the strongest currents around Skomer and how do they affect the marine life?

6. Why is the Sub-littoral (under water) zone around Skomer so rich in unusual species?

7. What are the main conservation features of interest in North Haven?

8. What is Skomer's main rock type and what effect does this have on the soil? How did farmers overcome this problem in the past?

9. When was Skomer first farmed? What evidence of the early Skomer occupants can still be seen today?

10. What evidence is there to suggest that there might have been woodland on Skomer in the past? Why are there no trees today?

11. Why isn't Skomer farmed today?

12. Which seabirds nest on Skomer? What are their habitats? Why are these different? Can you think of any other birds that the island is important for?

13. What is Skomer's most common gull? If the numbers of this gull were to increase how would this affect the Manx shearwaters and the puffins? What do you think should be done to prevent this occurring?

14. Which gull is declining on Skomer and why?

15. Which bird lives on Skomer in the greatest numbers? Why do visitors rarely if ever see one? Where does it go in the winter?

16. Why are ground-nesting seabirds restricted to isolated places like Skomer?

17. Name Skomer's neighbouring islands. For which birds are these important?

18. What effects do rabbits have on the islands ecology? Which species of gull is large enough to pick up a rabbit in its beak and fly off with it? Predators control the numbers of rabbits to a certain extent; can you think of other factors that keep rabbit numbers down?

19. What is Skomer’s unique animal? What does it feed on and why is this remarkable? What is its main predator?

20. Why does bracken present the Skomer Warden with a conservation management dilemma? Give two reasons.

21. Why is it important that visitors keep to the footpaths on Skomer?

22. Should a limit be set on the number of visitors to Skomer? How would you find out how to set such a limit?

23. Suggest reasons why the conservation of Skomer Island and its surrounding sea area may not be enough to protect the marine life. Can you think of extra measures that would help?

24. At present certain commercial activities such as fishing are allowed to continue within the Skomer MNR. Some conservation groups feel this is inappropriate in a nature reserve and there are marine reserves in New Zealand and the Galapagos where nobody is allowed to do ANYTHING to harm the animals and plants. These are called non-exploitation reserves. Suggest some advantages and disadvantages if this approach was adopted around Skomer.

SOME ANSWERS AND SUGGESTIONS FOR THOUGHT.

1. Countryside Council for Wales. Wildlife Trust South and West Wales. National Nature Reserve (NNR). Marine Nature Reserve (MNR).

2. Access, control, information point.

3. Over fishing, Drift nets, pollution, dredging and dumping of spoil, water sports etc.

4. Setting out of lobster pots, nets etc., Dive boats, speed boats, jet skis getting too close to the cliffs, yachts with sails flapping. Breeding season, Apr-Aug birds, Sep-Nov seals. Exclusion zones, differential access zones, speed limits.

5. Headlands, sounds. Bring nutrients & respiratory gases, take away waste & gametes.

6. Microhabitat diversity (high energy-low energy sites) and mixture of warm and cold water species at the edges of their range.

7. Interesting sheltered rocky shore; Eel grass (*Zostera marina*) bed (rare species plus nursery for juvenile fish), large puffin colony.

8. Volcanic, acidifies it. Add lime.

9. Opinion varies, <4500 years ago. Hut circles, field boundaries, burial Cairns, series of dams, Harold stone.

10. Woodland flora plus comparison with other Islands known to have been wooded. Parent trees chopped down, no seed bank, grazing herbivores and unsuitable climate.

11. Isolation (economic and cultural), presence of NNR.

12. Some of Skomer's seabirds and their idealised nesting habitats.

Species	Nesting Habitat	Other Island (see17)
Manx Shearwater	Burrows, inland	S
Puffin	Burrows, top of cliff	S
Guillemot	Horizontal rock ledges	S,R.G.
Razorbill	Crevices in rock face	S,R,G.
Fulmar	Deeper rock ledges	S,R,G.
Kittiwake	Vertical rock face	S,R,G.
Great black-backed gull	Rock outcrops inland	S,R,G.
Lesser black-backed gull	Grass, inland	S,R,G.
Herring gull	Grass, top of cliff	S,R,G.

12 (cont.) Interspecific competition. Choughs, short-eared owls, peregrines.

13 Lesser black-backed. Adversely as a result of direct predation (although this is mostly the great black-backed gull) and competition for food.

14 Herring gull, botulism from refuse sacks.

15 Manx shearwater. It is either under the ground or out to sea during daylight hours (cf. Gull predation). South Atlantic.

16 Ground predators, disturbance, and incompatibility with human occupancy.

17 Skokholm (S)-same as Skomer, Ramsey (R)-Choughs and see table above, Grassholm (G)-Gannets and see table above.

18 Grazing affects plant species composition and biodiversity, effects on soil (formation and erosion), food for predators. GBB gull. Myxomatosis and food supply.

19 The Skomer vole (*Clethrionomys glareolus skomerensis*) feeds on bracken, unusual because this plant is highly toxic. Main predator is the short-eared owl.

20 Disadvantages: Toxicity, forms dense canopy (hence few if any plants survive underneath it (reduction in biodiversity), spreads rapidly, difficult to control. Puffins avoid nesting near bracken as LBB gulls use the fronds as cover to attack from, higher incidence of “puffinosis” in Manx shearwaters with burrows near bracken. Advantages: Food supply for Skomer vole, essential canopy for bluebell bulbs.

21 Welfare of birds/nests, control of visitor pressure, safety of visitors.

22 Your opinion. Compare breeding success on The Neck and the main part. Study behaviour of birds at different visitor densities.

23 Biological ranges of many species that use the Island far exceed the protected area as does that of their food supply (cf. Manx shearwater). Species area effects. Sea water effectively a global mass, interactions with climate. Progress towards larger conservation units eg. SAC’s may help, as would looking after the whole biosphere.

24 **Advantages**: Tool for fisheries management (benefits include, increased abundance and size of commercial species; increased production of eggs and larvae and export of these to fishing grounds; rapid build up of fish spawning stock biomass; enhanced catches close to reserves and protection of stocks especially vulnerable to overfishing). Fish behaviour different; better for study, photography, enjoyment and probably the fishes stress levels. No damage to fragile, long-lived benthic species like sea fans. Extremely simple rulebooks. Etc, etc. **Disadvantages:** Ummmmm, can’t seem to think of any.