Merkinch LNR Management Group

Merkinch Local Nature Reserve Management Plan

Biodiversity Management Plan
and
Habitat and Species Survey

January 2009

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Alastair Sommerville
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Summary

Merkinch was designated a Local Nature Reserve in 2007 and a Management Plan[1] for the site written in 2008. However, this plan did not go into the detail of the biodiversity of the site and its conservation which were identified as actions under the Aim 2 '*To celebrate the biodiversity value of the reserve through the conservation and sustainable management of its habitats and species*'. Objective 2a included the surveying the vegetation of the site to identify its National Vegetation Classification (NVC) communities and initial management needs (Measure 1) and drawing together existing data on species, habitats and hydrology to '*formulate sensible scheme of management to preserve and enhance the Reserve's biodiversity*'.

This Biodiversity Management Plan achieved these two Measures by surveying[2] the vegetation of the site, undertaking simple surveys of the marine life, the invertebrates and the vertebrates, compiling biodiversity data about the site from a number of existing sources and formulating prioritised actions to conserve the habitats and species over the next five years.

The original management plan identified a review cycle of three years but the biodiversity requirements suggested that a minimum of five years would be required to make most of the various actions achievable.

The marine aspects of the LNR were briefly surveyed for the first time. This survey along with the results of the land-based vegetation survey identified 14 different communities including 11 NVC plant communities (a total of 14 sub-communities). These were made up of 212 plant species. There were also records of 307 animal species from the site including 138 invertebrate species and 163 vertebrates. The latter include 3 fish, 9 mammals and 150 birds. No rare species depended on the site although a few species with a recognised conservation status were identified.

Conservation actions were prioritised depending on the status of the various habitats and species, their importance within the LNR and their management needs. This included redefining the Reserve Compartments in the light of the improved biological data available. The resultant analysis identified six Objectives and 15 Key Actions needed over the next five years to achieve them.

This Plan also summarises the species lists and includes the fully detailed records.

[1] **Merkinch Local Nature Reserve Management Plan**, March 2008 Bill Taylor, Toni Clark and Phil James for Merkinch Greenspace, 76pp.

[2] The surveys were undertaken on the 5th August, 3rd, 16th and 17th September 2008 a total equivalent of five and a half survey days.

Biodiversity Management Plan, Habitat and Species Survey

Contents

1. The biodiversity of Merkinch LNR and its conservation

Since 1985 when this site received its first botanical survey this site has been recognised as having considerable wildlife importance. In particular the marshland with its mix of saltmarsh and heathland vegetation was considered unusual and the similarly odd saline lagoons were also of note. The identification of the local Slender Spike-rush (*Eleocharis uniglumis*) picked out this site from others and its location on the edge of a nationally important marine bird site, the Beauly Firth, encouraged bird recording from an early time. The site is also on the edge of dense housing which adds considerably to its special features by having the potential to show a wide range of habitats and species to a sizable urban population.

1.1 The existing Management Plan

The Plan written in early 2008 identified the main biodiversity features particularly the easily accessible coastal and intertidal areas and the wide range of habitats (woodland, scrub, wet grassland, fen, open water and salt marsh). It also noted potential threats to the wildlife of the site including encroachment of the lagoons by more terrestrial habitats and similar succession within the fen and bog to scrub and woodland.

To counteract these potential threats and to ensure the proper management of the habitats and species on the site the Management Plan identified actions under three of its six Aims. This Biodiversity Management Plan is compatible with these wherever possible with further explanations given where there appears to be some deviation from the existing Management Plan. The three Aims are:

1.1.1 Aim 1 To increase the benefits to individuals and communities through active *involvement with the reserve*

Within this aim *Objective 1g)* is relevant:

Objective 1g) Train local people to act as volunteer reserve rangers, guided walk leaders, providers of information, basic interpretive techniques, biological recording.

Within this objective *Measure 1* is relevant:

Measure 1 Six members of local community are trained to operate as voluntary Reserve rangers, assist within the information centre and are able to carry out biological recording as necessary by 04/09.

This biodiversity plan has interpreted *Aim 1* as preferring the use of volunteers to do the biological recording on the LNR rather that getting the work done by experts from elsewhere. The work proposed in this plan is based on this assumption although it will obviously be necessary to encourage, train and oversee any volunteers until they have the confidence and skills to carry out this type of work.

1.1.2 Aim 2 To celebrate the biodiversity value of the reserve through the conservation and sustainable management of its habitats and species.

Within this aim *Objectives 2a), 2c)* and 2*d)* are all relevant:

Objective 2a) The Reserve maintains a detailed inventory of habitats and species

Measure 1: Detailed species and habitat mapping available to at least Phase 2 and identifying NVC communities and guidance on initial management needs.

This biodiversity plan includes the information on the vegetation and provides management requirements.

Measure 2: Database of species and habitats maintained

This biodiversity plan agrees that protocols for recording, a recording computer database, and seeking help from existing recording groups are all necessary. However, there is a lot of detail within these measures which would benefit from some careful planning, discussion and seeking best practice so that the system that is set up is robust and will function over many years. It also emphasises that local volunteer involvement is essential with the associated training and mentoring to make them effective.

Measure 3: Draw together all data gathered on species, habitats and hydrology and formulate a sensible scheme of management to preserve and enhance the Reserve's biodiversity.

This measure has been carried out and is presented in this plan. The collected data has been computerised and is available. Management proposals are included and have been devised not only on the priority management needs of the habitats and species but also on the likely resources of labour, skills, expertise and money that will be available to the LNR – which already has a considerable programme of amenity and educational work to carry out. The LNR has developed its interest over about 150 years through natural processes and it is considered that over-management would not only be impractical but also undesirable. The key to conservation management decisions is to know the current situation very well and proceed through careful monitoring and assessment and taking major action only if it can be justified and the management actions proposed are known to be effective. Initial management in this plan includes some experimental management where there are no close parallel experience to call upon.

Objective 2c) The Reserve is a place where practical conservation work is promoted.

Measure 2: Establishment of wildflower meadow on agreed section of amenity ground

No comment is made here on this proposal, as any effort spent on creating the meadow will result in a greater diversity than exists at the moment. Obviously the selection of species of plants already growing on the reserve would be a sensible starting point.

Measure 3: Survey of alien shrub species

Although this survey has not been carried out in detail it has been obvious that there is, as yet, no conservation problem associated with the main species previously identified. However, the recognition of the invasive nature of the garden escape Michaelmas Daisy is described below and has a programme of management proposed to counter its spread.

Objective 2d) The Reserve is a place where students and researchers provide valuable management support information.

Again this plan recognises the value in getting expert advice when needed through existing 'voluntary' sources. In this case the marine investigations would benefit from the specialist marine knowledge for both sampling and, particularly for identification of species. More practical help might be available for more specialist surveys (e.g. pitfall trapping for invertebrates, small mammal surveys) and specialist assessment (e.g. the practicality of putting a one-way valve on the Kingfisher Lagoon outfall culvert). Where possible experts should allow volunteers to help which would allow LNR participants to gain experience.

1.1.3 Aim 6 To deliver best practice management for the Reserve that will be an exemplar for other reserves.

This Aim is obviously central to the purpose of the LNR and is a very worthy ambition. Obviously how it is achieved does depend on the organisation of the reserve's management, the availability of expert help, the number of volunteers and their commitment to learning new skills when required and the quality and accuracy of record keeping including not only biodiversity data but also the monitoring of conservation actions.

1.2 The Biodiversity Management Plan

This plan follows the principles already set down and has assumed, in preparing a five-year conservation programme, that the organisation, training and continuity of volunteers will be achieved. Involvement in the biodiversity of the reserve is clearly a huge opportunity for everyone. The conservation work to be done has something to interest and involve all.

2. The physical structure of Merkinch LNR

2.1 Rocks, soils and water

The hydrology, geology and geomorphology of the LNR are described in the Management Plan. However, as these aspects of site have such a profound influence on the majority of the habitats they are re-described here with an interpretation of how they have helped create the wildlife found here today.

2.2 Underlying geology, the old coastline and gravel deposits

The sandstone underlying the area of the LNR is covered with a layer of gravel which formed the original shoreline which approximately matches the outer, eastern boundary of the site. This gravel material is seen covering most of the West Foreshore and the East Foreshore, in places mixed with thick muds and sands depending on the drainage patterns of the tidal flows.

2.3 Construction of embankments

It is relatively easy to see that the main embankment was constructed between the old ferry and the canal by excavating the gravel, leaving the lowest ground next to the landward side of the embankment, being widest and deepest towards the south. Today the main body of the marsh lies over 30cms of soil made up of peaty fen soil (about 13cms thick) and gritty, grey mineral soil above gravel, the latter made up of rounded stones about 2cms in diameter of less. There is a lateral gradation to the marsh soils which become shallower to the east and progressively more acidic (see below).

The railway may have used the gravels to construct the embankments and could have resulted in the deepest excavations to the north and south of the railway embankment but it may have been as easy to bring in material from elsewhere as the building of the line progressed. A spur to the railway (to service the canal) was also constructed about the same time and forms the southwestern boundary to the site and the western edge of the Kingfisher Lagoon. The landward edge of this embankment has been in filled and is level with the top of the disused track.

2.4 Water in and out of the site

Although the motivation behind building the seawall appears to be to get goods and people to and from the ferry to the canal, it clearly required the area of the old shore, cut-off by the seawall, to be drained. The system installed was not only to allow the water from the burn to the extreme south of the site to drain to the sea but also to flush the salt from the remainder of the site and allow it to be used for grazing. A stone culvert to do this was built beneath the seawall and continues to function at the south end of what is now the Kingfisher Lagoon although it is not easy to see the construction details. However, at the exit to the culvert there is an elaborate dressed-stone structure which may well had a valve or sluice fitted to it to allow freshwater out while preventing seawater flowing in. The culvert now allows water out of the lagoon but also allows seawater to flow back into the lagoon, the flow only being restricted by the diameter of the culvert.

Clearly when the railway line was built the northern part of the site was cut off and required its own drainage system. To do this a 16-inch metal pipe was built through the seawall immediately to the north of where the railway embankment crosses it and runs across the foreshore to discharge about thirty metres out. This pipe was sealed at the seaward end by a bronze flap-valve which is still in place although the lower half of the flap has been broken off. Again any one-way function of this pipe has stopped and water flows from the Westfield Lagoon into the sea and seawater flows into the lagoon with every tide. The amount of water exchanged is only restricted by the size of the pipe and the depth of the

incoming sea. It is reasonable to assume that when first built this pipe allowed the reclaimed land to become freshwater marsh or even drier ground until the pipe valve failed and the current mix of saltwater and fresh became established.

There is now some evidence that a small amount of seawater also seeps into the reserve under the seawall at high tide and as a result is affecting the plant communities near it at the north end of the marsh, which is well beyond the influence of the inflow into Westfield Lagoon.

The railway embankment also cut off a small section of the shore to form the Witches Coffin Lagoon. However, in this case a wide, bridged section was made in the railway embankment to allow water from the Kingfisher Lagoon to escape to the sea. However, there is no restriction on the entry of seawater and this lagoon remains almost entirely marine in nature.

The actual sources of freshwater into the site are limited. The main Westfield section obviously drains westwards to the marsh although with no obvious burns or ditches. However the seawater entering the site with each tide clearly blocks the free drainage of the marsh and the shallow nature of the site results in the water levels in the marsh changing rapidly throughout the day. The whole of the marsh can flood if there is any appreciable rainfall, especially at high tide. Obviously it is this section of the LNR where the hydrology has the greatest effect on the vegetation resulting in a mix of salinities which changes with the hour. It appears that the saltwater flowing in with the tide pushes northward up the marsh through the gravelly subsoil and forces the freshwater, which lies above it, nearer the surface. This allows some freshwater marsh plants growing in the peat layer to thrive unaffected by the salt while some deeper-rooted saltmarsh plants can grow alongside them. The resulting mix of plant species is unusual and one of the special features of the site.

The Kingfisher Lagoon has a shallow and slight drainage flow from the northeast corner of the landfill area and a more substantial burn in the southeast corner which emerges from a stone culvert from beneath in-filled ground. This culvert probably dates from the time when the railway spur embankment was built from the line. The burn flows through the site parallel to the canal and through the stone culvert into the Witches Coffin Lagoon.

Map 1 shows the main features associated with water flows on the site.

3. Habitats

The complex mix of salt and freshwater within the site has given rise to a wide variety of habitats from open sea to amenity grassland all of which have been influenced over the last 150 years by man. Unfortunately the site has only relatively recently (in the last 23 years) been recognised as being of wildlife importance. As a result details of the wildlife on the site in the past and of the changes which have happened there are sketchy or absent.

3.1 Main habitats

The reserve easily divides into some broad habitats, the two tidal bays; the saltmarsh fringing those bays, Witches Coffin Lagoon, Kingfisher Lagoon and Westfield Lagoon; the remaining Westfield marsh; the planted woodland and original scrub; the disturbed ground to the east of the Kingfisher Lagoon and to the north end of the Westfield section; the grassland communities mainly the amenity grassland. However, the saltmarsh and marsh habitats are complex mosaics with various communities within them influenced by the ratio of salt to freshwater and the degree of flooding.

3.2 Marine communities

The habitat classification used here is the JNCC's ***Marine Habitat Classification for Britain and Ireland*** version 04.05 which identifies 5 Broad Habitats and 370 biotopes and sub-biotopes (see www.jncc.gov.uk)

Although it has not been practicable to examine all of the two bays they are very similar in nature with extensive areas of mud and coarse sand overlain by small and medium sized pebbles. In detail there are muddier areas, especially where there are drainage channels, and rockier beds in the slightly higher parts. There are also a few shallow pools at low tide especially near the shore.

LR.LLR.FVS.ASc.VS (Ascophyllum nodosum and Fucus vesiculosus on variable salinity mud)

Most of the bay is dominated by brown seaweeds dominated by Knotted Wrack (*Ascophyllum nodosum*) attached to the larger pebbles. This sheltered, estuarine habitat characteristically has an impoverished diversity of species with a few barnacles (e.g. *Balanus balanus*, *Semibalanus balanoides*), shore crabs (*Carcinus maenas*) and winkles (e.g. *Littorina littorea*, *L. saxatile*, *L. rudis*).

LS.LSa.MuSa.CerPo community (Cerastoderma edule and polychaetes in littoral muddy sand

In the lower parts of the shore, where there are more extensive areas of sandy mud, cockles beds occur in small numbers along with worms such as *Pygospio elegans* and the very abundant, but tiny, surface living spire shell *Hydrobia ulvae*.

SS.SMu.SMuLS (Sublittoral mud in low or reduced salinity lagoons)

The even more sheltered Witches Coffin Lagoon has no seaweed cover, as the mud is very soft and organic. This habitat is dominated by the casts of the Lugworm (*Arenicola marina*).

It is worth noting that there are many shells of marine species found throughout the main bay in particular but all are dead shells being washed out of the mud sediments. For most of these species (e.g. the Oyster *Ostrea edulis* which has no recent records for the Moray Firth area) no living examples could be found and they are clearly sub-fossil species dating from times when this area supported different habitats. Obviously the building of the seawall changed the flow of freshwater and the tidal patterns in the area. Pollution from Inverness both domestic and industrial must have had significant effects as well.

Other fringing habitats (e.g. saltmarsh) have been classified using the terrestrial National Vegetation Classification (NVC) and are shown on Map 2.

3.3 Terrestrial communities

All of the terrestrial communities were identified using the standard method associated with the ***National Vegetation Classification*** (NVC) system. This is based on a survey begun in 1975 which is a phytosociological computer analysis of field samples of vegetation from throughout the UK. The five published volumes describing the NVC include 103 community types and 578 sub-communities.

3.3.1 Saltmarsh communities

S20 Scirpus lacustris ssp. tabernaemontani swamp

S20 a Scirpus lacustris ssp tabernaemontani-dominated sub-community

Grey Club-rush (*Schoenoplectus tabernaemontani*) is a species which does grow in freshwater but is very tolerant of saltwater. In ideal conditions it forms dense stands with out other species present and small patches of it are found in Kingfisher Lagoon.

S20b Agrostic stolonifera sub-community

The scattered stems of the Grey Club-rush in the Southern Marsh probably indicate the remains of old stands which have succeeded to drier land. Occasional stems of *Typha latifolia* are typical of this sub-community.

S21 Scirpus maritimus swamp

S21a Scirpus maritimus dominated sub-community

The very characteristic triangular stem and tight cluster of flower heads make the Sea Club-rush (*Scirpus maritima*) very easy to identify and it frequently occurs in dense species-poor stands particularly around the junction of salt and freshwaters. Large beds of it occur around the Westfield Lagoon, the Kingfisher Lagoon and south end of the Witches Coffin Lagoon.

S21c Agrostis stolonifera sub-community

On the fringes of the beds of Sea Club-rush are some areas which include a number of other plants scattered through dense growth of Creeping Bent-grass (*Agrostis stolonifera*) and including Spear-leaved Orache (*Atriplex prosrata*), Sea Arrow-grass (*Triglochin maritima*), Sea Milkwort (*Glaux maritima*) and Sea Rush (*Juncus gerardi*).

SD3 Matricularia maritima – Galium aparine strandline community

This strandline community, marked out by the white flowers of the Sea Mayweed (*Matricularia maritima*), is found edging most of the lagoons' edges just above the high tide mark. In amongst the mayweed are various species of semi-succulent oraches including Babington's Orache (*Atriplex glabriuscula*) and Common Orache (*A. patula*). In autumn the large Perennial Sow-thistle (*Sonchus arvensis*) sends up tall spikes of yellow flowers.

SM13 Pucinellia maritima salt-marsh community

SM13d Plantago maritima – Armeria maritima sub-community

Common Saltmarsh-grass (*Pucinellia maritima*) is found throughout the saltmarsh communities in those areas which are flooded regularly by saltwater. In this case several areas around the lagoons are marked out by an extensive mix of the grass with Sea Plantain (*Plantago maritima*), Thrift (*Armeria maritima*), Sea Milkwort (*Glaux maritima*) and Sea Aster (*Aster tripolium*).

SM16 Festuca rubra salt-marsh community

SM16b Sub-community with Juncus gerardii dominant

Red Fescue (*Festuca rubra*) is a very widespread, fine-leaved grass which forms very dense swards in coastal situations. In these areas where there is a significant saltwater influence the Saltmarsh Rush (*Juncus gerardii*) is common and forms dense stands in places on the edges of the main saltmarsh areas around the lagoons.

SM16e Leontodon autumnalis sub-community

Slightly further back the *J. gerardii* is less abundant and Autumn Hawkbit (*Leontodon autumnalis*) and White Clover (*Trifolium repens*) are common.

3.3.2 Marsh communities

M27 Filipendula ulmaria – Angelica sylvestris mire

M27a Valeriana officinalis – Rumex acetosa sub-community

The majority of the marsh, particularly the Southern Marsh fits into this sub-community. Characteristically Meadowsweet (*Filipendula ulmaria*) and Angelica (*Angelica sylvestris*) are common but usually with a scattering of Common Valerian (*Valeriana officinalis*). The lower sward is made up of many different species including Sorrel (*Rumex acetosa*), Ragged Robin (*Lychnis flos-cuculi*), Devilsbit Scabious (*Succisa pratensis*), Cuckoo Flower (*Cardamine pratensis*), Wavy Bittercress (*C. flexuosa*), Common Sedge (*Carex nigra*), Marsh Horsetail (*Equisetum palustre*) and Marsh Bedstraw (*Galium palustre*).

However, much of this habitat is dominated by Common Michaelmas Daisy (*Aster x salignus*) a vigorous hybrid which is clearly spreading on this site and producing solid stands in places.

The areas least affected by the invading Aster, towards the northern end of the Southern Marsh, have a richer range of marsh plants including Marsh Marigold (*Caltha palustris*), Water Forgetmenot (*Mysotis scorpioides*), Bottle Sedge (*Carex rostrata*) and Lesser Spearwort (*Ranunculus flammula*).

Other marsh communities

Common Cotton-grass (*Eriophorum angustifolium*) is widespread as a component of the southern end of the marsh but grows as solid stands in the shallow peaty pools which have been dug at the foot of the seawall. This type of growth is well known in more acidic vegetation (e.g. ***M3 Eriophorum angustifolium bog pool community***) where the peat has been exposed through erosion or cutting. As with other 'bog' components of this marsh it was considered that without the context of sphagnum mosses it was thought most appropriate to not specifically classify these pools.

The eastern fringes of the marsh contain a range of plants which are more characteristic of acid peatlands than fens. .These include Bog Asphodel (*Narthecium ossifragum*), Heather (*Calluna vulgaris*), Cross-leaved Heath (*Erica tetralix*) and Bilberry (*Vaccinium myrtillis*). The two communities merge very gradually into each other making it difficult to identify the origins of the moorland/heathland component. All of the dominant species are found in ***M25 Molinia caerula – Potentilla erecta*** **mire** but Purple Moor-grass (*Molinia caerula*) is absent. The next closest fit is ***U5*** grassland, which although predominately upland vegetation does occur at lower altitudes (see below).

3.3.3 Woodland and scrub communities

The recently planted woodland has not yet developed its own understory although a few woodland plants (e.g. Bluebell (*Hyacinthoides non-scripta*), Male Fern (*Dryopteris filix-*

mas), Wood Speedwell (*Veronica montana*)) can be found in places. It is mostly a transition between ***W23*** and ***W24*** and its development will clarify how it should be classified.

W23 Ulex europeus – Rubus fructicosus scrub

W23a Anthoxanthum odorata sub-community

The bulk of the area now planted with woodland was previously whin scrub, scattered remains of which can be found in small unplanted areas along the west side of the woodland in particular. This scrub has grown up from grassland and is characteristically dominated by Whin (*Ulex europeaus*) and Bramble (*Rubus fructicosus agg.)* with scattered Raspberry (*Rubus idaeus*) and Broom (*Cystisus scoparius*). The grasses include Common Bent-grass (*Agrostis capillaris*) and Sweet Vernal Grass (*Anthoxanthum odorata*). Whin is a nitrogen fixing plant and as such is able to enrich the soil. However, it is also a short-lived species and very easily shaded out by taller trees.

W24 Rubus fructicosus – Holcus lanatus underscrub

This is a common vegetation type amongst the weeds on the Southern Wasteground but it is also widespread along the edges of the railway embankment and the seawall (on the inner side). In these situations seeds from berries eaten by birds have allowed a range of shrubs to develop mainly Bramble (*Rubus fructicosus agg.*) but including Hawthorn (*Crataegus monogyna*), Elder (*Sambucus nigra*), Dog Rose (*Rosa canina agg.*) and Blackthorn (*Prunus spinosa*). The wind-blown seeds from other trees such as Sycamore (*Acer pseudoplatanus*), Downy Birch (*Betula pubescens*) also get trapped in the Bramble cover. In the more open areas beneath the scrub grow grasses such as Creeping Bent-grass (*Agrostis stolonifera*) and Cocksfoot (*Dactylis glomerata*) along with Hardheads (*Centaurea nigra*), Red Clover (*Trifolium arvense*) and Meadowsweet (*Filipendula ulmaria*)

3.3.4 Disturbed ground communities

OV25 Urtica dioica – Cirsium arvense community

OV25a Holcus lanatus – Poa annua sub-community

This community is characteristically dominated by tall weeds including Creeping Thistle (*Cirsium arvense*) and Nettle (*Urtica dioica*) and is found on waste ground which has been recently disturbed. The largest extent is found on the western bank of Kingfisher Lagoon (Southern Wasteground) but it also occurs where soil has been tipped at the very north end of the marsh (Northern Wasteground). This sub-community is more open with a clear range of grasses in the 'understory' particularly Yorkshire Fog (*Holcus lanatus*) and Annual Meadow Grass (*Poa annua*) along with White Clover (*Trifolium repens*) and Common Vetch (*Vicia sativa*).

OV25b Rumex obtusifolius – Artemesia vulgaris sub-community

In this sub-community the thistles and nettles are very dense with scattered Mugwort (*Artemesia vulgaris*), Broad-leaved Dock (*Rumex obtusifolius*) and Hogweed (*Heracl;eum sphondylium*) as well as abundant Cocksfoot Grass (*Dactylis glomerata*), Couch Grass (*Elymus repens*) and Bramble (*Rubus fructicosus agg.*). The Northern Wasteland is dominated by the scrambling weed Hedge Bindweed (*Calystegia sepium*).

The Bramble patches are, in places, dense enough to allow passerine birds to perch and seeds passed through them have given rise to saplings of a number of shrubs converting this community to ***W24*** scrub (see above).

3.3.5 Grassland communities

MG5 Cynosurus cristatus – Centaurea nigra grassland

MG5c Danthonia decumbens sub-community

Because so much of the management of the site has changed relatively recently (through intensive mowing and tree planting) it is difficult to identify what the drier parts of the site would have been like when it was grazed. Clearly the site was rough grassland with considerable amounts of whin, bramble, willow and birch which can be seen in aerial photographs. However, since the grassland has not been grazed the site has been planted up with trees and the process of succession has led to the grassland becoming more tussocky and invaded by whin and broom (see ***W23*** above).

However, small areas of grassland on the east side of the woodland indicate what the grassland was likely to be like. The dominant grasses include Common Bent-grass (*Agrostis capillaris*), Red Fescue (*Festua rubra*), Cocksfoot Grass (*Dactylis glomerata*) and Sweet Vernal Grass (*Anthoxanthum odorata*) with Ribwort Plantain (*Plantago lanceolata*), Yarrow (*Achillea millefolium*) and the characteristic Hardheads (*Centaurea nigra*). The sub-community represented here is that of more acidic soil as tracing the grassland down to the marsh edge indicates the gradual merging of the two communities.

MC8 Festuca rubra – Armeria maritima maritime grassland

This is a plant community typical of grasslands very exposed to the sea and salt-spray. In less exposed sites the grassland is perhaps more closely related to ***MC9 Festuca rubra-Holcus lanatus maritime grassland***.

MC8a Typical sub-community

This grassland is characteristically dominated by Red Fescue (*Festuca rubra*) a fine-leaved grass which forms a dense thick sward with few other species in it. On this site it occurs along the exposed slope of the seawall and in a number of small areas in the saltmarsh in the south of the Southern Marsh and the south end of the Witches Coffin Lagoon. Small tufts of Thrift (*Artemesia maritima*) occur in places in the sward.

MC8d Holcus lanatus sub-community

This sub-community is similar to ***MC8a*** but there is a number of other species present including Cocksfoot Grass (*Dactylis glomerata*), Creeping Bent-grass (*Agrostis stolonifera*), Ribwort Plantain (*Plantago lanceolata*), Sorrel (*Rumex acetosa*), Bird'sfoot Trefoil (*Lotus corniculatus*) and Autumn Hawkbit (*Leontodon autumnalis*). This grassland also lies along the seawall higher up than ***MC8a***.

MC8g Armeria maritima-dominated sub-community

Nearest the sea the Red Fescue grassland thins out and the Thrift becomes dominant as clusters of tussocks with sparse grass between them. Where there is bare rock between tussocks the encrusting maritime lichens such as *Xanthoria* sp. and *Lecanora* sp.

U5 Nardus stricta-Galium saxatile grassland

U5d Calluna vulgaris-Danthonia decumbens sub-community

This grassland is typical of moist, peaty mineral soils, which are base-poor and infertile. This sub-community has a range of grasses within it not only Mat Grass (*Nardus stricta*) but also Common Bent-grass (*Agrostis capillaris*), Sheeps Fescue (*A. ovina*) and Sweet Vernal Grass (*Anthoxanthum odorata*). Both Heather (*Calluna vulgaris*) and Cross-leaved Heath (*Erica tetralix*) grow here although very sparsely.

Bog Asphodel (*Narthecium ossifragum*) is common and appears to be spreading. However, sphagnum mosses, which are associated with more bog-like vegetation, are absent although they were reported in 1996. It is possible that this nutrient poor vegetation is changing as a result of the nutrients being released by the growing, and encroaching, woodland.

3.4 Compartments

3.4.1 Previous divisions

Compartments within the site were identified crudely by A D Fox in 1985 on a map showing five areas: the north marsh, the south marsh, Westfield Lagoon, Kingfisher Lagoon and Witches Coffin Lagoon.

The management plan produced by William Vickers describes six compartments but provides no map (the original cannot be traced). These were C1 the north end of the marsh; C2 the middle section of the marsh; C3 the southern end of the marsh; C4 the woodland, then whin scrub with newly planted trees; C5, divided into four sub-compartments to the east of the south end of the marsh where the Bog Asphodel still grows; C6 Westfield Lagoon. This plan did not include the lagoons over the railway.

The current (2008) Management Plan identifies 10 zones and sub-zones one zone for the seashore (1A West Foreshore, 1B East Foreshore), one zone for the marsh, woodland and grassland (2A North Amenity Area, 2B South Amenity Area, 2C North Entrance, 2D Wet Grassland, 2E Woodland, 2F Westfield Lagoon) and two zones for the remaining lagoons (3 Kingfisher Lagoon, 4 Witches Coffin Lagoon).

3.4.2 Wildlife management compartments

This survey has looked at the site from a wildlife point of view and it seems sensible to divide up the site depending on the units which will be managed in a similar way. Making these as close to the existing divisions as possible it is suggested that there should be twelve management compartments as shown in Map 3. There are:

Northern Wasteground – the small area to the extreme north of the marsh where dumped material forms higher ground with coarse weeds growing on it

Northern Marsh – from the base of the Northern Wasteground south to the main east-west footpath crossing the site. Although this section differs slightly from one end to the other it is generally poor marshland with coarse grassland to the north and invading whins and alders to the south and east.

Southern Marsh (with **Westfield Lagoon**) – from the main footpath down to the southern end of the site. This includes the most varied part of the marsh and encompasses Westfield Lagoon. The eastern edge of this compartment is unclear at the moment as there are a number of small grassland/heathland areas inset into the woodland and several places where willows and alders appear to be encroaching on the marsh. Establishing the importance of these areas may include them in the marsh of may leave them to become part of the woodland.

Kingfisher Lagoon – This includes all of the open water and the saltmarsh areas but excludes the rising ground to the south-east,

Southern Wasteground – This is the recently disturbed ground to the southeast of Kingfisher Lagoon and is mainly weeds and developing scrub.

Witches Coffin Lagoon – this includes the tidal basin and the surrounding saltmarsh

Seawall – This notable feature of the LNR is physically quite different from the rest of the site and supports different vegetation. As it is also a main path through the site it is sensible to make it a compartment. It is divided into a north and a south section by the railway.

Woodland - this includes all of the planted woodland from south of the Northern Wasteground, east of the Northern Marsh, and east of the Southern Marsh.

Northern Amenity Grassland – although the amenity grassland in fact runs contiguously the potential for change in these areas suggest that it would be useful to retain the two compartments. This compartment retains some small clearings of important grassland which it is proposed could usefully be named as sub-compartments.

Southern Amenity Grassland – south of the main cross path to the extreme southeast of the site.

West Bay – all of the bay – here retained as one compartment but because of its extent may be divided into sub-compartments once further survey has been done. Includes the strandline except where this runs along the embankment.

East Bay – The entire bay within the LNR including the strandline.

4. Plants and animals

4.1 Recording

This site has not been a focus for recording and there is very little pre 1983 information available. A general search has been carried out but it maybe that other data, e.g. published in journals, may yet come to light. Some records[3] that were found came from the marsh habitat to the southeast of the site which has since been filled to form part of the industrial estate. The data sources so far identified are listed in Table 1.

Table 1 Biological records for Merkinch

Year	Recorder	Type of records			
		Birds	Mammals	Inverts	Plants
1934 - 1975	M McCallum Webster				5
1983 - 2008	A McNee	152*			
1983	S Moran		1	34	
1985	A D Fox				102
1992	J McKellar			1	
1993	M S C Elliot			11	
1993	S Moran			2	
1993	J McKellar			4	
1994	J McKellar			1	
1994	R Covey			5	
1994	F Fortune			3	
1994	K Thorpe			1	
1995	D McAllister		1		
1996	J McKellar			4	
1996	W Vickery	25	4		130
1996 – 2006	M Barron				4
1999	M Tyszka			2	
2005	D OBrian		1		
2006	J Waddell			2	1
2006	J McKellar		1		
2008	A Sommerville	28	5	110	122

*152 species recorded, number of records unknown.

16 people have contributed to wildlife information about the site over 74 years. Obviously most of these records (apart from the ongoing bird recording and the systematic site surveys by A D Fox, W Vickery and this survey) have been casual observations and for some recorders only represent those records sent in to the Highland Biological Records Centre.

The data on the 553 species found so far is summarised in Table 2. Although this appears a substantial number of species only the flowering plants and the birds can be regarded as near complete. For most of the other groups, especially the invertebrates, very little structured sampling has taken place and more work would easily add many species to the reserve's list. Obviously it is not possible to speculate on how many species might be present but a target of 850 has been suggested for the 25-year total.

[3] Botanical records from E W Groves in 1958

Table 2 Number of species recorded from Merkinch LNR (November 2008)

Group	Sub-group	Number of species
Algae		6
Mosses		7
Higher plants	Grasses, sedges, rushes, ferns	50
	Flowers	161
Invertebrates other than insects	Myriapods	4
	Molluscs	20
	Spiders	7
	Crustaceans	13
	Worms	5
	Hydroids, Bryozoans	2
Insects	Beetles	15
	Butterflies and moths	18
	Plant bugs	27
	Flies	15
	Dragonflies	2
Vertebrates	Fish	2
	Amphibians	1
	Birds (non breeding)	103
	Birds (breeding)	46
	Mammals	9

4.1.1 Available species records

All available records were obtained in as near to their original state as possible and were entered into a standard species-recording spreadsheet. Records collected during this survey were also entered in the same way with random sample records of the more widespread and common species. The Excel spreadsheet with the compiled data is available as an output from this project and has been included as a printout in Annex 5.

However, there is a considerable variation in the degree of accuracy of the data which includes imprecise grid references some of which only represent the site centroid, some of which are only to four figure accuracy and only a few of which are more than six-figure accuracy. On a small site such as this one eight to ten figure accuracy is useful as it allows a species observation to be linked to a specific compartment or habitat.

The majority of the bird data was not available as individual records but only as summary information collected over a 25-year period and has been entered as such. Obviously this makes interpretation of this data (e.g. looking at activity during the year and trends over the years) impossible. The individual records behind this dataset are available but not easily accessible and it would take a lot of work to extract, collate and computerise them.

Some of the data is now old and care must be taken to check if the species concerned are still present on the site. The summary species lists include all species ever recorded from

the site and these lists cannot be regarded as an accurate description of what is found on the LNR today. It is essential that the available records are examined in detail (e.g. for date, grid reference accuracy and recorder) before any assumptions about their present relevance are made.

Obviously as good quality, accurate, repeated records build up for the site and much better idea of individual species rarity, distribution, seasonality etc. will emerge. However, the previous records serve a vital function to indicate the possible flora and fauna on the site as well as the possible gaps in the recording.

4.2 Plants

Most recording on this site has been focussed on the plants as the marsh and saltmarsh areas represent relatively rare habitat type especially so close to a city. The oldest records include some for the area to the southeast of the LNR which is now an industrial estate but was a saltmarsh area in the 1950s. No truly rare plants have been found but the diversity of the higher plants is notable and the list does include some specialist species which are not generally common but are found in similar habitats around the Beauly and Moray Firths. The marsh is particularly rich and probably contains some species still to be recorded. However the site is poor in mosses and liverworts which would be expected to be abundant in both the freshwater marsh and in the 'peat-bog' communities. For example, sphagnum moss was recorded in 1996 but none was found in 2008. This paucity of lower plants may be due to the saline influence of the groundwater.

A summary list of all of the plant species found on the Reserve is given in Annex 3.

4.2.1 Marine plants

The plants associated with the marine part of the reserve are mostly the very common and widespread brown seaweeds which would be expected in the estuarine conditions of this site. A wider range of marine algae would be found further away from the considerable freshwater influence of the River Ness. The marine flowering plant Glasswort (*Salicornia europea*) was found in Witches Coffin Lagoon in 1985 but was not seen in 2008. A wide range of other flowering plants are associated with the saltmarsh areas on the site and all are tolerant of being submerged from time to time in seawater. In the wettest areas Sea Plantain (*Plantago marina*), Sea Aster (*Aster trifolium*), Sea Milkwort (*Glaux maritima*) are all common along with a few species of grass such as Common Saltmarsh Grass (*Puccinellia maritima*). Of particular note on this site are the dense beds of Sea Club-rush (*Scirpus maritimus*) and Sea rush (*Juncus maritimus*).

The dryer saltmarsh areas include the strandline species including dense mats of Red Fescue (*Festuca rubra*), with Sea Mayweed (*Matricaria maritima*), Babington's Orache (*Atriplex glabriuscula*), Grass-leaved Orache (*A. littoralis*) and Perennial Sow-thistle (*Sonchus arvensis*).

4.2.2 Freshwater and marshland plants

The saltmarsh plant communities grade into freshwater communities of emergent plants and marsh. In the most nutrient rich parts of the site (at the southwest end of the marsh) the remains of old open-water pools are now represented by the scattering of Grey Bulrush (*Schoenoplectus tabernaemontani*), Lesser Bulrush (*Typha latifolia*) and a few remnants of Reed Canary–grass (*Phalaris arundinacea*). All three of these species are scarce and the populations consist of dispersed individual stems suggesting that they are declining as the open water has succeeded to marsh.

There are, however, a series of small, shallow pools scattered throughout the marsh which clearly dry up during most summers (probably not during 2008) and may represent what is

left of the original, deeper pools. However, it is doubtful that these are the result of peat-digging but maybe some have originated from small areas of burning. Whatever their origins these bare, muddy patches have been colonised by the Slender Spike-rush (*Eleocharis uniglumis*) and Common Cotton-grasses (*Eriophorum angustifolium*).

Elsewhere in the marsh, particularly half way up the site, south of the main east-west path there are very small wet area with plants such as Bog Pondweed (*Potamogeton polygonifolius*) and Lesser Spearwort (*Ranunculus flammula*). However, the majority of the area is permanently wet ground with occasional flooding when there is heavy rain and the seawater wedge from the rising tide pushes the freshwater in the peaty soil to the surface. A very wide range of plants grow in these conditions including the scrambling Marsh Pennywort (*Hydrocotyle vulgaris*), Marsh Arrow-grass (*Triglochin palustris*), Marsh Lousewort (*Pedicularis palustris*), Devilsbit Scabious (*Succisa pratensis*), Marsh Marigold (*Caltha palustris*), Sneezewort (*Achillea ptarmica*) and Creeping Buttercup (*Ranunculus repens*).

A number of tall native species also occur in the marsh including Meadowsweet (*Filipendula ulmaria*), Angelica (*Angelica sylvestris*), Marsh Thistle (*Cirsium palustre*), Tufted Hair-grass (*Deschampsia cespitosa*) and rushes (*Juncus effusus*, *J. conglomerata*).

Besides the saltwater influence on the marsh there is also a distinct acidic component with a range of plants more associated with acidic bogs rather than fens or marshes. Most of these species are found at the south end of the marsh towards the eastern side where there has possibly been a longer presence of a peat surface and less influence from saltwater. These were first noted in 1996 but little indication was given of the distribution or abundant of the acid loving species. Today there are a few plants of Heather (*Calluna vulgaris*), Cross-leaved Heath (*Erica tetralix*) and Bilberry (*Vaccinium myrtillis*) but the populations do appear to be on the decline and being overcome by grasses and marshland species. This may relate to the planting of the trees on the rest of the site, the associated nutrient increase and/or the ceasing of grazing which might have favoured the heathland species. The most widespread species is Bog Asphodel (*Narthecium ossifragum*) which forms extensive beds in places. The Bog Cotton-grass (*Eriophorum vaginatum*) was found in the past but with no indication how widespread it was.

4.2.3 Terrestrial plants

The dryer, mineral soils on the higher parts of the site have been altered dramatically quite recently. Most of the area has been planted up and most of the rest has been heavily disturbed.

The oldest parts of the woodland does include some old trees of Goat Willow (*Salix caprea*) and possible some of Downy Birch (*Betula pubescens*) and Alder (*Alnus glutinosa*). There is some evidence that the woodland is developing as the previous vegetation of Whin (*Ulex europaeus*) scrub grassland and marsh has been supressed by the canopy of the planted trees. Ferns such as Male Fern (*Dryopteris filix-mas*) appear to be spreading along with a few other woodland species such as Bluebell (*Hyacinthoides nonscriptus*) and Wood Speedwell (*Veronica montana*).

Amongst the woodland are a few open areas of grassland which appear to be the original cover of much of the area before grazing ceased. It is now tussocky grassland with Cocksfoot grass (*Dactylis glomerata*), Common Bent-grass (*Agrostis capillaris*) and False Oat-grass (*Arrhenatherum elatius*) but includes plants such as Harebell (*Campanula rotundiflora*), Black Knapweed (*Centaurea nigra*), Greater Stitchwort (*Stellaria holostea*) and Yarrow (*Achillea millifolium*). As this grassland is left ungrazed (or un-cut) it will revert

to being dominated by coarse grasses and Hogweed (*Heracleum spondyllium*) and eventually turn into scrub and woodland.

Various parts of the site have had soil and rubbish dumped on them and these rich disturbed ground has encourage a range of tall, dense weedy species to colonise. These include Creeping Thistle (*Cirsium arvense*), Nettle (*Urtica dioica*), Bramble (*Rubus fructicosus*) and Broad-leaved Dock (*Rumex obtusifolius*). However, these sites are also prime areas for nitrogen-fixing shrubs such as Whin (*Ulex europaeus*) and Broom (*Cytisus scoparius*) to estabish, followed by shrubs with bird-carried seeds including Hawthorn (*Crategus monogyna*), Blackthorn (*Prunus spinosa*) Rowan (*Sorbus aucuparia*) and Elder (*Sambucus nigra*).

The cut areas of grass have little diversity and appear to be mainly Rye grass (*Lolium perenne*), Red Fescue (*Festuca rubra*), Yorkshire Fog (*Holcus lanatus*), Common Bent-grass (*Agrostis capillaris*) and White Clover (*Trifolium repens*).

4.2.4 Local and rare plants

There are no rare plants in the LNR. The rarest species found on the site is the local Slender Spike-rush (*Eleocharis uniglumis*) which, in Scotland, is scattered around the coast. However, in the context of a peri-urban site many of the plants growing in the Reserve have a very restricted distribution. Of interest are the three species of orchid including Fragrant Orchid (*Gymnadenia conopsea*), Lesser Butterfly Orchid (*Platanthera bifolia*) and Northern Marsh Orchid (*Dactylorhiza purpurella*) all of which are locally common and add considerably to the attractiveness of any site. In this case all three species were recorded in 1996 but only a few seed heads of the Northern Marsh Orchid were found in 2008. It is quite likely that many dead spikes had been overlooked late in the season but it maybe that succession of the vegetation was decreasing the suitability of the habitats for orchids.

4.2.5 Invasive plants

Snowberry (*Symphoricarpos albus*). This large shrub grows in several places within the reserve mainly on the sides of the embankments where the drainage is good. The large white berries produced in autumn are eaten by birds and the plant can be spread to other areas of native scrub where birds rest. Once established the plant can spread through suckers forming dense monocultures at the expense of other species. The shrub is frequently planted especially to form dense cover for game birds as well as an ornamental plant. From local knowledge it appears that the plants along the embankment pathways were not planted but may have spread from the dense patches along the canal banking at the south end of the site. However, the shrub does provide a degree of shelter and cover and does not, at the moment, appear to be threatening any native species and has a limited opportunity to spread. No action is required to control it but it could be replaced with native shrubs.

Japanese Knotweed (*Reynoutria japonica*). This tall perennial forms very dense thickets which expand through underground rhizomes, which can grow up to three metres deep, although there are some cases of spreading through seeds. Most plants are, however, introduced through the dumping of soil containing rhizome fragments although such material will be regarded as controlled waste. It is illegal to plant the species but not to have it growing on a site. On the LNR there are a few plants but no suggestion that the species is spreading significantly.

Common Michaelmas Daisy (*Aster x salignis*). The marsh has stands of tall herbs throughout of which the most noticeable is the Common Michaelmas Daisy which flowers in the autumn. The hybrids of this genus are difficult to identify, as there are several

closely related species which have been introduced to the UK that have given rise to a range of crosses. However, specimens of the plant from Merkinch most closely match *A. x salignus* which is also the most widespread hybrid and commonly found in wet ground. This hybrid alien plant is superficially similar to the native Sea Aster but its leaves are not succulent and it can grow to a much more substantial plant. On this site is appears in various forms (height, colour of the vegetation etc.) probably depending on the acidity of the peat and the salinity of the groundwater. Without better records it is not possible to track the spread of this species through the marsh although it was present in 1975. Today it is found in abundance throughout the marsh and in places forms tall, dense monoculture stands which are probably threatening the diversity of the marsh.

4.3 Invertebrates

There has been some recording of invertebrates in the past including casual sightings (e.g. butterflies and dragonflies) and systematic collecting (e.g. plant bugs). Further sampling was done in 2008 but was only possible very late in the season when the adults of most insect species had died. The number of possible invertebrate species on the site is bound to be many hundreds and only a small, and probably unrepresentative, sample of these has been taken so far.

A summary list of the invertebrate species found so far on the Reserve is given in Annex 4.

4.3.1 Marine invertebrates

The fauna of the estuarine mud and gravels is limited and so far has proved to be made up of worms (e.g. the Lugworm (*Arenicola marina*) and ragworms (*Hedista diversicolour*)), crabs (*Carcinus maenas*) and shrimps (*Corophium volutator*) with a very limited range of bivalves. There are also encrusting colonial animals on the fronds of the brown seaweeds including the bryozoan *Frustrellidra hispida* as well as the colonial hydroid *Dynamena pumila*. However, the strandline has its own specialist fauna including the tiny ground beetle *Aepus marinus* which lives under pebbles and feeds on springtails, the soil-living centipede *Strigamia maritima* and the small rove beetle *Micralymma marinum*. The ground beetle *Dicheirotrichus gustavii* is a specialist predator living in saltmarsh.

4.3.2 Marshland invertebrates

On the surface of the small pools of open water a few water skaters (*Gerris thoracicus*) feed on emerging gnats and underwater waterboatmen (*Callicorixa wollastoni*, *Hesperocorixa sahlbergi*) swim around with the Hog Louse (*Asellus aquaticus*) that feeds on particles in the mud. The mud is also home to various small beetles (e.g. *Megasternum obscurum*, *Anacaena globulus*) as well as the larvae of droneflies (*Eristalis pertinax*, *Sericomyia silentis*). Various predatory spiders live deep in the vegetation including *Pachygnatha clercki* and the wolf spider *Pardosa pullata*. Living on the marshland plants are the larvae of the hoverfly *Pyrophaena granditarsa* feeding on aphids whereas those of *Cheilosia illustrata* actually burrow into the stems of umbels and feed on the plant's tissues. There are also the caterpillars of the Scotch Argus butterfly (*Erebia aethiops*) eating grasses, the caterpillars of the micro-moth *Coleophora caespititiella* feeding on juncus flower heads and the bug *Kelisia vittipennis* feeding on the sap of cotton-grass. The Marsh Damselbug (*Nabicula limbata*) is a predator on a range of marshland insects including the bugs *Cicadella viridis* and *Conomelus anceps*.

4.3.3 Grassland invertebrates

Many of the insects found in the marsh also occur on the surrounding grasslands including the caterpillars of the Meadow Brown Butterfly (*Maniola jurtina*) and various plant bugs (e.g. *Stenodema holsatum, Elymana sulphurella*). The tussocky nature of some grasses provides a home for allsorts of invertebrates including woodlice (e.g. *Philoscia muscorum*)

but on this site several species of bumblebees (e.g. the Common Carder Bee (Bombus pasquorum) and the White-tailed Bumblebee (*Bombus lucorum*) along with its parasitic Gipsy Cuckoo Bee (*Psithyrus bohemicus*)) nest within the tussocks. The drier ground also provides habitat for the predatory larvae of the largest British horsefly *Tabanus sudeticus*

4.3.4 Woodland invertebrates

Although the woodland is only just developing the build up of leaf litter from the scrub grasslands have provided a woodland type soil for a wide range of snails (e.g. *Oxychilus alliarius*, *Nesovitrea hammonis*, *Discus rotundatus*, *Cochlicopa lubrica*), slugs (e.g. *Arion subfuscus*) and millipedes (e.g.*Tachypodoiulus niger*, *Polydesmus angustus*). The high humidity and shelter provided by the woodland is ideal for the Speckled Wood butterfly (*Pararge aegeria*) and the Vapourer Moth (*Orgyia antiqua*) whose female is wingless and never leaves the outside of the cocoon she has hatched from. The larvae of the woodland hoverfly *Xylota segnis* feed in wet deadwood.

4.3.5 Local and rare invertebrates

Only a couple of rare species have been found so far includes the Nationally Notable B (originally listed in the UK BAP's Long list of Globally Threatened/Declining Species (1995)) ground beetle *Aepus marinus* which was very common beneath pebbles near the high tide mark. This species has been recorded previously from the Moray Firth area and may well be more widespread as it lives in an overlooked habitat and is very small. The small yellow and brown jumping plant bug *Craspedolepta sonchi* is very local and possibly rare in Scotland. It is likely that there are other species of invertebrates yet to be discovered, particularly from the saltmarsh and the marsh, which are rare.

4.4 Birds

151 species of bird have been recorded from the site over the last 25 years[4]. However, detailed records are not available and the analysis of the use of the site by birds can only be based on the summary information which is available.

A summary list of birds recorded on or from the Reserve is given in Annex 4.

4.4.1 Breeding birds

23 species of bird breed every year on the site of which the most abundant are the House Sparrow, Chaffinch, Dunnock, Meadow Pipit, Starling and Willow Warbler. As expected for a woodland and scrubland site the most widespread resident 'garden' birds are present (e.g. Blackbird, Bluetit, Greenfinch) as well as summer migrants such as the Whitethroat, Grasshopper Warbler and Sedge Warbler. The latter two species are characteristic of the marsh component of the site. Birds breeding on the open water on the site include the Little Grebe, Mallard and Moorhen.

A further 23 birds occasionally breed such as the Bullfinch, Coal Tit and the Pied Wagtail with the Mute Swan, Tufted Duck and Teal nesting in the Kingfisher Lagoon part of the site.

4.4.2 Birds visiting in summer and winter

As the LNR is on the edge of the Beauly Firth, which is one of Scotland's most important estuary sites for birds including breeding seabirds and waders and wintering seabirds, waders and wildfowl, a further 67 species of which are regularly seen from the reserve. These include summer visitors such as the terns (Arctic and Common Terns), Common Sandpiper, Ringed Plover and Oystercatcher. Just before high-tide the two tidal 'islands' seen from the car park hold good numbers of waders in autumn and winter and Wigeon,

[4] mostly by Al McNee, Inverness and Nairn County Recorder, who has visited the site regularly

Teal, Red-breasted Mergansers and Goosanders can be seen from the embankment along with the odd diver and Slavonian Grebe.

The landward part of the site also has visits from Pheasant, Lesser Redpoll, Kestrel and Jackdaw from time to time. However the most numerous group are those species which are passage migrants or winter visitors such as the Bar-tailed Godwit, Curlew, Dunlin and the Kingfisher. The latter is a regular winter visitor to the lagoons.

Half of the recorded visiting birds are only occasional and include species which are rare or very local such as the Common Scoter, Grey Plover and Spotted Redshank. On the landward part of the site the equivalent species include the Blackcap, Great-spotted Woodpecker and Redstart.

4.4.3 Rare birds

There are no rare birds dependant on the site although several rarely seen species (e.g. Crested Tit, Green-winged Teal) have been recorded from the reserve. The Grasshopper Warbler is probably the most important species on the site as it is dependant on a scarce habitat, the marsh, for its breeding.

4.4.4 Changes in the bird populations

Although there are no detailed bird records available, some species which have changed recently[5] probably due to the changes in management of the site. The main factor has been the replacement of the extensive area of whin scrub with trees and as a result the Stonechat no longer breeds on the site. There have also been declines in the numbers of Reed Buntings, Whitethroat, Sedge Warblers and Grasshopper Warblers breeding although the populations of the three migratory warblers are known to fluctuate dramatically due to climatic changes in their overwintering countries.

The planting of the trees appears to have favoured woodland birds such as the Siskin, Lesser Redpoll and Long-tailed Tit.

4.5 Mammals

Nine species of mammal have been recorded from the Reserve and these are listed in Annex 4. Of these three are dependant on the sea including the Bottlenose Dolphin (which may have been seen from the Reserve but may not have actually come into either of the bays – the only detailed record available indicates the sighting at the very edge of the LNR). The Common Seal is frequently seen in the West Foreshore bay at high tide.

The Otter also frequents the Reserve although, again, detailed records are not available. Casual reports suggest that most sightings are around the old ferry area and are of individuals moving up and down the estuary. However, other reports[6] indicate that the otters do use the lagoons as well. A recent survey[7] did not find any signs of otters; neither did this survey suggesting that their use of the reserve is probably casual and occasional.

Of the mammals breeding on the reserve the ubiquitous ones such as Common Shrew, Field Vole and Stoat have been recorded. The only known record for a Fox was of a scent mark found during this survey although foxes must use a place like this regularly. Rabbits do breed on the reserve but were only seen along the railway embankment by Witches Coffin Lagoon where they have burrowed into the bank and feed on the strandline vegetation.

[5] Comments from Al McNee September 2008.
[6] Katy Martin, Highland Council Ranger (2008)
[7] 2008 by Grace Yoxon, International Otter Survival Fund

Roe Deer were first reported in 2005 and currently there are several individuals present including at least one buck and two does. Signs of their slots and tracks are everywhere in the new woodland and they have been seen lying up in scrub on the marsh.

4.6 Fish

Only two species of fish have been recorded from the LNR and these are listed in Annex 4. Although no survey has been attempted of Kingfisher Lagoon this water body could well support several more species. Similarly the two main marine bays will include a number of both resident species and the young of a number of other fish which breeding in the main estuary. Currently Three-spined Sticklebacks (*Gasterosteus aculeatus*) can be seen shoaling in the outflow area from Kingfisher Lagoon and the Sand Goby (*Pomatoschistus minutus*) is common in the shallow pools left at low tide in West Foreshore bay.

5. Developing a Vision for the wildlife of the LNR

5.1 Land use, key events and changes in the LNR

The LNR has a complicated history of development with a range of major changes to the site dating back to 1862 when the main components of the reserve, as we know it today, were created. The areas of the North Amenity Area and the South Amenity Area were enclosed fields and presumably have been grazed by stock for generations. The land to the west of the fields remained rough open grazing and the marsh appears to have developed from a few decades after the embankment was built. This suggests that the marsh is over one hundred years old and the hydrological regime seen today has probably existed during that time. It is not known when agricultural grazing stopped but casual grazing by horses was withdrawn less than 20 years ago.

Table 3 Merkinch Timeline

Year	Event	Significance
1755	Eastern outlet of R. Ness cut-off	West Foreshore bay no longer directly influenced by river water
1822	Caledonian Canal completed	
1835	Seawall completed	Exit pipe from Kingfisher Lagoon built
1862	Railway embankment completed	Exit pipe from Westfield Lagoon built
1900	Map shows lagoon behind seawall and marshland extent as today	Drainage from Westfield Lagoon failing
1930	Map shows extent of Westfield Lagoon and Kingfishers Lagoon similar to today	Development of the vegetation seen today dates from before this date.
1934	First plant record from the site	False Fox-sedge no longer on the site
c.1970	First bird records from the site	
1985	First comprehensive description of the site by A D Fox.	The importance of the area was first recognised.
c.1990	Casual grazing by horses stopped	Grazing pressure on the site ceased
1992	Trees and shrubs planted by the Beechgrove Garden project	Woodland develops from this date
1995	Trees planted (3.5 hectares)by South Kessock Community Project	Majority of whin scrub planted up
1996	Survey and management plan by William Vickers	
2008	Merkinch LNR Management Plan written	

Looking ahead to identify how the LNR might develop in the next decades requires some extrapolation of the possible changes in the various habitats based on what has happened in the past. The West Foreshore Bay and the East Foreshore Bay are truly marine and although there is evidence of major changes in historical times any changes that might happen in the years to come will probably be minor and out with any management control by the LNR.

The newly planted trees will continue to grow in height and girth and the increasing shade beneath them will shade out the old scrub-grassland or marsh vegetation and provide sheltered, humid conditions suitable for the development of woodland plants.

The marsh has occupied the same area for one hundred years and throughout that period has become more diverse as new plants colonise it. The relatively small build up of peaty soil does suggest that the process of succession is still slow with the saltwater inputs suppressing other species of plants. However, the apparent recent spread of Michaelmas Daisy, although poorly documented, does indicate that this plant is able to grow on the marsh and can dominate most of the species found there. There is every reason to think that that process will continue at the detriment of the diversity of the marsh.

The saltmarsh within the Witches Coffin Lagoon has also been present for about one hundred years and the regime of being flushed by the tide everyday suggests that no changes are imminent.

The Kingfisher Lagoon has also been present for many decades and although casual observations do suggest that there is gradual colonisation by saltmarsh plants from the eastern edge there is no evidence to suggest that the process is particularly rapid.

The waste ground areas, disturbed ground a few decades ago are already reverting to scrub as berries are being brought into the site by birds. Clearly this process if happening quite fast and will continue to develop with the encroaching scrub suppressing the tall weeds and their leaf fall allowing more woodland plants to develop.

The amenity areas are under a very severe cutting regime and will not change significantly unless the regime does. The small remaining patches of grassland, associated with the previous rough grassland and whin scrub, are becoming tussocky and are being invaded by whin and tree saplings and will, left unmanaged, become part of the woodland.

The animals associated with the various habitats will respond to any changes in those habitats. It has already been noted that some of the open whin scrub grassland birds have been lost and various woodland birds have increased.

5.2 A vision of the biodiversity of Merkinch LNR

Without doubt the LNR is very well placed by being near the centre of Inverness but with one side open to the Beauly Firth and the sea. Although the site does not contribute in a big way to the marine life of the area is has a range of common seashore species and a large number of visiting marine species of mammals and birds. The marsh is rich in wildflowers with some very unusual types of vegetation within it from saltmarsh to freshwater marsh to acid heath. This diversity is clearly well worth conserving. The woodland is new and developing but all woodland is important in the Scottish context and within Merkinch LNR it will add variety, shelter and a potential new habitat.

5.2.1 By 2011 three years on

Although a lot of work has been expended on the site in recent years the LNR is only just getting going. From the biodiversity point of view several descriptions of the importance of the site have been done and the next task is to clarify those aspects which are still not clear and to work out ways of implementing practical conservation management and wildlife observation, recording and monitoring.

By 2011 the small-scale management of the LNR's natural habitats is organised and several experimental methods have been developed and have started. The biological recording procedures have been developed with a number of regular recorders contributing data. Several good sequences of records are available including a study on roe deer and throughout the year recording of the birds using the site. Key aspects of the

reserve have been investigated through commissioned surveys while others are ongoing. The detailed knowledge of the site allows good decisions to be made on the next three years conservation work.

5.2.2 By 2019 ten years on

Careful monitoring over the first five years have given the LNR's managers confidence in planning the next management programme. The first review of trends on the reserve has shown where action is, and is not, needed and practical management work has been planned and extended accordingly. Analysis of the records has identified poorly covered groups for further study. The development of the woodland ground flora has been a major project involving a lot of preparation, practical work and careful monitoring of successes.

By 2019 the marsh area is free from invading aster and scrub and the increasing size of the orchid populations in the marsh and surrounding grasslands are demonstrating that these habitats are being managed effectively. The maturing woodland has been enhanced in places with a range of woodland species and these are beginning to extend and spread naturally. Several locally rare invertebrate species have been identified and a programme set up to monitor their populations.

5.2.3 By 2034 twenty five years on

By 2034 the actual management of the site is very well organised and the team involved are very familiar with the special features of the site and how well they are thriving. The total species list is over 850.

This confidence has resulted in the controlling of the flow of seawater into Kingfisher Lagoon which is now a magnificent freshwater pool rich in dragonflies and breeding wildfowl. The construction of a 'kingfisher bank' on the far side has encouraged a pair of Kingfishers to breed for the first time.

The mature woodland has several paths through it to see the bluebells and other spring flowers and the first breeding pied flycatchers have been seen using a bird box in the wood.

6. Management objectives

The management of a LNR requires some considerable thought about what deserves and what would benefit from a practical management input. To make a significant difference to the development of wildlife on a piece of land requires any actions to be well thought out, skilled and, usually, long-term, with substantial physical and financial commitment. Therefore, the decisions on what should be done are based on existing priorities, known threats and recognised techniques to ensure that the outcomes required are achievable. In this case there are UK Priorities already set by the UK Biodiversity Action Plan (UKBAP), the Inverness and Nairn Local Biodiversity Action Plan (LBAP) and the analysis undertaken in this Plan.

The priorities have been identified below and management objectives constructed based on the analysis of these priorities.

6.1 Management principles

The essential aspect of this site is that it is a Local Nature Reserve and as such 'is a place with special local natural interest, set up to protect nature, and for people to enjoy and appreciate'. This Biodiversity Plan describes the special local natural interest and what is needed to protect it. The elements for people to enjoy and appreciate are covered in the Management Plan but it has been interpreted here as ideally involving local people in the active management of the site (as per the MP Ob1g etc). It is reasonable to assume that doing the biodiversity management through local people may not be the quickest or the most easily implemented way but will be the most sustainable in the long run and probably the cheapest.

Organising the work is a problem as the more people and groups involved and the greater the need for training the more leadership and organisational skills are required. However, the Management Plan does not make it clear how the necessary drive and logistics are to be inputted into the LNR. It may be relevant to identify the entire high-level organisation, negotiation and training that is needed and put this in the hands of a professional warden or equivalent. It is not appropriate to explore this idea further here.

6.2 Setting priorities

6.2.1 UKBAP Priority Habitats

The UKBAP includes four habitats which are represented on the LNR. These are **Mudflats** – exposed mud in estuaries; **Coastal Saltmarsh** – vegetation which develops in the higher parts of mudflats; **Saline Lagoons** – bodies of water only partially connected to the sea which have variable salinities; **Fens** – peatlands which have a groundwater mineral input. Obviously the Habitat Action Plans associated with these habitats are primarily concerned with the wider UK conservation but clearly the managers of any part of these habitats has a responsibility to look after them as a contribution to the UK resource.

Obvious actions in these cases are investigating and documenting their biodiversity, countering any threat to them, monitoring their condition and reporting back on progress.

6.2.2 UKBAP Priority Species

There are also five UKBAP species found on the LNR. These are **Linnet** – three pairs breed regularly; **Reed Bunting** – up to three pairs breed regularly; **Bullfinch** – one pair breed occasionally; **Song Thrush** – 1 pair breed regularly. There is also the **Otter** – which although apparently not breeding on the reserve does frequently use it.

As with the priority habitats the reserve does not hold any outstanding numbers of these species and the likely actions must be centred on improving their habitat if practical, monitoring their numbers and reporting back on trends.

6.2.3 LBAP Priority Habitats

These include the UKBAP Priority Habitats shown above plus **Coastal Waters** and **Wetlands and Ponds**. Actions for these habitats are unclear and for Coastal Waters there is little management which is relevant although small contributions, such as a shoreline litter clean up, can be important. In the case of Wetlands and Ponds documenting the biodiversity of the sites, managing threats, monitoring progress and reporting back are all relevant.

6.2.4 LBAP Priority Species

The list of species in the LBAP include some species which are perceived as important in the public's view as well as ones which are under threat. The ones found on the reserve include: **Toad** – only one record, no breeding record; **Yellowhammer** – three pairs occasionally breed; **House Sparrow** – ten pairs regularly breed; **Speckled Wood** – common throughout the woodland, numbers unknown; **Common Seal** – occasionally visits the reserve's waters but clearly part of a wider population; **Common Cockle** – fairly common in the muddy sand in both bays; **Edible Mussel** – in small numbers associated with the larger boulders; **Bluebell** – a small population in the southern part of the woodland; **Ragged Robin** – a fairly abundant and widespread species throughout the marsh.

6.2.5 Merkinch LNR Priorities

The wider priorities address the obvious priorities of the LNR in conserving the saltmarsh and marshland habitats along with the species found within them. Also identified are the conservation and enhancement of the remaining grassland and the enhancement of the woodland habitat.

A summary of the Objectives and their Key Projects, with their associated costings is shown in Annex 1 and the days of work involved in Annex 2.

6.3 Objective one: establish the importance of the mudflats within the LNR.

6.3.1 Background

The largest area of the LNR is the area of foreshore within the West Foreshore Bay and the, much smaller, East Foreshore Bay. However, relatively little is known about the site including the significance of the Witches Coffin Lagoon which is really a small, sheltered and partly cut-off piece of foreshore.

6.3.2 Management and monitoring proposals

It is impractical to do any direct management of the marine habitats found there but the contribution that they make to the wildlife of the area should be established. Part of that exercise is to discover the full range of species living in or feeding on the marine habitat including invertebrates and vertebrates. As the LNR is a, small, sample of the estuarine habitat it can form a very useful monitoring point to establish long-term changes in the use of the area by setting up agreed procedures for recording observations. Bird (and mammal) watching are very popular and a simple method of recording sightings could be very instructive as the data builds up.

6.3.3 Key projects

a) Sampling and recording the marine habitats

Occasional trips out onto the mudflats should be arranged to sample, through digging and washing sediments and by hand netting, the marine life of the bays. It is suggested that sample locations are recorded using GPS and specimens are preserved. Help with their identification should be sought from the appropriate marine scientists. It is not envisaged that there will be much seasonal change but the full extent of the bays should be covered if possible. The sampling can be organised over five years.

b) Counting and recording the use of the two bays by birds

A simple system to be set up to record the species and numbers of birds, their general behaviour (e.g. feeding, roosting, flying past etc.) and their approximate location within the two bays and Witches Coffin Lagoon. The recording should include as many, competent, people as possible and should be ongoing throughout the year. Records of otters and dolphins within the LNR should be kept using the same system. The data should be analysed once a year to show the range of species, their maximum and minimum numbers, their use of the LNR through the year etc.

6.4 Objective two: conserve the saltmarsh communities and saline lagoons

6.4.1 Background

The saltmarsh fragments found along the edge of the two sea bays, especially along the East Foreshore, around the Westfield Lagoon, Witches Coffin Lagoon and Kingfisher Lagoon add considerably to the diversity of the LNR. Most of these have been untouched for about 150 years and have developed into a complex series of different vegetation types. However, although some work has been done to identify the plants and vegetation types within the saltmarsh the specialist fauna often associated with saltmarsh has hardly been looked at. The ground beetle *Dicheirotrichus gustavi* is a species of saltmarsh and is also unusual in having the sexes of different colours.

6.4.2 Management and monitoring proposals

The inflow of seawater into Witches Coffin Lagoon is more or less unimpeded through a large arch in the railway embankment. However, the flow from the Lagoon into Kingfisher Lagoon is through a culvert which appears to originally had a control valve on it to prevent seawater flowing in while allowing freshwater to flow out. Obviously the mix of freshwater and saltwater vegetation in Kingfisher Lagoon is unusual and a feature of the LNR but with open, still freshwater relatively rare in the immediate area consideration could be given to installing a valve to prevent seawater flowing in and Kingfisher Lagoon reverting to a freshwater pool. However, the biodiversity role of this lagoon has not yet been fully established and it is proposed that the possibility of changing the water regime is considered in five years time.

Kingfisher Lagoon in particular has not been evaluated for its bird population although it is, as the name suggests, the place where kingfishers regularly overwinter. The saltmarsh vegetation appear to be the places where mallard, little grebe and moorhen breed and the open water does have other species using it in winter. However, it is not yet clear if there are significant fish populations present which might allow fish-eating birds (such as herons and mergansers) to use it. Once a full picture has been developed to show which species use this site to feed, to breed or just to shelter then a more informed discussion can be had as to whether the lagoon should be converted to freshwater.

Previous suggestions have been made that in some places Sea Club-rush maybe significantly encroaching on the saltmarsh but there is no evidence to support, or refute, this. Obviously the proportions of each community will change with time but the management object in this case is to retain the spread of saltmarsh vegetation types and not interfere with their development.

6.4.3 Key projects

c) Investigating the invertebrate fauna of the saltmarsh

Invertebrate, particularly insects, to be sampled through sweeping saltmarsh vegetation, searching in the vegetation sward, setting pitfall traps in the high-tide sections and sieving soil samples. Possible species of note would include bugs, ground beetles, rove beetles and spiders. This work is technically skilled and would need to be done by an entomologist (or equivalent) familiar with this habitat. It is not envisaged, because of the history of the saltmarsh and its extent that the fauna will be exceptional but a better understanding of this habitat's diversity would add significantly to the knowledge of the LNR. Two recording visits, at different times of year would be suffice to characterise the saltmarsh and should include samples from each saltmarsh area.

***d)* Investigating the fish population of Kingfisher Lagoon**

Using a fine-mesh trawl net (electro-fishing will not work in saline water) sample the range of fish species present and their approximate size range and abundance. One visit, at any time of year, would be sufficient. However, the technique would have to be done from a boat and will require experienced samplers. A simple sounding of the lagoon, using a weighted line or pole, at the same time as the fish sampling would provide a profile of the water body.

6.5 Objective three: retain the extent and biodiversity of the marsh.

6.5.1 Background

It has been established that this is a created habitat dating back almost 150 years which has developed considerable diversity of the wetland plants. The unique water regime of the input of seawater to the southern end of the site twice a day has allowed a complex mosaic of saltmarsh, heath and freshwater marsh communities to develop. It would be possible to repair the flap on the outflow pipe which would prevent the flow of saltwater into the marsh. However, the present regime has been in place for a long time and the unique mix of salt and freshwater vegetation is a special feature of the LNR. Therefore no change to the outflow pipe is proposed.

The effects of grazing in the past are not known but may have controlled growth on the marsh to an extent. However the site is small, no longer grazed and is clearly now under threat from invading Michaelmas Daisy and possibly encroaching Alder. A small 'heath' component of the site might also be in decline due to lack of grazing and being overgrown by grassland species.

6.5.2 Management and monitoring proposals

It is not practical to consider reintroducing grazing as most of the reserve has been planted up with trees and is now a very public space. Any cutting of the marsh is also impractical as most machines would not function on such a soft surface (it maybe possible in very dry summers in some parts) and cutting by hand is very labour intensive and ongoing. However, at least on an experimental basis it would be worth testing out control measures to estimate how much effort might be required for the whole marsh into the future. It has not been possible to find useful examples of control of Michaelmas Daisy on other similar

sites and any work being proposed would be pioneering. It is essential that the trial plots are carefully chosen, surveyed before action is taken, the amount of time and effort (man-hours) spent on the control recorded and the site resurveyed each year for the next five years.

6.5.3 Key projects

e) Controlling (experimentally) of Michaelmas Daisy by hand-pulling

An area10x10 metre of the middle section of the marsh to be marked out in late summer in Year 1, all plants of Michaelmas Daisy to be counted, plotted and recorded. All plants within the plot to be pulled out with the roots if possible and removed from the site and weighed, keeping trampling of the marsh to the minimum. The plot to be re-recorded in Year 2 with a repeat pulling in Year 3 if required or if not, simply re-recorded. The process to be repeated in Years 4 and 5. A photographic record should be made of the process and a decision made of the effectiveness and the applicability of the techniques to the rest of the marsh in Year 5.

f) Managing (experimentally) heath by Flymo cutting

An area of 4x4 metres of the eastern edge of the marsh including some plants of Calluna or Erica near the southern end to be marked out in late summer of Year 1 and the main plants present recorded. The whole plot to be cut with a petrol Flymo to a 10 centimetre sward and the cuttings raked off and removed. The plot to be re-surveyed and re-recorded at two-year intervals to estimate the effects on the ericaceous plants. Repeat cutting to be carried out if appropriate. A decision made on the effectiveness and appropriateness of this management technique to be made in Year 5.

g) Monitoring the populations of key freshwater species

Set up survey and recording procedures for key freshwater species: Toad – identify and map in Year 1 any breeding sites through the presence of eggs in early spring or tadpoles in spring and summer recording any other amphibians present. Reed Bunting – count breeding pairs and map territories in Year 2 (see breeding bird survey below) from observations from the edge of the marsh – repeat in Years 3, 4, 5. Otter – map and record all sightings and behavioural observations (e.g. feeding, breeding, sprainting etc.) throughout the year in all years. Ragged Robin – count and map approximate extent of population in *Year 2 – repeat Year 5.*

6.6 Objective four: develop the biodiversity of the woodland

6.6.1 Background

The decision to plant trees on this site was not done in the context of a LNR but, more or less, the species chosen were a) native and b) suitable for the soils of the reserve. Growth has been vigorous and almost all the trees have survived. There has been some vandalism with the cutting down of trees or damaging them by cutting off branches, setting fires or building dens. However, the project has been effective and a potential small wood is developing. The previous vegetation is being suppressed rapidly and the building up of leaf litter has made a difference to the type of soils in the area and the flora and fauna that live there. Obviously the process of making a wood is a very long process. The original whin scrub has been reduced considerably and many of the bushes left are either being suppressed by woodland cover or have been burned. There is no obvious 'area' to retain as this scrub but all remaining bushes should be considered as a bonus to the site.

6.6.2 Management and monitoring proposals

When the trees were planted there was no matching planting of woodland flora or introduction of woodland mycorrhizal fungi. These species, so essential to woodland ecosystems, will colonise with time but some steps can be taken to accelerate the process. This approach to woodland creation is still experimental but a small peri-urban site like this which is managed as a nature reserve is a suitable place to trial such measures. The origins of the trees that were planted are not known but the general rule for further introductions must be that material should be sources from the nearest similar and suitable site.

Because the effectiveness of introducing woodland ground flora is poorly understood in Scotland any effort in this area should be modest and well thought out.

6.6.3 Key projects

h) Planting up woodland flora

Bluebells already occur in the south part of the wood and will naturally seed themselves. Further seeds should be collected in Year 1 from nearby woods and scattered in autumn to reinforce the existing plants. Seeds from native primrose, wood anemone, wood sorrel and bugle should be grown on in Year 2 in volunteers' gardens and young plants planted out in Year 3 or 4 on a small scale to see how well they do. If available an innoculum of woodland leaf litter and soil from a nearby wood should be used when planting. The success of these experimental enhancements should be measured in Year 5 by counting the number of remaining and extra plants in the wood.

i) Managing existing trees

The existing woodland needs little direct attention but some development of simple measures to look after the trees will be developed. Cutting down or damaging of trees needs to be stopped, as retaining a closed canopy is essential at this stage in the woods development. Dumped rubbish should be removed if it might be toxic in any way but scrap timber already there should be left to rot. Old trees (mainly willows) which were on the site originally must be identified and carefully protected as they may well support woodland invertebrates and fungi already. All deadwood will be retained and no thinning is required as the trees will compete naturally with each other. Scrub is important to retain cover (e.g. for certain breeding birds and for roe deer to lie up) and all whins should be kept. Thought should be given to planting shrub species in the second five years of management.

6.7 Objective five: retain flower rich grassland

6.7.1 Background

The Lesser Butterfly Orchid is listed for the reserve from the southern part of the marsh but the exact location/s of the population is not known. It was not found in the 2008 survey. The orchid is characteristic species of the richer more open grasslands (e.g. NVC type MG5) and might now occur anywhere around the fringes of the planted woodland where there is still open grassland. The vigorous growth of ungrazed grassland and the shading from encroaching tree cover and shrub regeneration will suppress this species. Although it a relatively common plant in northern Scotland it is a symbol of good grassland and can be used as an indicator in this case.

6.7.2 Management and monitoring proposals

The orchid flowers from late May to August and is a very distinct and easy to identify species. The key first step is to identify all areas which have the orchid and make an estimation of the population size. The identified areas of MG5 grassland may not have the orchid but should treated as having the potential to support it. If the plant is found, the state of the grassland/marsh/woodland around it needs to be examined to see if conditions appear to be suppressing the orchid. Management of the grassland would be needed if the present growth was too rank. As grazing in the current situation is not practical then mowing is the only available technique. Future counting of this orchid species will confirm the health of the grassland habitat.

6.7.3 Key projects

j) Developing a cutting regime for existing MG5 grassland

Identified areas of MG5 grassland should be mowed once a year in late summer starting in Year 1 and the cut material removed. This management should be extended to other areas which have butterfly orchids in Year 2 along with scrub and tree removal/pruning if these are significantly shading the orchids. A buffer zone of four metres should be cleared between any recorded orchids and the nearest woodland. The mowing should be repeated each year. If the grassland selected is adjacent to the existing mown amenity grassland the new cutting regime (height of cut, time of year, removal of cuttings) might be incorporated with advantage into the Council's grassland management regime.

k) Counting orchids

In Year 1 all of the grassland areas should be searched for the flowers of the lesser butterfly orchid (usefully extended to counts and mapping of all orchid species) and the position of each population noted, using GPS, along with a count of flower spikes. This search should be repeated in May, June and July. The count should be repeated in Year 2 before the management of new areas and every year after that. An assessment of the effectiveness of the grassland management to be made in Year 5.

6.8 Objective six: improve the recording of species

6.8.1 Background

Although the essential purpose of the LNR is to conserve biodiversity for the enjoyment of people it only possible to establish that the site is achieving these purposes if the wildlife is observed and recorded. The effects of management on the target habitat or species has to be monitored if the effectiveness (or otherwise!) of the action taken is to be proved. Even the biodiversity of the site needs to be explored in detail if the full interest of wildlife on the site is going to be appreciated. Trends in species (e.g. due to the change in the balance of habitats or changes in global climates) can be picked up through careful record keeping showing new species coming in, increasing or declining with time. Good recording also keeps the data on the reserve safe from changes in personnel as very knowledgeable people leaving the area can so often take their knowledge of the site with them.

6.8.2 Management and monitoring proposals

Each management proposal outlined above has its own monitoring built in and it is essential to retain all of this data in a form that can easily and quickly looked up. Species records are most easily kept on a standard recording computer package (a spreadsheet, Recorder or MapMate) with the standard data attached to each record (e.g. species,

numbers, sexes, date, site (compartment), grid reference (at least 6-figure, preferably ten), date, name of recorder, name of determiner and notes.

Changes in habitats, spread of species are best recorded on maps allowing a quick and effective visual appreciation of the information to be made. Ideally this would be on a computer based Geographical Information System (GIS) which would allow maps to be directly compared with each other. However, the technology available at the moment is too complex (and expensive) to be ready available. Instead a very good base map of the LNR would allow areas to be drawn on or species records to be printed on.

Photographic recording is also invaluable and with digital photography many more people can make very effective records of many species groups (e.g. plants, butterflies, bumblebees, even birds (through telescopes)).

Repeat records are vital and it is impossible to have too much data and only in retrospect can it be seen how valuable this information might be. Long term trends in populations, distribution of species within the site, different activities at different times of year, early springs etc can all be revealed by good analysis of the data. Even a lack of a record of a species can trigger off a search for why it has not been seen,

6.8.3 Key projects

l) Setting up recording procedures

The LNR management group should identify someone who will lead on recording and work with the Highland Biological Recording Group and others to establish the procedures and computer programmes needed to record all relevant data. Once these are in place, field recording sheets for recorders should be designed which are compatible with the recording system and all recorders encourage (and trained if necessary) to use it. A good A4 base map of the site for recording should be produced showing all obvious features (vegetation types, footpaths etc), compartments and overlain with a 100 metre grid.

m) Encouraging studies of new species groups

From Year 1 anyone who shows interest in recording on the LNR should be encouraged. This will include organisations such as the Inverness Bat Group (there are no bat records for the site) and the Highland Biological Recording Group but also individuals. The latter might take on recording for example bumblebees, spiders, mosses, small mammals, butterflies or moths.

n) Studying of the roe deer population

The LNR is unusual for a peri-urban site in having a small population of roe deer. It is suggested that these have moved in since the woodland cover was planted and probably breed on the site. As a large and easily seen species (at dusk and dawn) this species deserves a careful long-term study of the individual animals concerned, their changing behaviour throughout the year, the breeding (if any) and its success and the use of the reserve and surrounding areas for feeding and courting. Two people should take this on and, using the reserve-recording map, keep records of when the deer were seen and where. Records from others would be very valuable. An analysis over a year or two could add very intriguing and useful data about the LNR.

o) Surveying breeding birds

A standard method of recording breeding birds (e.g. the British Trust for

Ornithology's Common Bird Census) based on singing male birds, should be used to establish the numbers and territories of birds breeding on the reserve in the marsh, around Kingfisher Lagoon and in the woodland preferably from Year 1 but more practically from Year 2. Advice and training should be available from the appropriate members of Highland Branch of the Scottish Ornithologist Club. Annual assessment of the pairs of breeding birds will give a good summary of the general quality of the different habitats.

Annex 1 Estimated costings of implementing the Biodiversity Key Projects

Key Project	Year 1				Year 2				Year 3				Total cost	Comments
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter		
a) Sampling and recording the marine habitats	300											300	600	GPS, specimen tubes, 70% alcohol, nets, sieves, spade
b) Counting and recording the use of the two bays by birds	20											20	40	notebooks (rest own equipment)
c) Investigating the invertebrate fauna of the saltmarsh					2,500							2,500	5,000	consultant at £250/day
d) Investigating the fish population of Kingfisher Lagoon														volunteer expert with own equipment
e) Controlling (experimentally) Michaelmas Daisy by hand-pulling		30										30	60	spring balance, bags etc scrap, manual transport of cuttings
f) Managing (experimentally) heath by Flymo cutting	350											350	700	Flymo plus fuel, bags etc scrap, manual transport of cuttings
g) Monitoring the populations of key freshwater species														
Toad														(Use GPS as above)
Reed Bunting														(Use GPS as above)
Otter														(Use GPS as above)
Ragged Robin														(Use GPS as above)
h) Planting up woodland flora														
i) Managing existing trees														
j) Developing a cutting regime for existing MG5 grassland		50										50		(Flymo as above), loppers, secateurs

Key Project	Year 1 Spring	Year 1 Summer	Year 1 Autumn	Year 1 Winter	Year 2 Spring	Year 2 Summer	Year 2 Autumn	Year 2 Winter	Year 3 Spring	Year 3 Summer	Year 3 Autumn	Year 3 Winter	Total cost	Comments
k) Counting orchids														(Use GPS as above)
l) Setting up recording procedures	1500											1500		(Use GPS as above), computer, printer, Recorder software etc
m) Encouraging studies of new species groups														
n) Studying the roe deer population														
o) Surveying breeding birds														(Use GPS as above)
TOTALS	**£2,170**	**£80**			**£2,500**							**£4,750**	**£7,330**	

Annex 2 Estimated days involved in implementing the Biodiversity Key Projects

Key Project	Year 1				Year 2				Year 3				Total days	Comments
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter		
a) Sampling and recording the marine habitats		4											4	A one off survey
b) Counting and recording the use of the two bays by birds	13	13	13	13	13	13	13	13	13	13	13	13	156	Involving all available birdwatchers on a rota system, ongoing
c) Investigating the invertebrate fauna of the saltmarsh					2	2	6						10	Commissioned professional survey, one off.
d) Investigating the fish population of Kingfisher Lagoon		3											3	Expert survey, one off.
e) Controlling (experimentally) Michaelmas Daisy by hand-pulling			2				2				2		6	Ongoing, decision on widespread removal Year 5.
f) Managing (experimentally) heath by Flymo cutting		2								2			4	Ongoing.
g) Monitoring the populations of key freshwater species													0	
Toad	1												1	Ongoing if justified
Reed Bunting	2	2			2	2			2	2			12	Ongoing
Otter	1	1	1	1	1	1	1	1	1	1	1	1	12	Ongoing
Ragged Robin		1				1				1			2	Ongoing
h) Planting up woodland flora			1		1						3		5	Ongoing if necessary, work dependant on scale of planting scheme/s.
i) Managing existing trees				3				3				3	9	Routing inspection and maintenance of woodland, amount of work dependant on progress with respect for trees etc. Ongoing.
j) Developing a cutting regime for existing MG5 grassland			2				2				2		6	Decision on Council grass cutting involvement in Year 3. Ongoing.
k) Counting orchids		1				1				1			3	Ongoing.
l) Setting up recording procedures	5	5	3	3	3	3	3	3	3	3	3	3	40	Hours involved depend on who becomes recorder, how recording is organised etc. Ongoing.

Key Project	Year 1				Year 2				Year 3				Total days	Comments
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter		
m) Encouraging studies of new species groups														
n) Studying the roe deer population	2	2	2	2	2								10	Very approximate observation time needed - should involve more than one person. Ongoing if justified.
o) Surveying breeding birds	8				2				2				12	Should be split amongst several people, ongoing.
							Total person days						**295**	

Annex 3 Plants recorded from Merkinch LNR

List of all known plant species recorded from the site, including records dating back to 1934.

Algae	Ascophyllum nodosum
	Enteromorpha sp.
	Fucus serratus
	Fucus vesiculosus
	Pelvetia canaliculata
	Polysiphonia lanosa
Mosses	Acrocladinum cuspidatum
	Campylium stellatum
	Climacium dendroides
	Dicranium scoparium
	Hylocomium splendens
	Rhytidiadelphus squarrosus
	Sphagnum sp.
Higher plants	Acer pseudoplatanus
	Achillea millefolium
	Achillea ptarmica
	Aegopodium podagraria
	Alchemilla vulgaris agg.
	Alnus glutinosa
	Angelica sylvestris
	Anthriscus sylvestris
	Armeria maritima
	Artemesia vulgaris
	Aster maritima
	Aster sp.
	Aster tripolium
	Aster x salignus
	Atriplex glabriuscula
	Atriplex littoralis
	Atriplex patula
	Atriplex prostrata
	Bellis perennis
	Betula pendula
	Betula pubescens
	Betula sp.
	Calluna vulgaris
	Caltha palustris
	Calystegia sepium
	Campanula rotundifolia
	Cardamine pratensis
	Centaurea nigra
	Cerastium fontanum
	Chamaenerion angustifolium
	Chamomilla suaveolens
	Cirsium arvense
	Cirsium palustre
	Cirsium vulgare
	Cochlearia officinalis
	Corylus avellana
	Crataegus monogyna
	Crepis capillaris

Cystisus scoparius
Dactylorhiza maculata
Endymion non-scriptus
Epilobium angustifolium
Epilobium montanum agg.
Epilobium palustre
Erica tetralix
Euphrasia nemorosa
Euphrasia officinalis agg.
Filipendula ulmaria
Galium aparine
Galium palustre
Galium saxatile
Galium verum
Geum urbanum
Glaux maritima
Heracleum sphondylium
Hieracium aurantiacum
Hieracium pilosella
Honkenya peploides
Hyacinthoides nonscriptus
Hydrocotyle vulgaris
Hypericum pulchrum
Hypochaeris radicata
Lathyrus pratensis
Leontodon autumnalis
Linaria purpurea
Linum cartharticum
Lotus corniculatus
Lychnis flos-cuculi
Matricaria maritima
Menyanthes trifoliata
Mysotis scorpiodes
Mysotis sp
Mysotis sp.
Oenanthe crocata
Pedicularis palustris
Petasites albus
Plantago lanceolata
Plantago major
Plantago maritima
Polygonum oviculare
Populus sp.
Potamogeton polygonifolius
Potemogeton sp.
Potentilla erecta
Potentilla palustris
Prunella vulgaris
Prunus avium
Prunus padus
Prunus sp.
Prunus spinosa
Quercus petraea
Quercus robur
Quercus sp.
Ranunculus acris

Ranunculus ficaria
Ranunculus flammula
Ranunculus flammula subsp. scoticus
Ranunculus repens
Ranunculus sceleratus
Reynoutria japonica
Rhinanthus minor
Ribes sanguineum
Rosa arvense
Rosa arvensis
Rosa canina
Rosa canina agg.
Rosa sp.
Rubus fructicosus agg.
Rubus idaeus
Rumex acetosa
Rumex crispa
Rumex crispus
Rumex obtusifolius
Sagina nodosa
Salicornia europea
Salix aurita
Salix caprea
Salix fragilis
Salix purpurea
Salix sp.
Sambucus nigra
Scenecio aquaticus
Senecio aquaticus
Senecio jacobaea
Senecio jacobea
Silene alba
Silene maritima
Solanum dulcamara
Sonchus arvense
Sorbus aucuparia
Spergula arvensis
Spergula media
Stellaria alsine
Stellaria graminea
Stellaria holostea
Succisa pratensis
Symphoricarpos albus
Taraxicum vulgaris agg.
Torilis japonica
Trifolium arvense
Trifolium pratense
Trifolium repens
Tussilago farfara
Ulex europaeus
Ulmus glabra
Urtica dioica
Vaccinium myrtilis
Valeriana officinalis
Veronica beccabunga
Veronica montana

	Vicia cracca
	Vicia hirsuta
	Vicia sativa
	Viola canina
	Viola palustris
	Dactylorhiza purpurella
	Gymnadenia conopsea
	Narthecium ossifragum
	Platanthera bifolia
	Triglochin maritima
	Triglochin palustris
Grasses, sedges, rushes	Agrostis canina
	Agrostis capillaris
	Agrostis stolonifera
	Anthoxanthum odoratum
	Arrhenatherum elatius
	Carex curta
	Carex echinata
	Carex flacca
	Carex nigra
	Carex otrubae
	Carex panicea
	Carex pulicaris
	Carex rostrata
	Carex serotina
	Cynosurus cristata
	Dactylis glomerata
	Danthonia decumbens
	Deschampsia caespitosa
	Deschampsia flexuosa
	Dryopteris dilatata
	Dryopteris filix-mas
	Eleocharis palustris
	Eleocharis uniglumis
	Elymus farctus
	Elymus repens
	Equisetum fluviatile
	Equisetum palustre
	Eriophorum angustifolium
	Eriophorum vaginatum
	Festuca ovina agg.
	Festuca rubra
	Holcus lanatus
	Holcus mollis
	Juncus bufonius
	Juncus conglomeratus
	Juncus effusus
	Juncus gerardii
	Juncus squarrosus
	Lolium multiflorum
	Lolium perenne
	Luzula campestris
	Molinia caerula
	Nardus stricta
	Phagmites australis
	Phalaris arundinacea

Poa subcaerulea
Puccinellia maritima
Schoenoplectus tabernaemontani
Scirpus maritimus

Annex 4 Animals recorded from Merkinch LNR

List of all known animal species recorded from the site, including records dating back to 1983.

Bryozoans	Frustrellidra hispida	
Hydroids	Dynamena pumila	
Molluscs	Aequipecten opercularis	Queen scallop
	Arctica islandica	
	Arion ater	Large Black slug
	Arion fasciatus	slug
	Arion subfuscus	slug
	Cerastoderma edule	Common Cockle
	Cochlicopa lubrica	snail
	Discus rotundatus	snail
	Gibbula cineraria	Grey Top Shell
	Hydrobia ulvae	
	Littorina littorea	Common Periwinkle
	Littorina obstusata	periwinkle
	Littorina rudis	periwinkle
	Littorina saxatile	Rough Periwinkle
	Milax gagates	
	Mya arenaria	
	Mytilus edulis	Edible Mussel
	Nesovitrea hammonis	snail
	Nucella lapillus	Dog Whelk
	Ostrea edulis	Oyster
	Oxychilus alliarius	Garlic Snail
	Turritella communis	
Worms	Arenicola marina	Lugworm
	Hedista diversicolour	ragworm
	Heterochaeta costata	sludge worm
	Nereis virens	King Rag
	Pygospio elegans	
Centipedes	Strigamia maritima	
Millipedes	Ophyiulus pilosus	snake millipede
	Polydesmus angustus	flat-backed millipede
	Tachypodoiulus niger	snake millipede
Bristletails	Petrobius maritimus	Sea Bristletail
Dragonflies	Aeshna juncea	Common hawker
	Sympetrum danae	Black Darter
Earwigs	Forficula auricularia	European Earwig
Barkflies	Stenopsocus immaculatus	
Plantbugs	Anthocoris nemoralis	a predatory bug
	Anthocoris nemorum	a predatory bug
	Anthocoris sarothamni	a flower bug
	Callicorixa wollastoni	a waterboatman
	Chartoscirta cincta	a shore bug
	Cicadella viridis	Green leaf-hopper
	Conomelus anceps	a plant-hopper
	Craspedolepta sonchi	jumping plant-louse
	Cyrtorhinus caricis	a plant bug
	Elymana sulphurella	a leaf-hopper
	Gerris thoracicus	water skater
	Hesperocorixa sahlbergi	water boatman
	Heterocordylus tibialis	a ground bug

	Idiocerus confusus	a leaf-hopper
	Kelisia vittipennis	a plant-hopper
	Leptopterna dolabrata	a plant bug
	Livia juncorum	a plant-louse
	Loricula pselaphiformis	a lichen bug
	Lygus rugulipennis	a plant bug
	Megamelus notula	a plant-hopper
	Nabicula limbata	a damsel bug
	Neophilaenus lineatus	
	Orthotylus virescens	a plant bug
	Pachytomella parallela	a plant bug
	Philaenus spumarius	a spittle bug
	Stenodema holsatum	grass bug
	Stynocoris pedestris	
Beetles	Aepus marinus	ground beetle
	Agabus bipustulatus	waterbeetle
	Agonum albipes	ground beetle
	Anacaena globulus	ground beetle
	Calathus piceus	ground beetle
	Dicheirotrichus gustavi	ground beetle
	Galerus tanaceti	leaf beetle
	Megasternum obscurum	
	Micralymma marinum	rove beetle
	Nebria brevicollis	ground beetle
	Notiophilus biguttatus	ground beetle
	Pterostichus strenuus	ground beetle
	Tachinus marginellus	rove beetle
	Tachinus signatus	rove beetle
	Trechus obtusus	ground beetle
Butterflies	Aglais urticae	Small Tortoiseshell
	Erebia aethiops	Scotch Argus
	Inachis io	Peacock
	Lycaena phlaeas	Small Copper
	Maniola jurtina	Meadow Brown
	Maniola jurtina	Meadow Brown
	Pararge aegeria	Speckled Wood
	Pieris brassicae	Large White
	Pieris napi	Green-veined White
	Pieris rapae	Small White
	Polyommatus icarus	Common Blue
	Vanessa atalanta	Red Admiral
Moths	Anthophila fabriciana	Nettle Tap
	Autographa gamma	Silver Y
	Coleophora caespititiella	
	Diachrysia chrysitis	Burnished Brass
	Orgyia antiqua	Vapourer
	Udea lutealis	a pyralid moth
Flies	Cheilosia illustrata	hoverfly
	Eristalis horticola	drone fly
	Eristalis pertinax	drone fly
	Eristalis tenax	drone fly
	Erisyrphus balteus	hoverfly
	Eupeodes corollae	hoverfly
	Heliophilus hybridus	drone fly
	Heliophilus pendulus	drone fly
	Lonchoptera lutea	

	Platycheirus albimanus	hoverfly
	Pyrophaena granditarsa	hoverfly
	Sericomyia silentis	hoverfly
	Syrphus ribesii	hoverfly
	Tabanus sudeticus	horsefly
	Xylota segnis	hoverfly
Bees, ants	Bombus lapidarius	
	Bombus lucorum	
	Bombus pasquorum	
	Bombus terrestris	
	Eriocampa ovata	
	Myrmica ruginodis	
	Psithyrus bohemicus	
Crustaceans	Asellus aquaticus	hog louse
	Balanus balanus	barnacle
	Carcinus maenas	Shore Crab
	Corophium insidiosum	shrimp
	Corophium volutator	
	Crangon crangon	shrimp
	Eulimnogammarus obtusatus	shrimp
	Ligia oceanica	sea slater
	Mysidae	
Woodlice	Oniscus ascellus	woodlouse
	Philoscia muscorum	woodlouse
	Semibalanus balanoides	barnacle
	Sphaeroma rugicauda	sea slater
Harvestmen	Oligolophus tridens	
Spiders	Araneus diadematus	Orb spider
	Clubiona diversa	
	Meta mengei	
	Pachygnatha clercki	
	Pardosa pullata	wolf spider
	Tibellus spp	
Fish	Gasterosteus aculeatus	Three-spined Stickleback
	Pomatoschistus minutus	Sand Goby
	Pomatoschistus sp	goby
Ampibians	Bufo bufo	Common Toad
Birds	Accipiter gentilis	Goshawk
	Accipiter nisus	Sparrowhawk
	Acrocephalus schoenobaenus	Sedge Warbler
	Actitis hypoleucos	Common Sandpiper
	Aegithalos caudatus	Long-tailed Tit
	Alauda arvensis	Skylark
	Alca torda	Razorbill
	Alcedo atthis	Kingfisher
	Anas acuta	Pintail
	Anas clypeata	Shoveler
	Anas crecca	Teal
	Anas crecca carolinensis	Green-winged Teal
	Anas penelope	Wigeon
	Anas platyrhynchos	Mallard
	Anser anser	Greylag Goose
	Anser brachyrhyncus	Pink-footed Goose
	Anthus petrosus	Rock Pipit
	Anthus pratensis	Meadow Pipit
	Apus apus	Swift

Ardea cinerea	Grey Heron
Arenaria interpres	Turnstone
Asio otus	Long-eared Owl
Aythya fuligula	Tufted Duck
Aythya marila	Scaup
Bombycilla garrulus	Waxwing
Branta bernicla	Brent Goose
Branta canadensis	Canada Goose
Bucephala clangula	Goldeneye
Buteo buteo	Buzzard
Calidris alba	Sanderling
Calidris alpina	Dunlin
Calidris canutus	Knot
Calidris ferruginea	Curlew Sandpiper
Calidris minuta	Little Stint
Calidris temminckii	Temminck's Stint
Carduelis cannabina	Linnet
Carduelis carduelis	Goldfinch
Carduelis chloris	Greenfinch
Carduelis flammea	Lesser Redpoll
Carduelis flammea flammea	Mealy Redpoll
Carduelis flavirostris	Twite
Carduelis spinus	Siskin
Certhia familiaris	Treecreeper
Charadrius hiaticula	Ringed Plover
Cinclus cinclus	Dipper
Clangula hyemalis	Long-tailed Duck
Columba oenas	Stock Dove
Columba palumbus	Woodpigeon
Corvus corax	Raven
Corvus corone	Carrion Crow
Corvus frugilegus	Rook
Corvus monedula	Jackdaw
Cuculus canorus	Cuckoo
Cygnus cygnus	Whooper Swan
Cygnus olor	Mute Swan
Delichon urbica	House Martin
Dendrocopos major	Great Spotted Woodpecker
Emberiza citrinella	Yellowhammer
Emberiza schoeniclus	Reed Bunting
Erithacus rubecula	Robin
Falco columbarius	Merlin
Falco peregrinus	Peregrine
Falco tinnunculus	Kestrel
Fratercula arctica	Puffin
Fringilla coelebs	Chaffinch
Fulica atra	Coot
Fulmarus glacialis	Fulmar
Gallinago gallinago	Common Snipe
Gallinula chloropus	Moorhen
Gavia arctica	Black-throated Diver
Gavia stellata	Red-throated Diver
Haematopus ostralegus	Oystercatcher
Hirundo rustica	Swallow
Larus argentatus	Herring Gull
Larus canus	Common Gull

Larus fuscus	Lesser Black-backed Gull
Larus glaucoides	Iceland Gull
Larus hyperboreus	Glaucous Gull
Larus marinus	Great Black-backed Gull
Larus minutus	Little Gull
Larus ridibundus	Black-headed Gull
Limosa lapponica	Bar-tailed Godwit
Limosa limosa	Black-tailed Godwit
Locustella naevia	Grasshopper Warbler
Loxia curvirostra	Common Crossbill
Lymnocryptes minimus	Jack Snipe
Melanitta nigra	Common Scoter
Mergus merganser	Goosander
Mergus serrator	Red-breasted Merganser
Milvus milvus	Red Kite
Motacilla alba alba	White Wagtail
Motacilla alba yarrellii	Pied Wagtail
Motacilla cinerea	Grey Wagtail
Motacilla citreola	Citrine Wagtail
Numenius arquata	Curlew
Numenius phaeopus	Whimbrel
Oenanthe oenanthe	Wheatear
Pandion haliaetus	Osprey
Parus ater	Coal Tit
Parus caeruleus	Blue Tit
Parus cristatus	Crested Tit
Parus major	Great Tit
Passer domesticus	House Sparrow
Passer montanus	Tree Sparrow
Phalacrocorax aristotelis	Shag
Phalacrocorax carbo	Cormorant
Phasianus colchicus	Pheasant
Philomachus pugnax	Ruff
Phoenicurus phoenicurus	Redstart
Phylloscopus collybita	Chiffchaff
Phylloscopus trochilus	Willow Warbler
Plectrophenax nivalis	Snow Bunting
Pluvialis apricaria	Golden Plover
Pluvialis squatarola	Grey Plover
Podiceps auritus	Slavonian Grebe
Prunella modularis	Dunnock
Pyrrhula pyrrhula	Bullfinch
Rallus aquaticus	Water Rail
Regulus regulus	Goldcrest
Riparia riparia	Sand Martin
Rissa tridactyla	Kittiwake
Saxicola rubetra	Whinchat
Saxicola torquata	Stonechat
Scolopax rusticola	Woodcock
Somateria mollissima	Eider
Stercorarius parasiticus	Arctic Skua
Stercorarius pomarinus	Pomarine Skua
Stercorarius skua	Great Skua
Sterna hirundo	Common Tern
Sterna paradisaea	Arctic Tern
Sterna sandvicensis	Sandwich Tern

	Streptopelia decaocto	Collared Dove
	Strix aluco	Tawny Owl
	Sturnus vulgaris	Starling
	Sula bassana	Gannet
	Sylvia atricapilla	Blackcap
	Sylvia communis	Whitethroat
	Tachybaptus ruficollis	Little Grebe
	Tadorna tadorna	Shelduck
	Tringa erythropus	Spotted Redshank
	Tringa nebularia	Greenshank
	Tringa totanus	Redshank
	Troglodytes troglodytes	Wren
	Turdus iliacus	Redwing
	Turdus merula	Blackbird
	Turdus philomelos	Song Thrush
	Turdus pilaris	Fieldfare
	Turdus viscivorus	Mistle Thrush
	Uria aalge	Guillemot
	Vanellus vanellus	Lapwing
Mammals	Apodemus sylvaticus	Wood mouse
	Erinaceus europaeus	Hedgehog
	Microtus agrestis	Field Vole
	Capreolus capreolus	Roe Deer
	Lutra lutra	Otter
	Mustela erminea	Stoat
	Oryctolagus cuniculus	Rabbit
	Phoca vitulina	Common Seal
	Sorex araneus	Common shrew
	Tursiops truncatus	Bottlenose Dolphin
	Vulpes vulpes	Fox

Annex 5 Data gathered in the 2008 survey for the Plan

Survey work was carried out in 2008 to provide baseline information for the Biodiversity Management Plan. A total of 251 records were collected from Merkinch LNR between 3/8/2008 and 17/9/2008. Pitfall trapping carried out over a period has a start and end date and species found in the traps are given an abundance.

Recorder: Alastair Sommerville
Determiner: Alastair Sommerville

Species	Start date	End date	Grid ref	Abundance	Comments
Acer pseudoplatanus	16/09/2008		NH649465		Canal bank
Achillea millefolium	16/09/2008		NH654470		Inner slope of seawall
Achillea millefolium	16/09/2008		NH6552847027		Residual patch of grassland
Achillea ptarmica	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Aegithalos caudatus	05/08/2008		NH652468		with young
Aegopodium podagraria	03/09/2008		NH6546046927		Inner slope of seawall
Aegopodium podagraria	16/09/2008		NH6538146693		In birch 'wood'
Aepus marinus	03/09/2008		NH6544847175		very common understones at hightide mark
Aequipecten opercularis	16/09/2008		NH6496547084		queen scallop; sub-fossil shells common in soft sediments
Agabus bipustulatus	17/09/2008		NH653469		swept from marsh vegetation
Aglais urticae	17/09/2008		NH654466		one flying along amenity grassland
Agrostis canina	16/09/2008		NH654470		Inner slope of seawall
Agrostis capillaris	16/09/2008		NH6552847027		Residual patch of grassland
Agrostis stolonifera	16/09/2008		NH6526446777		By seawall
Alnus glutinosa	05/08/2008		NH654470		Marsh
Alnus glutinosa	05/08/2008		NH 653469		Seawall
Alnus glutinosa	05/08/2008		NH653467		South end of woodland
Alnus glutinosa	03/09/2008		NH6545947031		Grassland east of marsh
Alnus glutinosa	16/09/2008		NH655470		Planted trees?
Anacaena globulus	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh, 1
Anas platyrhynchos	05/08/2008		NH651465		eight in freshwater lagoon
Anas platyrhynchos	16/09/2008		NH654471		ten birds along sea edge
Angelica sylvestris	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Angelica sylvestris	05/08/2008		NH653467		South end of woodland
Angelica sylvestris	16/09/2008		NH6538146693		In birch 'wood'
Anthophila fabriciana	16/09/2008	`	NH652466		common on flowers in wasteground
Anthoxanthum odoratum	16/09/2008		NH6552847027		Residual patch of grassland

Species	Start date	End date	Grid ref	Abundance	Comments
Araneus diadematus	17/09/2008		NH653469		swept from marsh vegetation
Arctica islandica	16/09/2008		NH6496547084		sub-fossil shells common in soft sediments
Ardea cinerea	05/08/2008		NH650466		with young
Arenaria interpres	05/08/2008		NH649466		small flock in saltwater lagoon
Arenicola marina	05/08/2008		NH650466		common in saltwater lagoon mud
Arion ater	17/09/2008		NH65404684		common everywhere
Arion fasciatus	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood, 1
Arion subfuscus	03/09/2008	16/09/2008	NH6542546961	6	pitfall trap edge of marsh
Arion subfuscus	17/09/2008		NH654468		one under sheet of wood in woodland
Armeria maritima	05/08/2008		NH654470		Seawall
Arrhenatherum elatius	16/09/2008		NH6552847027		Residual patch of grassland
Artemesia vulgaris	05/08/2008		NH6546547061		Grassland next to path
Ascophyllum nodosum	03/09/2008		NH6541147180		dominant seaweed across both bays, attached to pebbles
Asellus aquaticus	16/09/2008		NH6532646827		few in peaty pool
Aster maritima	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Aster maritima	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Aster x salignus	05/08/2008		NH654470		Marsh
Aster x salignus	05/08/2008		NH6538346818		Clearing in woodland
Aster x salignus	16/09/2008		NH6538146693		In birch 'wood'
Atriplex glabriuscula	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Atriplex littoralis	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Atriplex prostrata	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Autographa gamma	03/09/2008		NH654470		occassional disturbed in grassland
Balanus balanus	16/09/2008		NH651469		common on large pebbles
Betula pendula	05/08/2008		NH 653469		Seawall
Betula pendula	05/08/2008		NH653467		South end of woodland
Betula pendula	16/09/2008		NH655470		Planted trees?
Betula pubescens	05/08/2008		NH654470		Marsh
Betula pubescens	05/08/2008		NH653467		South end of woodland
Bombus lapidarius	16/09/2008		NH654470		male; occassional
Bombus lucorum	05/08/2008		NH654470		Common
Bombus pasquorum	05/08/2008		NH655470		common everywhere
Bombus pasquorum	03/09/2008		NH65264685		male: common everywhere
Bombus terrestris	03/09/2008		NH65264685		male; common everywhere
Calathus piceus	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood, 1
Calluna vulgaris	16/09/2008		NH6532046850		

Species	Start date	End date	Grid ref	Abundance	Comments
Calluna vulgaris	16/09/2008		NH652468		
Caltha palustris	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Campanula rotundifolia	03/09/2008		NH6545947031		Grassland east of marsh
Campanula rotundifolia	16/09/2008		NH6552847027		Residual patch of grassland
Capreolus capreolus	05/08/2008		NH654468		tracks and dropping throughout main wood
Carcinus maenas	05/08/2008		NH650466		several in saltwater lagoon
Carduelis carduelis	16/09/2008		NH65254685		flock of about eight in scrub along sea embankment
Carex echinata	03/09/2008		NH652468		common along the edge of wet runnels in marsh
Carex nigra	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Carex rostrata	16/09/2008		NH6534246880		
Centaurea nigra	05/08/2008		NH654470		Marsh
Centaurea nigra	05/08/2008		NH653467		South end of woodland
Centaurea nigra	16/09/2008		NH654470		Inner slope of seawall
Centaurea nigra	16/09/2008		NH6552847027		Residual patch of grassland
Cerastoderma edule	03/09/2008		NH653471		common in sandy mud
Cheilosia illustrata	05/08/2008		NH652467		Common
Cicadella viridis	17/09/2008		NH653468		common in marsh
Cirsium arvense	05/08/2008		NH6546547061		Grassland next to path
Cirsium palustre	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Cirsium palustre	16/09/2008		NH6538146693		In birch 'wood'
Clubiona diversa	17/09/2008		NH653469		swept from marsh vegetation
Cochlearia officinalis	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Cochlearia officinalis	16/09/2008		NH6526446777		By seawall
Cochlicopa lubrica	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood, 1
Coleophora caespititiella	17/09/2008		NH655470		
Columba palumbus	05/08/2008		NH654470		Common
Corophium insidiosum	05/08/2008		NH650466		common in saltwater lagoon mud
Corvus corone	05/08/2008		NH653470		Common
Corylus avellana	16/09/2008		NH655470		Planted trees?
Crataegus monogyna	05/08/2008		NH 653469		Seawall
Crataegus monogyna	05/08/2008		NH653467		South end of woodland
Crataegus monogyna	16/09/2008		NH655470		Planted trees?
Crepis capillaris	16/09/2008		NH654470		Inner slope of seawall
Cygnus olor	16/09/2008		NH653472		two bird in sea in main bay
Cystisus scoparius	16/09/2008		NH6552847027		Residual patch of grassland
Dactylis glomerata	16/09/2008		NH654470		Inner slope of seawall

Species	Start date	End date	Grid ref	Abundance	Comments
Dactylis glomerata	16/09/2008		NH6552847027		Residual patch of grassland
Dactylis glomerata	16/09/2008		NH6538146693		In birch 'wood'
Dactylorhiza purpurella	16/09/2008		NH6531646850		
Danthonia decumbens	03/09/2008		NH653468		scattered through wet heathy area
Deschampsia caespitosa	05/08/2008		NH653467		South end of woodland
Deschampsia caespitosa	05/08/2008		NH6538346818		Clearing in woodland
Deschampsia caespitosa	05/08/2008		NH6546547061		Grassland next to path
Deschampsia caespitosa	16/09/2008		NH6538146693		In birch 'wood'
Diachrysia chrysitis	05/08/2008		NH471655		one flying in rough grassland
Discus rotundatus	17/09/2008		NH654468		under rubbish in wood
Dryopteris dilatata	16/09/2008		NH650465		On canal bank, Kingfisher Lagoon
Dryopteris filix-mas	16/09/2008		NH6538146693		In birch 'wood'
Dynamena pumila	16/09/2008		NH6492546984		colonies common on base of Ascophyllum
Eleocharis palustris	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Eleocharis uniglumis	16/09/2008		NH6526446777		By seawall
Elymus repens	03/09/2008		NH6545947031		Grassland east of marsh
Enteromorpha sp.	03/09/2008		NH6541147180		coating surface of mud especially near shore
Epilobium angustifolium	16/09/2008		NH649465		Canal bank
Equisetum palustre	03/09/2008		NH653468		sparse through much of the marsh
Erebia aethiops	05/08/2008		NH654469		common throughout marsh
Erica tetralix	16/09/2008		NH652468		
Eriocampa ovata	05/08/2008		NH654468		on hogweed flower (larva feeds on alder)
Eriophorum angustifolium	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Eristalis horticola	16/09/2008		NH654470		a few on flowers
Eristalis pertinax	03/09/2008		NH654470		huge numbers on all flower heads
Eristalis pertinax	16/09/2008		NH653469		very common everywhere on flowers
Eristalis tenax	03/09/2008		NH652468		a few on flowers
Erisyrphus balteus	03/09/2008		NH653469		very common everywhere
Erithacus rubecula	16/09/2008		NH653466		two on wasteground behind large pool
Eulimnogammarus obtusatus	03/09/2008		NH653471		
Eupeodes corollae	16/09/2008		NH653469		very common everwhere
Eupeodes corollae	17/09/2008		NH653468		very common on Aster flowers
Festuca rubra	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Festuca rubra	16/09/2008		NH6526446777		By seawall
Festuca rubra	16/09/2008		NH6552847027		Residual patch of grassland
Filipendula ulmaria	05/08/2008		NH654470		Marsh

Species	Start date	End date	Grid ref	Abundance	Comments
Filipendula ulmaria	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Filipendula ulmaria	05/08/2008		NH653467		South end of woodland
Filipendula ulmaria	05/08/2008		NH653467		South end of woodland
Fringilla coelebs	05/08/2008		NH654469		
Fringilla coelebs	16/09/2008		NH655470		several in scrub along sea embankment
Frustrellidra hispida	16/09/2008		NH651469		occassional colonies on seaweed
Fucus serratus	03/09/2008		NH6541147180		Common
Fucus vesiculosus	03/09/2008		NH6541147180		Common
Galerus tanaceti	17/09/2008		NH653469		swept from marsh vegetation - feeds on Succisa?
Galium palustre	16/09/2008		NH6534246880		
Gallinula chloropus	16/09/2008		NH65274669		three in emergent vegetation around large pond
Gasterosteus aculeatus	05/08/2008		NH650465		shoal near outfall of Kingfisher Lagoon
Gerris thoracicus	16/09/2008		NH6532646827		few on peaty pools
Geum urbanum	16/09/2008		NH654470		Inner slope of seawall
Gibbula cineraria	03/09/2008		NH650468		scattered amongst stones
Glaux maritima	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Glaux maritima	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Haematopus ostralegus	05/08/2008		NH653472		party of seven flying around
Heliophilus hybridus	17/09/2008		NH653468		a few on flowers
Heliophilus pendulus	03/09/2008		NH654470		a few on flower heads
Heracleum sphondylium	05/08/2008		NH653467		South end of woodland
Heracleum sphondylium	16/09/2008		NH654470		Inner slope of seawall
Heracleum sphondylium	16/09/2008		NH6552847027		Residual patch of grassland
Hesperocorixa sahlbergi	16/09/2008		NH6532646827		few in peaty pools
Holcus lanatus	05/08/2008		NH6538346818		Clearing in woodland
Honkenya peploides	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Hyacinthoides nonscriptus	16/09/2008		NH6538146693		In birch 'wood'
Hydrobia ulvae	16/09/2008		NH653471		very common on mud and dead shells
Hydrocotyle vulgaris	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Inachis io	03/09/2008		NH655471		
Inachis io	17/09/2008		NH655466		
Juncus conglomeratus	16/09/2008		NH6536246810		
Juncus effusus	05/08/2008		NH6538346818		Clearing in woodland
Juncus gerardii	16/09/2008		NH6599046538		
Juncus gerardii	16/09/2008		NH6526446777		By seawall
Juncus squarrosus	16/09/2008		NH6536246810		

Species	Start date	End date	Grid ref	Abundance	Comments
Kelisia vittipennis	17/09/2008		NH653469		swept from marsh vegetation
Larus argentatus	05/08/2008		NH652470		flock of about twenty on single bank
Larus argentatus	16/09/2008		NH651467		one; common in main bay
Larus fuscus	05/08/2008		NH650467		Several
Larus marinus	16/09/2008		NH651467		one feeding in main bay
Larus ridibundus	05/08/2008		NH654472		Common
Leontodon autumnalis	16/09/2008		NH6542647026		
Linaria purpurea	16/09/2008		NH652466		Edge of Kingfisher Lagoon
Littorina littorea	03/09/2008		NH653471		common under stones
Littorina obstusata	03/09/2008		NH653471		common under stones
Littorina rudis	03/09/2008		NH653471		common under stones
Littorina saxatile	03/09/2008		NH653471		common under stones
Lonchoptera lutea	03/09/2008	16/09/2008	NH6546046927		pitfall trap in wood, common
Lotus corniculatus	05/08/2008		NH6546547061		Grassland next to path
Lychnis flos-cuculi	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Lygus rugulipennis	17/09/2008		NH653469		swept from marsh vegetation
Maniola jurtina	05/08/2008		NH654470		few in grassland
Matricaria maritima	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Megasternum obscurum	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood, 1
Megasternum obscurum	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh, 1
Mergus serrator	16/09/2008		NH651466		one female landing in large pond
Meta mengei	17/09/2008		NH653469		swept from marsh vegetation
Micralymma marinum	03/09/2008		NH6544847175		few under stones at hightide mark
Microtus agrestis	16/09/2008		NH6503346515		one recently dead adult
Milax gagates	17/09/2008		NH654468		one under sheet of wood in woodland
Motacilla alba yarrellii	16/09/2008		NH65344697		three flying along outer edge of sea embankment
Mya arenaria	16/09/2008		NH653471		sub-fossil shells common in soft sediments
Myrmica ruginodis	16/09/2008		NH654468		colony under dumped sheet of wood
Mysotis scorpiodes	16/09/2008		NH6534246880		
Mytilus edulis	03/09/2008		NH653471		small numbers attached to large pebbles
Nabicula limbata	16/09/2008		NH652468		common in marsh vegetation
Nabicula limbata	17/09/2008		NH653469		swept from marsh vegetation
Narthecium ossifragum	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Narthecium ossifragum	16/09/2008		NH652468		
Nebria brevicollis	03/09/2008	16/09/2008	NH6546046927	8	pitfall trap in wood, 8
Nebria brevicollis	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh

Species	Start date	End date	Grid ref	Abundance	Comments
Neophilaenus lineatus	17/09/2008		NH653469		swept from marsh vegetation
Nereis virens	16/09/2008		NH6492546984		kingrag, common in thick mud
Nesovitrea hammonis	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh, 1
Nucella lapillus	03/09/2008		NH653471		
Numenius arquata	05/08/2008		NH652470		five in main bay
Numenius arquata	17/09/2008		NH649468		occassional on mudflats
Oenanthe crocata	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Oenanthe oenanthe	16/09/2008		NH651467		single bird flying along sea embankment
Oligolophus tridens	03/09/2008	16/09/2008	NH6542546961	2	pitfall trap edge of marsh, 2
Oniscus ascellus	17/09/2008		NH65404684		common under scap wood in woodland
Ophyiulus pilosus	03/09/2008	16/09/2008	NH6546046927	2	pitfall trap in wood
Orgyia antiqua	17/09/2008		NH6540046797		female on alder with cocoon and eggs
Oryctolagus cuniculus	05/08/2008		NH650466		common on shoreline eating sea plantain
Ostrea edulis	16/09/2008		NH652471		oyster; sub-fossil shells common in soft sediments
Oxychilus alliarius	17/09/2008		NH654469		
Pachygnatha clercki	16/09/2008		NH655470		common in marsh
Pararge aegeria	05/08/2008		NH654467		few in wood
Pararge aegeria	03/09/2008		NH654466		
Pararge aegeria	17/09/2008		NH6542346722		several at edge of wood
Pardosa pullata	16/09/2008		NH655470		common, females with egg capsules
Pedicularis palustris	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Pelvetia canaliculata	03/09/2008		NH6541147180		formed fringe round base of seawall
Petasites albus	05/08/2008		NH6546547061		Grassland next to path
Phalacrocorax carbo	05/08/2008		NH649469		one fishing in main bay
Phasianus colchicus	17/09/2008		NH6531646850		a few in marsh and woodland
Philoscia muscorum	17/09/2008		NH654467		common under fallen branches in grassland
Phoca vitulina	05/08/2008		NH651471		one in main bay
Phylloscopus trochilus	05/08/2008		NH652469		with young
Pieris brassicae	03/09/2008		NH65254683		one, flying over marsh
Pieris napi	05/08/2008		NH654468		common throughout wooded area
Plantago lanceolata	05/08/2008		NH654470		Seawall
Plantago lanceolata	05/08/2008		NH6546547061		Grassland next to path
Plantago lanceolata	16/09/2008		NH654470		Inner slope of seawall
Plantago lanceolata	16/09/2008		NH6552847027		Residual patch of grassland
Plantago maritima	05/08/2008		NH654470		Seawall
Plantago maritima	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh

Species	Start date	End date	Grid ref	Abundance	Comments
Plantago maritima	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Platycheirus albimanus	16/09/2008		NH653469		common everywhere
Polydesmus angustus	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood
Polydesmus angustus	16/09/2008		NH654468		under rubbish in wood
Polysiphonia lanosa	03/09/2008		NH6541147180		growing on Ascophyllum
Pomatoschistus minutus	03/09/2008		NH6540147130		common in sandy pools
Potamogeton polygonifolius	16/09/2008		NH6534246880		
Potentilla erecta	05/08/2008		NH6538346818		Clearing in woodland
Prunella vulgaris	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Prunella vulgaris	16/09/2008		NH6538146693		In birch 'wood'
Prunus spinosa	05/08/2008		NH 653469		Seawall
Psithyrus bohemicus	03/09/2008		NH65264685		male; parasitic on B. lucorum
Pterostichus strenuus	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh
Puccinellia maritima	03/08/2008		NH651467		common in wet/flooded parts of saltmarsh
Pyrophaena granditarsa	16/09/2008		NH653468		common in marsh on Aster flowers
Ranunculus acris	03/09/2008		NH652468		
Ranunculus ficaria	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Ranunculus repens	16/09/2008		NH6538146693		In birch 'wood'
Reynoutria japonica	16/09/2008		NH6551847133		
Reynoutria japonica	16/09/2008		NH6554471		In birch 'wood'
Rhytidiadelphus squarrosus	03/09/2008		NH653468		common in wet heathy grassland in marsh
Rosa arvense	16/09/2008		NH655470		Planted trees?
Rosa canina	05/08/2008		NH654470		Marsh
Rosa canina agg.	16/09/2008		NH654470		Inner slope of seawall
Rubus fructicosus agg.	05/08/2008		NH654470		Marsh
Rubus fructicosus agg.	16/09/2008		NH654470		Inner slope of seawall
Rubus fructicosus agg.	16/09/2008		NH649465		Canal bank
Rubus fructicosus agg.	16/09/2008		NH6538146693		In birch 'wood'
Rubus idaeus	05/08/2008		NH 653469		Seawall
Rubus idaeus	16/09/2008		NH649465		Canal bank
Rubus idaeus	16/09/2008		NH6538146693		In birch 'wood'
Rumex acetosa	16/09/2008		NH6552847027		Residual patch of grassland
Rumex crispus	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Rumex crispus	16/09/2008		NH6526446777		By seawall
Salix aurita	05/08/2008		NH 653469		Seawall
Salix caprea	05/08/2008		NH 653469		Seawall

Species	Start date	End date	Grid ref	Abundance	Comments
Salix caprea	16/09/2008		NH649465		Canal bank
Salix fragilis	05/08/2008		NH654470		Marsh
Salix purpurea	05/08/2008		NH653467		South end of woodland
Sambucus nigra	05/08/2008		NH 653469		Seawall
Sambucus nigra	16/09/2008		NH654470		Inner slope of seawall
Sambucus nigra	16/09/2008		NH655470		Planted trees?
Scenecio aquaticus	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Schoenoplectus tabernaemontani	05/08/2008		NH 653469		Seawall
Scirpus maritimus	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Scirpus maritimus	16/09/2008		NH6526446777		By seawall
Semibalanus balanoides	16/09/2008		NH651469		common on large pebbles
Senecio jacobaea	16/09/2008		NH654470		Inner slope of seawall
Sericomyia silentis	03/09/2008		NH653468		
Silene alba	16/09/2008		NH6552847027		Residual patch of grassland
Silene maritima	03/08/2008		NH649466		occassional in strandline
Solanum dulcamara	03/09/2008		NH6545947031		Grassland east of marsh
Sonchus arvense	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Sonchus arvense	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Sonchus arvense	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Sorbus aucuparia	05/08/2008		NH 653469		Seawall
Spergula media	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Spergula media	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Stellaria alsine	05/08/2008		NH 653469		Seawall
Stellaria holostea	16/09/2008		NH6552847027		Residual patch of grassland
Stenodema holsatum	16/09/2008		NH653469		common in grasses
Stenopsocus immaculatus	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood, 1
Sterna hirundo	05/08/2008		NH653472		few flying along the shore
Strigamia maritima	03/09/2008		NH6544847175		common understone at hightide mark
Stynocoris pedestris	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh, 1
Succisa pratensis	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Succisa pratensis	05/08/2008		NH6538346818		Clearing in woodland
Sylvia communis	05/08/2008		NH654469		Several
Symphoricarpos albus	16/09/2008		NH6501446508		Canal bank
Syrphus ribesii	17/09/2008		NH653468		very common on Aster flowers
Tabanus sudeticus	05/08/2008		NH653468		resting on alder
Tachinus marginellus	03/09/2008	16/09/2008	NH6542546961	1	pitfall trap edge of marsh, 1

Species	Start date	End date	Grid ref	Abundance	Comments
Tachinus signatus	03/09/2008	16/09/2008	NH6546046927	1	pitfall trap in wood, 1
Tachybaptus ruficollis	16/09/2008		NH65204668		one calling on large pond
Tachypodoiulus niger	17/09/2008		NH654468		under rubbish in wood
Tibellus spp	16/09/2008		NH655470		common, all immature
Torilis japonica	16/09/2008		NH654470		Inner slope of seawall
Trechus obtusus	03/09/2008	16/09/2008	NH6542546961	3	pitfall trap edge of marsh, 3
Trifolium arvense	05/08/2008		NH654470		Marsh
Trifolium arvense	16/09/2008		NH6552847027		Residual patch of grassland
Trifolium repens	16/09/2008		NH654470		Inner slope of seawall
Trifolium repens	16/09/2008		NH6526446777		By seawall
Triglochin maritima	05/08/2008		NH650466		Witches Coffin Lagoon, saltmarsh
Triglochin maritima	03/09/2008		NH6544447219		Satmarsh strip around turning circle
Triglochin palustris	16/09/2008		NH654470		
Tringa totanus	16/09/2008		NH651467		small flock on exposed sandbank
Turdus merula	05/08/2008		NH654470		with young
Turdus merula	16/09/2008		NH652466		on wasteground behind large pool
Turritella communis	16/09/2008		NH6496547084		sub-fossil shells common in soft sediments
Tussilago farfara	16/09/2008		NH650465		On canal bank, Kingfisher Lagoon
Typha latifolia	05/08/2008		NH 653469		Seawall
Typha latifolia	16/09/2008		NH6526446777		By seawall
Ulex europaeus	05/08/2008		NH654470		Marsh
Ulex europaeus	05/08/2008		NH653467		South end of woodland
Ulex europaeus	16/09/2008		NH654470		Inner slope of seawall
Ulex europaeus	16/09/2008		NH6538146693		In birch 'wood'
Ulmus glabra	05/08/2008		NH 653469		Seawall
Urtica dioica	05/08/2008		NH653467		South end of woodland
Urtica dioica	16/09/2008		NH654470		Inner slope of seawall
Urtica dioica	16/09/2008		NH6538146693		In birch 'wood'
Vaccinium myrtilis	03/09/2008		NH653468		very few stunted shoots in wet heath area
Valeriana officinalis	05/08/2008		NH654470		Marsh
Valeriana officinalis	05/08/2008		NH652467		Westfield Lagoon, saltmarsh and marsh
Valeriana officinalis	16/09/2008		NH6534246880		
Veronica montana	16/09/2008		NH6538146693		In birch 'wood'
Viola canina	16/09/2008		NH6538146693		In birch 'wood'
Vulpes vulpes	17/09/2008		NH654468		fox scent in wood
Xylota segnis	05/08/2008		NH655470		on elder leaves

Annex 6 Data sets collated for the preparation of the Plan

Existing data was collated from six sources to provide context and trends and to establish the recording coverage of the site. The data sets used are described below and the abbreviated records listed.

Survey by A D Fox

101 records from an NCC file note were extracted by Alastair Sommerville. Grid references and location comments refer to an annotated map included with the file note. Abundance is recorded as a code against some species but without explanation but are presumably the standard abbreviations: d – dominant, ld – locally dominant, vc – very common, c – common, lc – locally common, f – frequent, o – occasional, r – rare.

Recorder: A D Fox
Site Name: Muirtown Basin
Date: 26/06/1985

Species	Grid ref	Abundance	Location
Acrocladinum cuspidatum	NH653469	d	Area A: fen
Angelica sylvestris	NH653469	o	Area A: fen
Anthoxanthum odoratum	NH654470		Area A: dry grassland
Anthoxanthum odoratum	NH654470	o	Area A: quadrat
Anthoxanthum odoratum	NH653469	o	Area A: fen
Armeria maritima	NH654470		Area A: wet grassland
Armeria maritima	NH653468		Area B: swamp
Arrhenatherum elatius	NH653469	o	Area A: fen
Aster tripolium	NH654470		Area A: wet grassland
Atriplex glabriuscula	NH650466		Area D: saltmarsh
Atriplex littoralis	NH650466		Area D: saltmarsh
Atriplex patula	NH650466		Area D: saltmarsh
Bellis perennis	NH654470		Area A: dry grassland
Campylium stellatum	NH653469	ld	Area A: fen
Cardamine pratensis	NH653469	r	Area A: fen
Carex curta	NH653469	f	Area A: fen
Carex echinata	NH653469	o	Area A: fen
Carex flacca	NH654470	r	Area A: quadrat
Carex flacca	NH653469	c	Area A: fen
Carex nigra	NH654470		Area A: wet grassland

Species	Grid ref	Abundance	Location
Carex nigra	NH653469	ld	Area A: fen
Carex nigra	NH653469		Area A: fen pool
Carex nigra	NH653468		Area B: swamp
Centaurea nigra	NH654470	r	Area A: quadrat
Cerastium fontanum	NH654470	r	Area A: quadrat
Cirsium palustre	NH654470	r	Area A: quadrat
Cirsium vulgare	NH654470	o	Area A: quadrat
Cochlearia officinalis	NH654470		Area A: wet grassland
Cochlearia officinalis	NH650466		Area D: saltmarsh
Dactylorhiza purpurella	NH654470		Area A: dry grassland
Dactylorhiza purpurella	NH654470	r	Area A: quadrat
Dactylorhiza purpurella	NH653469	o	Area A: fen
Dactylorhiza purpurella	NH651466		Area E: lagoon
Deschampsia caespitosa	NH654470		Area A: wet grassland
Eleocharis uniglumis	NH654470	r	Area A: grassland
Eleocharis uniglumis	NH653469		Area A: fen pool
Eleocharis uniglumis	NH653468		Area B: swamp
Eleocharis uniglumis	NH654470	d	Area A: pools
Eriophorum angustifolium	NH653469	c	Area A: fen
Eriophorum angustifolium	NH653469		Area A: fen pool
Festuca rubra	NH654470	d	Area A: grassland
Festuca rubra	NH654470	d	Area A: quadrat
Festuca rubra	NH653469	r	Area A: fen
Festuca rubra	NH650466		Area D: saltmarsh
Filipendula ulmaria	NH653469	f	Area A: fen
Galium palustre	NH653469	o	Area A: fen
Galium palustre	NH653469		Area A: fen pool
Glaux maritima	NH654470	o	Area A: grassland
Glaux maritima	NH650466		Area D: saltmarsh
Holcus lanatus	NH654470	f	Area A: grassland
Holcus mollis	NH654470	f	Area A: quadrat
Holcus mollis	NH653469	o	Area A: fen
Hydrocotyle vulgaris	NH653469	f	Area A: fen
Hydrocotyle vulgaris	NH653469		Area A: fen pool
Hypochaeris radicata	NH654470	o-f	Area A: grassland
Juncus conglomeratus	NH653469	f	Area A: fen

Species	Grid ref	Abundance	Location
Juncus gerardii	NH654470	la	Area A: grassland
Juncus gerardii	NH653468		Area B: swamp
Lotus corniculatus	NH654470		Area A: dry grassland
Lotus corniculatus	NH654470	vc	Area A: quadrat
Luzula campestris	NH654470	o	Area A: quadrat
Lychnis flos-cuculi	NH653469	c	Area A: fen
Mysotis sp	NH653469	o	Area A: fen
Nardus stricta	NH654470		Area A: dry grassland
Nardus stricta	NH654470	r	Area A: quadrat
Nardus stricta	NH653469	f	Area A: fen
Oenanthe crocata	NH651466		Area E: lagoon
Pedicularis palustris	NH653469	o-r	Area A: fen
Phagmites australis	NH651466		Area E: lagoon
Plantago lanceolata	NH654470	o	Area A: quadrat
Plantago maritima	NH654470	o	Area A: grassland
Plantago maritima	NH650466		Area D: saltmarsh
Poa subcaerulea	NH654470	f	Area A: grassland
Poa subcaerulea	NH654470	f	Area A: quadrat
Prunella vulgaris	NH653469	o	Area A: fen
Puccinellia maritima	NH653468		Area B: swamp
Puccinellia maritima	NH650466		Area D: saltmarsh
Ranunculus acris	NH653469	o	Area A: fen
Ranunculus flammula	NH653469	f	Area A: fen
Ranunculus flammula	NH653469		Area A: fen pool
Ranunculus flammula	NH653468		Area B: swamp
Rhinanthus minor	NH650466		Area D: bank
Rosa sp.	NH653467		Seawall bank
Rubus fructicosus agg.	NH653467		Seawall bank
Rumex crispus	NH654470		Area A: wet grassland
Salicornia europea	NH650466		Area D: saltmarsh
Sambucus nigra	NH653467		Seawall bank
Schoenoplectus tabernaemontani	NH653468		Area B: pool
Scirpus maritimus	NH653468		Area B: pool
Silene maritima	NH650466		Area D: saltmarsh
Trifolium arvense	NH654470	lc	Area A: grassland

Species	Grid ref	Abundance	Location
Trifolium arvense	NH654470		Area A: dry grassland
Trifolium arvense	NH654470	o	Area A: quadrat
Triglochin maritima	NH653469		Area A: fen pool
Triglochin maritima	NH653468		Area B: swamp
Triglochin palustris	NH653469	r	Area A: fen
Typha latifolia	NH653468		Area B: pool
Typha latifolia	NH651466		Area E: lagoon
Ulex europaeus	NH654470		Area A: grassland
Veronica beccabunga	NH653469	r	Area A: fen
Viola palustris	NH653469	r	Area A: fen

Surveys by Al McNee

151 bird 'records' from the general area of Merkinch LNR have been constructed from the data included in Appendix 6 of the Merkinch LNR Management Plan. These represented a summary of the bird recording carried out by Al McNee, the Inverness and Nairn County Recorder, between, approximately, 1973 and 2008. The complete data is available but as a mixture of annual records submitted for the area and original notebooks. It was not practical to extract and collate the data in more detail.

Recorder: Al McNee
Date: 1973-2008

Common name	Species	Abundance	Comments
Goshawk	*Accipiter gentilis*		Rare (Pr 03/08 J Willet)
Sparrowhawk	*Accipiter nisus*	1	Occasional breeding
Sedge Warbler	*Acrocephalus schoenobaenus*	1 to 5	Annual breeding
Common Sandpiper	*Actitis hypoleucos*		Annual
Long-tailed Tit	*Aegithalos caudatus*	1+	Occasional breeding
Skylark	*Alauda arvensis*	1+	Occasional breeding
Razorbill	*Alca torda*		Annual
Kingfisher	*Alcedo atthis*		Annual regularly wintering
Pintail	*Anas acuta*		Annual
Shoveler	*Anas clypeata*		Occasional
Teal	*Anas crecca*	1+	Occasional breeding regularly wintering
Green-winged Teal	*Anas crecca carolinensis*		Rare
Wigeon	*Anas penelope*		Annual regularly wintering
Mallard	*Anas platyrhynchos*	2+	Annual breeding
Greylag Goose	*Anser anser*		Annual
Pink-footed Goose	*Anser brachyrhyncus*		Annual
Rock Pipit	*Anthus petrosus*		Annual
Meadow Pipit	*Anthus pratensis*	5+	Annual breeding
Swift	*Apus apus*		Annual
Grey Heron	*Ardea cinerea*		Annual
Turnstone	*Arenaria interpres*		Annual
Long-eared Owl	*Asio otus*		Occasional
Tufted Duck	*Aythya fuligula*	1	Occasional breeding
Scaup	*Aythya marila*		Annual

Common name	Species	Abundance	Comments
Waxwing	*Bombycilla garrulus*		Occasional
Brent Goose	*Branta bernicla*		Occasional
Canada Goose	*Branta canadensis*		Annual
Goldeneye	*Bucephala clangula*		Annual regularly wintering
Buzzard	*Buteo buteo*	1	Occasional breeding
Sanderling	*Calidris alba*		Occasional
Dunlin	*Calidris alpina*		Annual regularly wintering
Knot	*Calidris canutus*		Annual regularly wintering
Curlew Sandpiper	*Calidris ferruginea*		Occasional
Little Stint	*Calidris minuta*		Occasional
Temminck's Stint	*Calidris temminckii*		Rare
Linnet	*Carduelis cannabina*	3+	Annual breeding
Goldfinch	*Carduelis carduelis*	1+	Occasional breeding
Greenfinch	*Carduelis chloris*	3+	Annual breeding
Lesser Redpoll	*Carduelis flammea*		Annual
Mealy Redpoll	*Carduelis flammea flammea*		Occasional
Twite	*Carduelis flavirostris*		Occasional
Siskin	*Carduelis spinus*	1+	Occasional breeding regularly wintering
Treecreeper	*Certhia familiaris*	1	Occasional breeding
Ringed Plover	*Charadrius hiaticula*		Annual
Dipper	*Cinclus cinclus*		Occasional
Long-tailed Duck	*Clangula hyemalis*		Annual
Stock Dove	*Columba oenas*		Occasional
Woodpigeon	*Columba palumbus*	2+	Annual breeding
Raven	*Corvus corax*		Occasional
Carrion Crow	*Corvus corone*	1+	Annual breeding
Rook	*Corvus frugilegus*		Annual
Jackdaw	*Corvus monedula*		Annual
Cuckoo	*Cuculus canorus*		Annual
Whooper Swan	*Cygnus cygnus*		Annual
Mute Swan	*Cygnus olor*	1	Occasional breeding
House Martin	*Delichon urbica*		Annual
Great Spotted Woodpecker	*Dendrocopos major*		Occasional
Yellowhammer	*Emberiza citrinella*	3+	Occasional breeding
Reed Bunting	*Emberiza schoeniclus*	1 to 3	Annual breeding
Robin	*Erithacus rubecula*	2+	Annual breeding

Common name	Species	Abundance	Comments
Merlin	*Falco columbarius*		Occasional
Peregrine	*Falco peregrinus*		Annual
Kestrel	*Falco tinnunculus*		Annual
Puffin	*Fratercula arctica*		Occasional
Chaffinch	*Fringilla coelebs*	5+	Annual breeding
Coot	*Fulica atra*		Occasional
Fulmar	*Fulmarus glacialis*		Annual
Common Snipe	*Gallinago gallinago*		Annual regularly wintering
Snipe	*Gallinago gallinago*		Annual
Moorhen	*Gallinula chloropus*	2+	Annual breeding
Black-throated Diver	*Gavia arctica*		Annual
Red-throated Diver	*Gavia stellata*		Annual
Oystercatcher	*Haematopus ostralegus*		Annual
Swallow	*Hirundo rustica*	2+	Occasional breeding
Herring Gull	*Larus argentatus*		Annual
Common Gull	*Larus canus*		Annual
Lesser Black-backed Gull	*Larus fuscus*		Annual
Iceland Gull	*Larus glaucoides*		Occasional
Glaucous Gull	*Larus hyperboreus*		Occasional
Great Black-backed Gull	*Larus marinus*		Annual
Little Gull	*Larus minutus*		Occasional
Black-headed Gull	*Larus ridibundus*		Annual
Bar-tailed Godwit	*Limosa lapponica*		Annual regularly wintering
Black-tailed Godwit	*Limosa limosa*		Occasional
Grasshopper Warbler	*Locustella naevia*	1 to 3	Annual breeding
Common Crossbill	*Loxia curvirostra*		Annual
Jack Snipe	*Lymnocryptes minimus*		Occasional regularly wintering
Common Scoter	*Melanitta nigra*		Occasional
Goosander	*Mergus merganser*		Annual regularly wintering
Red-breasted Merganser	*Mergus serrator*		Annual regularly wintering
Red Kite	*Milvus milvus*		Annual
White Wagtail	*Motacilla alba alba*		Annual
Pied Wagtail	*Motacilla alba yarrellii*	1	Occasional breeding
Grey Wagtail	*Motacilla cinerea*	1+	Occasional breeding
Citrine Wagtail	*Motacilla citreola*		Rare
Curlew	*Numenius arquata*		Annual regularly wintering

Common name	Species	Abundance	Comments
Whimbrel	*Numenius phaeopus*		Annual
Wheatear	*Oenanthe oenanthe*		Annual
Osprey	*Pandion haliaetus*		Annual
Coal Tit	*Parus ater*	2+	Occasional breeding
Blue Tit	*Parus caeruleus*	2+	Annual breeding
Crested Tit	*Parus cristatus*		Rare
Great Tit	*Parus major*	3+	Annual breeding
House Sparrow	*Passer domesticus*	10+	Annual breeding
Tree Sparrow	*Passer montanus*		Occasional
Shag	*Phalacrocorax aristotelis*		Annual
Cormorant	*Phalacrocorax carbo*		Annual
Pheasant	*Phasianus colchicus*		Annual
Ruff	*Philomachus pugnax*		Occasional
Redstart	*Phoenicurus phoenicurus*		Occasional
Chiffchaff	*Phylloscopus collybita*	1+	Occasional breeding
Willow Warbler	*Phylloscopus trochilus*	5+	Annual breeding
Snow Bunting	*Plectrophenax nivalis*		Occasional
Golden Plover	*Pluvialis apricaria*		Annual
Grey Plover	*Pluvialis squatarola*		Occasional
Slavonian Grebe	*Podiceps auritus*		Annual
Dunnock	*Prunella modularis*	5+	Annual breeding
Bullfinch	*Pyrrhula pyrrhula*	1+	Occasional breeding
Water Rail	*Rallus aquaticus*		Annual
Goldcrest	*Regulus regulus*	1+	Occasional breeding
Sand Martin	*Riparia riparia*		Annual
Kittiwake	*Rissa tridactyla*		Annual
Whinchat	*Saxicola rubetra*	1	Occasional breeding
Stonechat	*Saxicola torquata*	1	Occasional breeding
Woodcock	*Scolopax rusticola*	1	Occasional breeding
Eider	*Somateria mollissima*		Occasional
Arctic Skua	*Stercorarius parasiticus*		Annual
Pomarine Skua	*Stercorarius pomarinus*		Occasional
Great Skua	*Stercorarius skua*		Annual
Common Tern	*Sterna hirundo*		Annual
Arctic Tern	*Sterna paradisaea*		Annual
Sandwich Tern	*Sterna sandvicensis*		Annual

Common name	Species	Abundance	Comments
Collared Dove	*Streptopelia decaocto*	1+	Occasional breeding
Tawny Owl	*Strix aluco*		Occasional
Starling	*Sturnus vulgaris*	5+	Annual breeding
Gannet	*Sula bassana*		Annual
Blackcap	*Sylvia atricapilla*		Occasional
Whitethroat	*Sylvia communis*	1 to 3	Annual breeding
Little Grebe	*Tachybaptus ruficollis*	2+	Annual breeding
Shelduck	*Tadorna tadorna*	1	Occasional breeding
Spotted Redshank	*Tringa erythropus*		Occasional
Greenshank	*Tringa nebularia*		Annual
Redshank	*Tringa totanus*		Annual regularly wintering
Wren	*Troglodytes troglodytes*	5+	Annual breeding
Redwing	*Turdus iliacus*		Annual
Blackbird	*Turdus merula*	4+	Annual breeding
Song Thrush	*Turdus philomelos*	1+	Annual breeding
Fieldfare	*Turdus pilaris*		Annual
Mistle Thrush	*Turdus viscivorus*		Occasional
Guillemot	*Uria aalge*		Annual
Lapwing	*Vanellus vanellus*		Annual

Survey by Frank Fortune et al.

12 marine records were collected by Frank Fortune, Roger Covey and Kath Thorpe on 19/8/1994 as part of a survey of the Moray Firth. The data was available via the NBN Gateway.

Common name	Species	Grid ref	Location	Recorder
Lugworm	*Arenicola marina*	NH654467	South Kessock Pond	Roger Covey
Lugworm	*Arenicola marina*	NH654467	South Kessock Pond	Roger Covey
	Corophium volutator	NH654467	South Kessock Pond	Roger Covey
shrimp	*Crangon crangon*	NH654467	South Kessock Pond	Roger Covey
Three-spined stickleback	*Gasterosteus aculeatus*	NH654467	South Kessock Pond	Roger Covey
Three-spined stickleback	*Gasterosteus aculeatus*	NH650466	West Muirtown Basin	Frank Fortune
ragworm	*Hedista diversicolour*	NH650466	West Muirtown Basin	Frank Fortune
sludge worm	*Heterochaeta costata*	NH650466	West Muirtown Basin	Frank Fortune
	Mysidae	NH650466	West Muirtown Basin	Frank Fortune
	Mysidae	NH650466	West Muirtown Basin	Frank Fortune
goby	*Pomatoschistus sp*	NH650466	West Muirtown Basin	Kath Thorpe
	Pygospio elegans	NH650466	West Muirtown Basin	Kath Thorpe

Records from the Highland Biological Recording Group

63 records collected by David McAllister, David Obrien, Jeff Waddell, Jimmy McKellar, M Tyszka, M S C Elliott and Stephen Moran between 28/8/1983 and 19/7/2006 and extracted from the data in Appendix 3 of the 2008 Management Plan. Included in this set is one Otter record by Ali Locke on 15/9/2008 constructed by Alastair Sommerville from data supplied as an email.

Common name	Species	Date	Grid ref	Location	Recorder
Common hawker	*Aeshna juncea*	28/08/1983	NH654472	Merkinch LNR	Ali Locke
Small Tortoiseshell	*Aglais urticae*	01/05/1994	NH655472	Merkinch	David McAllister
Small Tortoiseshell	*Aglais urticae*	29/07/1996	NH654469	Merkinch	David O'Brien
ground beetle	*Agonum albipes*	28/06/1993	NH653465	Merkinch LNR	Jeff Waddell
a predatory bug	*Anthocoris nemoralis*	28/08/1983	NH653465	Merkinch	Jeff Waddell
a predatory bug	*Anthocoris nemorum*	28/08/1983	NH652465	Merkinch	Jeff Waddell
a flower bug	*Anthocoris sarothamni*	28/06/1993	NH651466	Merkinch	Jimmy McKellar
a waterboatman	*Callicorixa wollastoni*	28/08/1983	NH654468	Merkinch	Jimmy McKellar
Roe Deer	*Capreolus capreolus*	22/03/2005	NH654466	Merkinch	Jimmy McKellar
a shore bug	*Chartoscirta cincta*	28/06/1993	NH654468	Merkinch	Jimmy McKellar
Green leaf-hopper	*Cicadella viridis*	28/08/1983	NH655472	Merkinch	Jimmy McKellar
a plant-hopper	*Conomelus anceps*	28/08/1983	NH640460	Merkinch	Jimmy McKellar
jumping plant-louse	*Craspedolepta sonchi*	28/08/1983	NH640460	Merkinch	Jimmy McKellar
a plant bug	*Cyrtorhinus caricis*	28/08/1983	NH654468	Merkinch	Jimmy McKellar
Northern Marsh Orchid	*Dactylorhiza purpurella*	06/06/2006	NH654468	Merkinch	Jimmy McKellar
ground beetle	*Dicheirotrichus gustavi*	28/06/1993	NH6546	Merkinch	M. Tyszka
a leaf-hopper	*Elymana sulphurella*	28/08/1983	NH6546	Merkinch	M. Tyszka
Scotch Argus	*Erebia aethiops*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
Scotch Argus	*Erebia aethiops*	01/08/1999	NH651465	Merkinch	M.S.C. Elliott
European Earwig	*Forficula auricularia*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
a ground bug	*Heterocordylus tibialis*	28/06/1993	NH651465	Merkinch	M.S.C. Elliott
a leaf-hopper	*Idiocerus confusus*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
Peacock	*Inachis io*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
a plant-hopper	*Kelisia vittipennis*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
a plant bug	*Leptopterna dolabrata*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
sea slater	*Ligia oceanica*	28/06/1993	NH651465	Merkinch	M.S.C. Elliott
a plant-louse	*Livia juncorum*	28/08/1983	NH651465	Merkinch	M.S.C. Elliott
a lichen bug	*Loricula pselaphiformis*	28/06/1993	NH651465	Merkinch	M.S.C. Elliott
Otter	*Lutra lutra*	15/09/2008	NH6546	Merkinch	Stephen Moran

Common name	Species	Date	Grid ref	Location	Recorder
Small Copper	*Lycaena phlaeas*	28/08/1983	NH6546	Merkinch	Stephen Moran
a plant bug	*Lygus rugulipennis*	28/08/1983	NH6546	Merkinch	Stephen Moran
European tarnished plant bug	*Lygus rugulipennis*	28/06/1993	NH6546	Merkinch	Stephen Moran
Meadow Brown	*Maniola jurtina*	28/08/1983	NH6546	Merkinch	Stephen Moran
Meadow Brown	*Maniola jurtina*	18/07/1992	NH651465	Merkinch	Stephen Moran
Meadow Brown	*Maniola jurtina*	29/07/1996	NH6546	Merkinch	Stephen Moran
Meadow Brown	*Maniola jurtina*	01/08/1999	NH6546	Merkinch	Stephen Moran
a plant-hopper	*Megamelus notula*	28/08/1983	NH6546	Merkinch	Stephen Moran
Stoat	*Mustela erminea*	19/07/2006	NH6546	Merkinch	Stephen Moran
a damsel bug	*Nabicula limbata*	28/08/1983	NH6546	Merkinch	Stephen Moran
ground beetle	*Notiophilus biguttatus*	28/06/1993	NH6546	Merkinch	Stephen Moran
a plant bug	*Orthotylus virescens*	28/08/1983	NH6546	Merkinch	Stephen Moran
a plant bug	*Pachytomella parallela*	28/08/1983	NH6546	Merkinch	Stephen Moran
a plant bug	*Pachytomella parallela*	28/06/1993	NH6546	Merkinch	Stephen Moran
Speckled Wood	*Pararge aegeria*	28/08/1983	NH6546	Merkinch	Stephen Moran
Speckled Wood	*Pararge aegeria*	15/08/1993	NH6546	Merkinch	Stephen Moran
Speckled Wood	*Pararge aegeria*	04/09/1993	NH6546	Merkinch	Stephen Moran
Sea Bristletail	*Petrobius maritimus*	28/06/1993	NH6546	Merkinch	Stephen Moran
a spittle bug	*Philaenus spumarius*	28/08/1983	NH6546	Merkinch	Stephen Moran
Large White	*Pieris brassicae*	28/08/1983	NH6546	Merkinch	Stephen Moran
Green-veined White	*Pieris napi*	28/08/1983	NH6546	Merkinch	Stephen Moran
Green-veined White	*Pieris napi*	28/06/1993	NH6546	Merkinch	Stephen Moran
Green-veined White	*Pieris napi*	29/07/1996	NH6546	Merkinch	Stephen Moran
Small White	*Pieris rapae*	28/08/1983	NH6546	Merkinch	Stephen Moran
Small White	*Pieris rapae*	29/07/1996	NH651465	Merkinch	Stephen Moran
Small White	*Pieris rapae*	06/06/2006	NH6546	Merkinch	Stephen Moran
Common Blue	*Polyommatus icarus*	27/06/2005	NH6546	Merkinch	Stephen Moran
Celery-leaved Buttercup	*Ranunculus sceleratus*	16/06/1999	NH6546	Merkinch	Stephen Moran
Common Shrew	*Sorex araneus*	28/08/1983	NH6546	Merkinch	Stephen Moran
sea slater	*Sphaeroma rugicauda*	28/06/1993	NH6546	Merkinch	Stephen Moran
Black Darter	*Sympetrum danae*	28/08/1983	NH6546	Merkinch	Stephen Moran
Bottlenose Dolphin	*Tursiops truncatus*	23/07/1995	NH6546	Merkinch	Stephen Moran
a pyralid moth	*Udea lutealis*	28/08/1983	NH6546	Merkinch	Stephen Moran
Red Admiral	*Vanessa atalanta*	28/08/1983	NH6546	Merkinch	Stephen Moran

Records from BSBI

10 plant records collected by Margaret Barron, Mary McCallum Webster and the Inverness Botany Group between 1976 and 16/6/1999. The information was supplied by Jeff Waddell the Vice-county Recorder for the area.

Common name	Species	Date	Grid ref	Location	Recorder	Comments
	Ranunculus flammula subsp. scoticus	1976	NH6546	Inverness: South Kessock - Muirtown	Barron, M.	Saltmarsh
Sea Aster	*Aster tripolium*	2005	NH6546	South Kessock to Muirtown	Barron, M.	Lagoons & marshy areas
Slender Spike-rush	*Eleocharis uniglumis*	2006	NH653469	South Kessoch	Barron, M.	Top of seawall
False Fox-sedge	*Carex otrubae*	23/06/1934	NH6546	South Kessock to Muirtown	Barron, M.	Lagoons
Slender Spike-rush	*Eleocharis uniglumis*	28/09/1975	NH6546	Muirtown	Inverness Botany Group	By board walk, lagoons
Babington's Orache	*Atriplex glabriuscula*	01/10/1975	NH6546	Inverness: Muirtown Basin	McCallum Webster, M.	Bog E, Voucher specimen
Small Tortoiseshell	*Aglais urticae*	28/08/1983	NH6546	Inverness: Muirtown	McCallum Webster, M.	Bog, E. of towpath
Knotted Pearlwort	*Sagina nodosa*	24/07/1994	NH6546	Inverness: Muirtown	McCallum Webster, M.	Bog E. of towpath
Bulrush	*Typha latifolia*	03/07/1996	NH6546	Muirtown Basin	McCallum Webster, M.	Saltmarsh E, Voucher specimen
Celery-leaved Buttercup	*Ranunculus sceleratus*	16/06/1999	NH6546	Muirtown	Inverness Botany Group	By board walk, lagoons