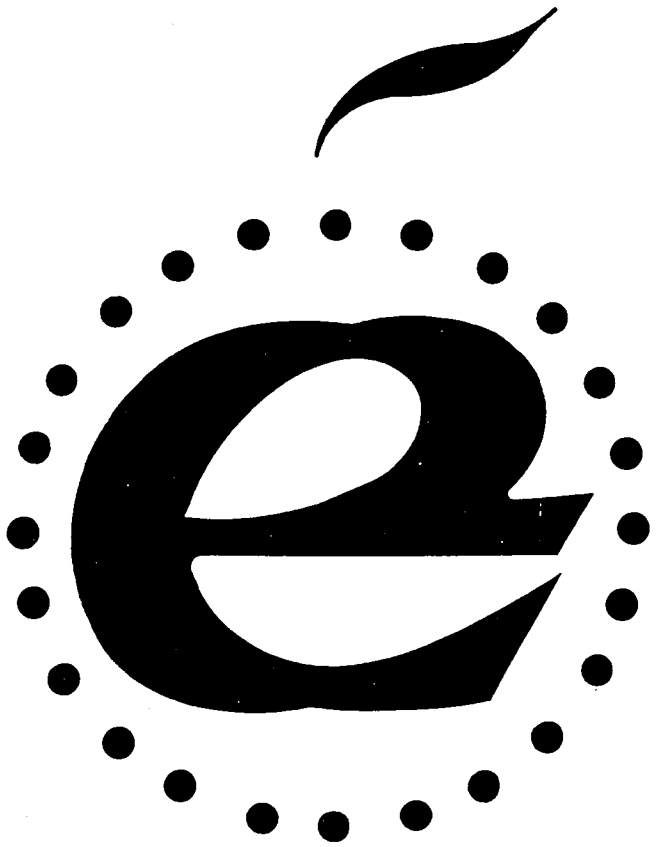

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ACKNOWLEDGEMENTS

The work and assistance in the field of Bernie Waldron, The National Parks and Wildlife Ranger, who gave unsparingly of his time and accompanied me on all field trips is gratefully acknowledged. Without this invaluable help, much time would have been lost searching for a convenient crossing point on the river or negotiating a pathway across the lake-beds. All the information on birds using the area and on local landuse was provided by the ranger.

Thanks are due to the following:

Mr. Martin Forde of Ballyhaunis Chamber of Commerce
Mr. Michael Sweeney of The National Parks and Wildlife Service.
The Waldron family who made me welcome in their home.

ECOLOGICAL SURVEY

of MANNIN and ISLAND LAKES,

BALLYHAUNIS, CO. MAYO.

Carried out on behalf of

Ballyhaunis Chamber of Commerce.

By Eigse Ltd., Environmental Services: Dr. M. Tubridy Mgr.
Innovation Centre.
Trinity College.
Dublin 2.

Author: Marie Dromey M. Sc.

December 1992.

CONTENTS

SUMMARY

Eigse was requested to carry out an ecological survey of the Mannin/Island Lakes area north of Ballyhaunis so that a decision could be made by the National Parks and Wildlife Service whether or not to designate the site an Area of Scientific Interest (ASI). The survey was carried out over four days in June and October 1992.

The solid geology of the area is mainly limestone and some eskers are present around the edges of the lake-beds. The Mannin/Glore River flows through the site and a raised bog, now cut-over, separates both lakes. During winter, the lakes are covered in approximately 15cm of water. Extensive grazing is carried out in some of the smaller fields on the slopes around the lakes while scrub has become established in others.

The lake-beds were drained 30 years ago and since that time a mosaic of vegetation habitats have become established on the shell marl of the original lake-beds. These are most easily seen from an aerial photograph. The most significant habitats include an extensive rich fen; nutrient-poor calcareous small lakes; ponds where Cladium mariscus (Saw Sedge) grows; wet meadows, calcareous grasslands and Hazelwood at the north west of Mannin Lake.

This combination of a range of wetland and other habitats with a good winter water depth makes the catchment attractive to a wide range of wintering waterfowl. Populations of five species reach levels which imply that their habitat is of National Importance while others are regionally important. Some threatened and vulnerable bird species found in the catchment are protected under Annexe 1 of the EC Bird Directive.

Otters, which are protected, are found on the site.

The local landowners have a positive attitude towards the proposed designation to ASI and have a good rapport with the local ranger of the National Parks and Wildlife Service.

The site can also be termed a local amenity in that it is of ecological interest throughout the year and very accessible.

Suggestions for defining a boundary to the proposed ASI are outlined and recommendations towards maintaining the ecological diversity listed.

The site should be designated an ASI on the basis of its size; the range and diversity of habitats within it and which are on the decline nationally; because of the important populations of ducks, swans, geese, Corncrake etc; because of the presence of otters which are protected and because of the positive attitude locally towards conservation.

2. INTRODUCTION

The Chamber of Commerce and local landowners have long been aware of the conservation value of the catchment around Mannin and Island Lakes which is just outside Ballyhaunis (Fig.1). A wish was expressed locally that the site be officially recognized under the Wildlife Act 1976. The National Parks and Wildlife Service advised that a study of the ecological and heritage value of the site be carried out. To this end, an initial independent assessment of the conservation value was commissioned. A preliminary report on the Management of the Environmental Heritage was submitted to the Chamber of Commerce, Ballyhaunis by Dr. M. Tubridy (1991) of Eigse. In this report she recommended the heritage resources within the site be evaluated in order to make a case for designation of the site as an Area of Scientific interest (ASI). In February 1992 a proposal for an ecological survey of the site was agreed between Eigse and Ballyhaunis Chamber of Commerce. The findings of that survey are contained within this report.

The objective of this study is to provide a basic ecological assessment of the area around the lakes to support the case for officially designating the catchment as an Area of Scientific Interest (ASI).

The study comprises of:
- a brief vegetation survey consisting of species records within the habitats,
- the compilation of natural history records from published and unpublished literature,
- the drawing up of a vegetation map,
- analysis of the wintering waterfowl populations,
- discussion of the some of the breeding bird species and other aspects of natural history.

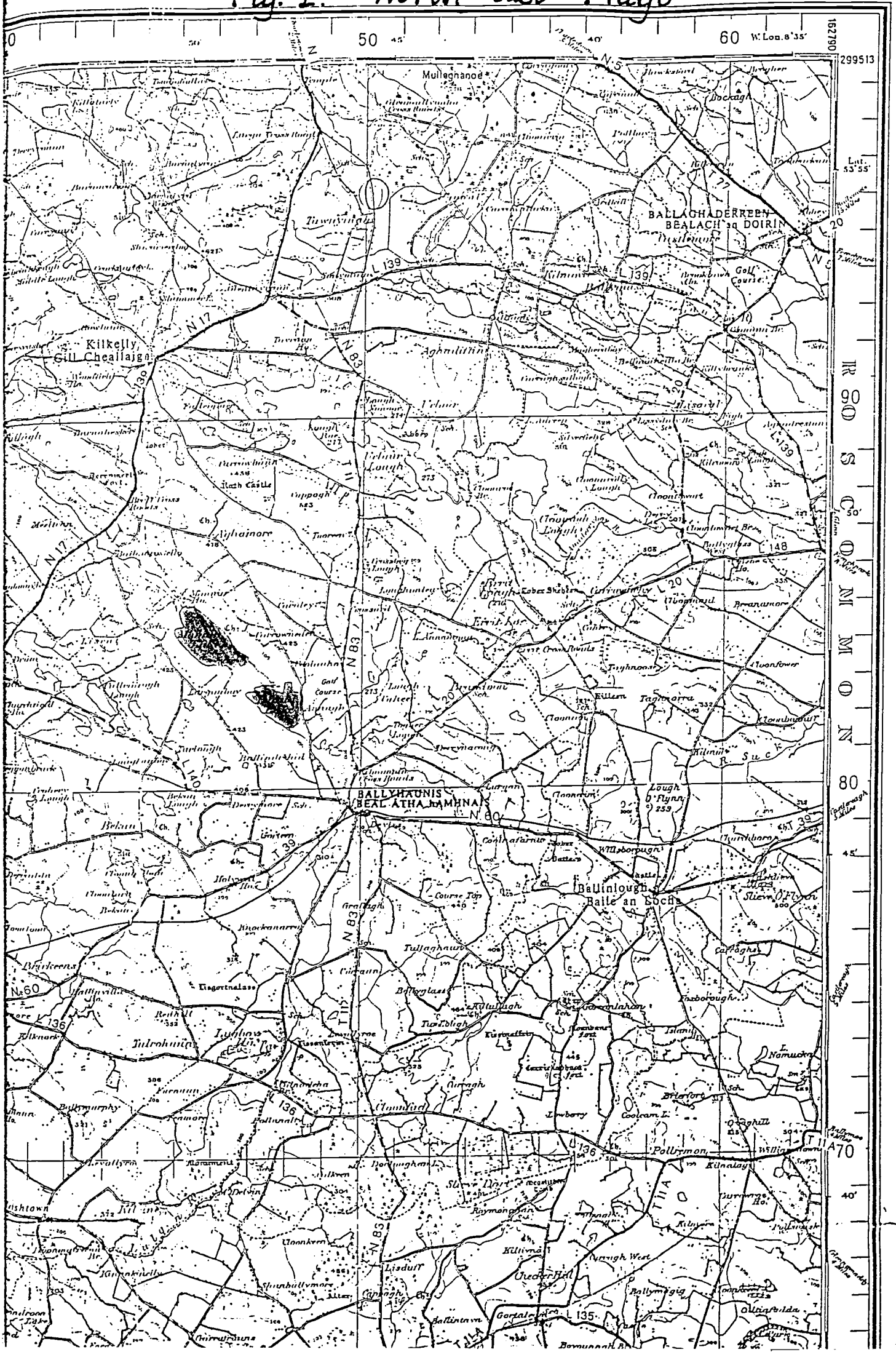
Guidelines towards boundary delineation of the proposed site are included with this report.

3. STUDY AREA

3.1 Size and Location

The study area is located in east Mayo approximately 3.5km north-east of Ballyhaunis. It consists of two lake basins, - Mannin and Island Lakes - which are linked by the Mannin/Glore River. The river flows in a north westerly direction and drains the site. It was arterially drained in the early 1960s. Both lakes lie in a wide valley between low hills. The higher ground gives way to lower ground along the east shore of Island Lake. Between both lakes is a raised bog now drained and cut-over.

Fig. 1. North east Mayo



The original lake-beds of Mannin and Island Lake are approximately 260ha and 285ha respectively. Prior to arterial drainage work carried out in the 1960s they were covered by water up to 1.8m deep (Ryan, 1982). At present, the lake area which is continually under water is greatly reduced (Fig. 3) but this does not detract from the conservation value of the site. Each winter, water levels increase to a depth of 15 - 30 cm over the lake-bed areas.

3.2 Geology

The solid geology around the lakes is mainly limestone with very small areas of sandstone occurring. The area is heavily glaciated with exposures of gravels at several points. Eskers occur to the south of the site at Ballyhaunis adjacent to the Ballyhaunis/Claremorris road and again directly north of Ballyhaunis. Along the south side of Island Lake and along the west of both, the topography is undulating, indicating gravely hills typical of glacial moraines. An exposure directly west of the lake shows sandy gravel thus confirming the nature of the underlying layers of material. The east of both lakes, particularly Island lake is lower and shows little undulation.

The composition of the lake beds is typical of that found in calcareous areas and consists of alternating layers of shell-marl and deep peat. (Ryan, 1982).

3.3 Landuse

Land surrounding the original lake basins - usually small fields - and the vegetation of the lake basin is generally grazed, particularly during the summer. The grazing, wherever it occurs around the lake edge, is extensive and the vegetation species-rich. Heavy grazing is carried out to a small extent on the higher slopes where some of the fields have been drained and fertilised. Nutrient enrichment of the lake-bed area by fertilizers etc. does not appear to be a problem. Dotted along the lake edge and on some slopes are meadows, rough grassland and fields reverting to scrub.

Shooting of ducks, in season is a local pastime but is not concentrated in any area of the catchment. Some land in the original lake-bed is unregistered. Permission is not required if people wish to shoot on it.

Small supplies of turf are harvested from the bog.

3.4 Water Supply

Both lake basins are fed by springs and seepage from the surrounding hillsides and are drained by the Mannin/Glore River. From observations of the vegetation type growing in the lakes, it appears that the water is nutrient-poor and low in pollutants reflecting extensive grazing practices, as noted in Section 3.3. Nutrient levels in the river may be higher. As the water quality of any freshwater system has important implications for the plant and animal communities which it supports, it should be studied. This is particularly true in order to determine if and where nutrients are entering the catchment.

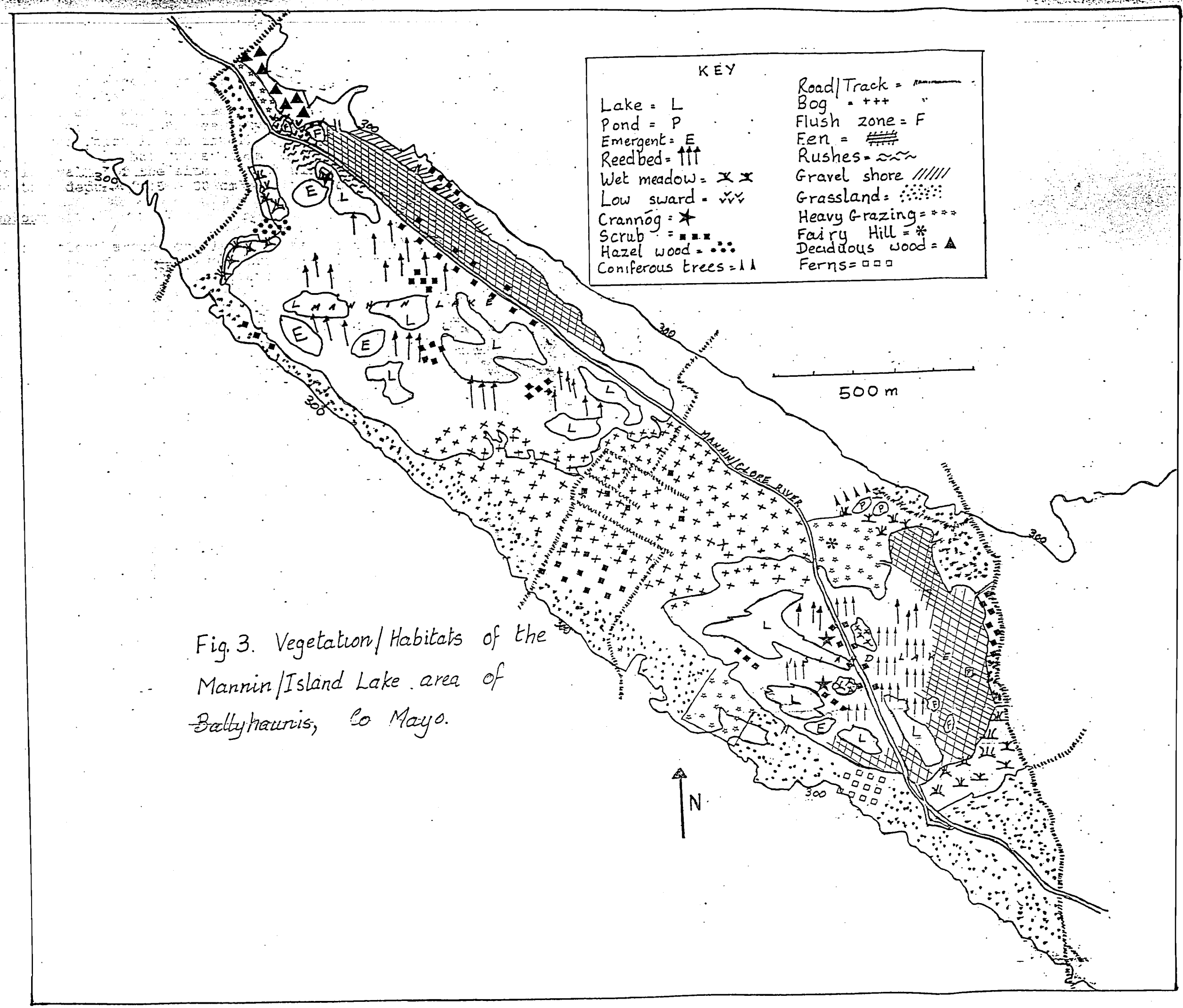


Fig. 3. Vegetation/Habitats of the Mannin/Island Lake area of Ballyhaunis, Co Mayo.

4. METHODOLOGY

4.1 Botanical Study

The site was visited on two occasions, each of two days, in early June and October 1992. During these visits, species presence/absence within many of the habitats was recorded. The county recorder of the Botanical Society of the British Isles (B.S.B.I.), i.e. the botanist who lists the plant species within each 10km square and who also notes the exact locations of rare and protected species, was consulted. Notwithstanding the limitations of time, the study has allowed an adequate assessment of the botanical importance of the site as most of the potentially interesting habitat types were seen during two stages of the growing season.

Results of the field survey combined with information provided by the wildlife ranger and from Ordnance Survey maps were used to prepare a vegetation map of the catchment.

4.2 Ornithological Study

Information on wintering waterfowl and some breeding bird populations of the area was provided by the local wildlife ranger. The Irish Wildbird Conservancy (IWC), The National Parks and Wildlife Services and relevant literature were also consulted.

4.3 Mammals and Invertebrates

Systematic recording of mammals and insects of the catchment were not taken. Some field observations were noted. Information on otters within the catchment was supplied by the ranger of the National Parks and Wildlife Service.

5. RESULTS

5.1 Botanical Survey

The habitats described in this section are well represented in the area and mapped on Fig. 3. A habitat describes the living place of a selected group of plant species growing together. Some habitats are very alike but can be distinguished by the dominance or presence of a particular species. Corresponding species lists for most of the habitats are given in Appendix 1. This list, comprising 175 vascular plant species and 8 mosses reflects the richness and diversity of the site. Twenty habitats are listed, 5 of which are water based, 9 found on dry land and the remainder transitional between the two. The terrestrial habitats are generally topographically distinct. However, vegetation overlap does occur especially between the transitional and aquatic communities as one habitat often grades into another. In such instances, the dominance of an indicator species distinguishes the habitat.

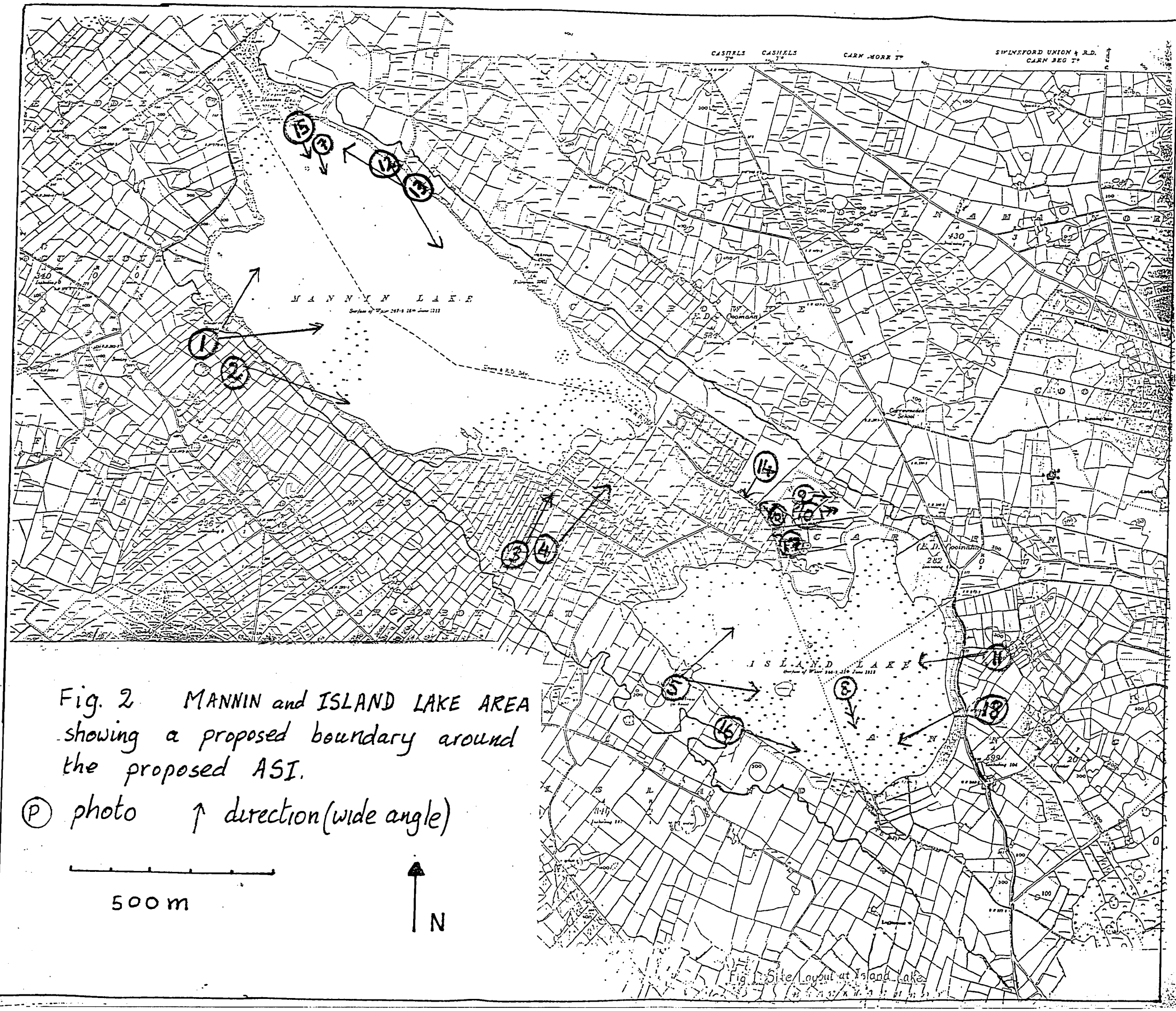


Fig. 2 MANNIN and ISLAND LAKE AREA showing a proposed boundary around the proposed ASI.

(P) photo ↑ direction (wide angle)

500m

N

Fig. 1 Site Layout at Island Lake

Aquatic Habitats

River (Plates 6,7 and 8)

The Mannin/Glore River flows in a north westerly direction through both lakes and the bog. It was deepened in the early 60s and now has steep edges. The flow in small stretches is quite strong but for the most part is predominantly slow. The river widens downstream in the vicinity of Mannin House. There is access to drinking water for cattle at the east bank at the northern end of Island Lake.

The canalised river supports species similiar to those found in the slow-moving canals of the calcareous plains of Ireland. Species common to both systems include Carex rostrata, Hippuris vulgaris, Alisma plantago-aquatica, Nuphar lutea, Potamogeton natans and others. In the River Glore, the diversity is quite high (Appendix 1). There are indications that a reed fringe is developing especially downstream. This will further add to the diversity as a new habitat will allow species not already present to colonise.

Ponds/Small Lakes (Fig. 3)

It was not possible to survey the vegetation of the small lakes found within the boundaries of the original lake-basins. The presence of a band of "quicksand" or very soft shell-marl around the lakes made access too dangerous. Abundant growths of Chara spp. were seen in these lakes.

There are three other small lakes near Island Lake. Two of these are at the north-east end (Plates 9 and 10). The third site is the excavated pond on the east of Island Lake (Plate 11). Detailed species lists were not recorded for the sites.

The two small lakes at the north-east end are fenced off from the surrounding grazing area and are of interest as the larger supports a stand of Cladium mariscus around its edge The C. mariscus is found in association with Phragmites australis, Carex rostrata and Menyanthes trifoliata. Mooney (1990), recorded a similiar but more extensive community around the margins of the Coolagh Lakes at the southern end of Lough Corrib - a lake similiar to Mannin and Island Lakes with deposits of precipitated marl overlying carboniferous limestone. O'Connell et al. (1984) recorded this association in Ireland from wetland habitats with a wide range in pH and nutrient-status. Mooney (1990), notes that this community has suffered considerable reduction within a north-west European context and is regarded as relict. There may be further bands of C. mariscus around some of the other small lakes.

The remaining pond, at the east of Island Lake has recently been excavated (Plate 11). There is no vegetation in it and the excavated marl deposited around the edges has dried out and is very hard. No vegetation is as yet growing on it.

Drains

A number of very shallow drains criss cross both original lake basins. Some, with a shallow depth of water support aquatic species while others, which were dry at the time of the visits, were dominated by sedges. The vegetation suggests lime-rich conditions and all the species found within the drains were found elsewhere in the catchment in more permanent habitats. A list of the species of the drains of Island Lake is given in Appendix 1.

Reedbed (Fig. 3 Appendix 1)

This is one of the more dominant habitats of the lake basins and occurs where winter flooding gives rise to water depths of approximately 20 - 30cm. An abundance of tall Phragmites australis reeds in association with Equisetum fluviatile, Mentha aquatica, Carex lepidocarpa, Angelica sylvestris, Ranunculus flammula, R. lingua and Scirpus lacustris make up this community.

O'Connell et al. (1984), describe a very similiar community as species-poor and note that where it is subject only to inundation during the winter, Agrostis stolonifera and Molinea caerulea may be important elements. Both these species are found in the reedbed zone of both lake basins within the catchment. Diversity is nevertheless low but was seen to increase around the edge of the reedbed zone where it merged into other wetland habitats.

Flushes (Fig. 3 Appendix 1)

There are many springs feeding both lake basins. These areas are easily identifiable in the field because the ground is wetter and softer. The vegetation, while somewhat similar in composition to the reedbed and fen zones found in the catchment, is dominated by Carex lepidocarpa, Mentha aquatica, and Hydrocotyle vulgaris in Island Lake. The vegetation of the surrounding reedbed, fen and swamp exert an influence on that of the flush. In contrast, Potamogeton coloratus and Chara spp. are found in the flush areas of Mannin Lake.

The differences in the vegetation of the flush areas of both lakes can, in part, be accounted for by their location. The largest flushes on Island Lake are very near the river at the south-east end and as noted above, are influenced by the surrounding habitats. The flush zones investigated at Mannin Lake were beside the very short sward of the shoreline vegetation at the north-east of the original lake basin section. Reed or fen vegetation is not present in the vicinity.

Transitional Habitats

Emergent/Marsh (Fig. Appendix 1)

The zonation continues from areas of permanently high water table to swamp/sedge marsh. There are many of these areas in the original lake basins as can be seen from a view of the mosaic of habitats (Plates 1 and 5). They appear dark green in colour. Not all were surveyed.

The areas are characterised by a dominance of Equisetum fluviatile in association with Cicuta virosa, Carex rostrata and other species such as Epilobium parviflorum and Juncus subnodulosus. This vegetation is very similiar to the Caricetum rostrate community of Carex rostrata, Equisetum fluviatile, Menyanthes trifoliata, Lemna minor and Mentha aquatica, described by O'Connell et al. (1984) and found to be frequent and widespread around Ireland.

Carex elata is growing at the south-east edge of the emergent vegetation near the crannog at the north-west area of Mannin Lake. The tussocky Carex elata is a frequent if rather fragmentary species on the shores of lakes and turloughs on Carboniferous limestone.

Juncus subnodulosus vegetation (Rushes. Fig.3)

There is a large stand of Juncus subnodulosus vegetation in the north-east end of the Mannin Lake site (Fig 3 , Plate 7). It was not surveyed in detail. It is a similar community to that described by Mooney (1990), found at Lough Corrib. Common to both is a substantial bryophyte presence consisting mainly of Calliergon cuspidatum; the presence of Molinia caerulea, Festuca arundinacea and large stands of Phragmites australis; the complete dominance of J. subnodulosus; and the fact that the two communities are found in depressions behind the reed zone.

Fen/Schoenus band (Fig. 3 Appendix 1.
Plates 11,12, 13 and 18)

This, along with the reedbed zone is the most dominant habitat of the lake basins. It is found all along the east of each and in smaller patches along the west. It is growing on shell-marl and is characterised by both the bryophyte and herb layers. According to O'Connell et al. (1984), diagnostic species of the Schoenus association characteristic of rich fens, include Campylium stellatum, Riccardia pinguis and Scorpidium scorpioides in the bryophyte layer and Carex lepidocarpa, Parnassia palustris and Pinguicula vulgaris in the herb layer. All these species are found in the fens of the present study area.

At the upper shore, there is a tussocky growth form of Schoenus nigricans and Molinea caerulea. Between the

tussocks, Cirsium dissectum, Epipactis palustris, Parnassia palustris and Pinguicula vulgaris have found a niche. The M. caerulea is a distinctive feature of a variant, recorded on carboniferous limestone of the west of Ireland, as described by O'Connell at al. (1984). Their species list is quite similar to that of the present study and listed above. However, Anagallis tenella, a diagnostic species according to them was not found in the present study. Species lists of similar communities described by Dierssen (1982) and Mooney (1990) had more in common with the findings of the present study. Good stands of Epipactis palustris feature in all three.

Within the Schoenus nigricans band of the present study, a zonation occurs between upper drier zone, a mid zone which is slightly wetter with mosses more abundant and a low zone where the water table remains at or above the ground surface throughout the winter and Carex lepidocarpa is abundant. The vegetation of this zone is very similar to that described for the flush area area.

Bog (Fig. 3 Appendix 1. Plates 3, 4 and 14)

A large area of the catchment between the two lakes consists of raised bog now drained and cut-over. The bog is criss-crossed by a network of tracks of imported calcareous material. Other habitats include drains, cut-away, bog scrub and transitional fen/raised bog at the lake margins. The species listed in Appendix 1 is typical of the whole bog and not any one habitat found within it.

In parts a Calluna vulgaris dominated vegetation is found with Eriophorum spp., Narthecium ossifragum, Erica tetralix, Vaccinium myrtillus, Drosera rotundifolia and Sphagnum spp., growing in association with it. In others, grass species such as Agrostis spp. and Molinea caerulea dominate, while in others Myrica gale in association with an under-storey of mosses dominates. Around the edges which are bordered by reed swamp, succession from swamp to fen to raised bog is taking place. Birch, willow scrub and ferns are growing in the drier areas. In the bog pools near the lake edge, Chara spp. in association with Utricularia spp. are growing.

Low Sward of Lake Edge (Fig. 3 Appendix 1)

This habitat is found at the lake edge beside Mannin House and results from light grazing. The three vegetation associations of grazed fen, marsh and calcareous grassland form an intricate vegetation mosaic (Plate 15). It is interesting from the point of view that this lightly grazed habitat can be compared with the ungrazed. It is very diverse but few flowering heads are present.

Wet meadow (west of Island Lake) (Fig. 3 Appendix 1)

There was only time to assess one area of wet meadow. It is a small raised section on the west side of the original lake basin of Island lake and is surrounded by wetter communities. It is characterised by meadow grasses such as Poa trivialis, Holcus lanatus, Anthoxanthum odoratum and Festuca spp. with small amounts of Molinea caerulea and Arrhenatherum elatius and herbaceous species such as Ranunculus acris, Filipendula ulmaria, Epilobium hirsutum, Angelica sylvestris and Rumex acetosa. The community is intermediate between the Filipendula ulmaria and Molinea/Arrhenatherum elatius and the Anthoxanthum odoratum/Rumex acetosa variant as described by Mooney (1990) and found around the shores of Lough Corrib.

Terrestrial Habitats

Wet grassland which phases into drier nutrient-poor grassland (Appendix 1)

Areas of wet grassland which phase into drier calcareous grassland were recorded from the west bank of both lake basins where esker-like deposits form low hills at the lake edge. Both areas support a very diverse though differing flora.

That at Island Lake is lightly grazed (Plate 16). Platanthera bifolia and other orchids grow on the grazed slope of the esker ridge while the wet area supports many low growing wetland species not found elsewhere in the catchment. Species found include Anagallis tenella, Lysimachia nemorum, Carex nigra, C. pulicaris, Eleocharis quinqueflora and Dactylorhiza spp.

At the Mannin Lake site, the wet grassland is somewhat similar to that described for wet meadow but is also influenced by the vegetation of the upper zone of the Schoenus band on the lake side of it. At the drier edge it merges into a very diverse calcareous community with Antennaria dioica and Polygala vulgaris as the characteristic species. This association was first described by Braun-Blanquet and Tuxen (1952) from the Irish midlands and Klein (1975) subsequently found it on the shores of Lough Ree.

Scrub along the river edge (Fig. 3 Appendix 1)

When the river was deepened the spoil was deposited on the banks, raising them above the level of the surrounding lake basins. This area does not become flooded in the winter. Willow and Birch now grow on these mounds along the river. Rushes such as Juncus acutifloris, J. effusus and J. subnodulosus as well as grasses such as Arrhenatherum elatius, Dactylis glomerata, Festuca spp. and Holcus lanatus grow in association with the willow.

Stony Shore (Fig. 3 Appendix 1. Plates 5,8 and 11)

This habitat is found along the north east shore of Mannin Lake on what was once the original lake shore. The vegetation is sparse but species-rich reflecting a calcareous influence. The community is very similar to that described for nutrient-poor grassland and found on the opposite bank. Along the edge of this gravel habitat, a diversity of scrub species including Birch, Willow, Alder and Hazel have established.

Heavily Grazed Rough Pasture (Fig. Appendix 1)

Much of the north east of the Island Lake site - between the original lake bed and bog - is drained and heavily grazed during the summer. It supports many of the species common to the ungrazed wet meadow and grazed field at the east of Island Lake. However, it differs from these communities in that this heavily grazed area supports abundant growths of the thistles - Cirsium arvense and C. vulgare - and abundant growths of Filipendula ulmaria, Plantago major and Urtica dioica (Plate 17). These species are indicative of heavily grazed and trampled pastures which have a very high input of nutrients.

The mound (Plate 17) is known locally as Fairy Hill. Tree/shrub species found on it include Crataegus monogyna. Prunus spinosa, Rubus spp., Salix viminalis and Sambucus niger. Between the mound and river is a large old spoil heap. Presumably, this spoil results from the dredging operations of the 1960s but a definite date is not known. The nutrients which would have been present in the spoil, have leached out by now. The vegetation presently growing on it is typical of lime-rich nutrient-poor soils and includes Carex flacca, Hieracium pilosella and Linum catharticum.

Rough Grassland (Appendix 1)

There is a patch of rough grassland which is being colonised by Bramble, Broom and Gorse, along the east of Island Lake. There is an interesting range and diversity which also includes calcareous species in the ground layer.

Other Terrestrial Habitats (Fig. 3)

The terrestrial habitats of Hazel Wood of the west bank of Mannin Lake, the deciduous woodlands around Mannin House, a stand of coniferous trees, the various crannogs, buildings and old walls within the catchment were not surveyed in detail.

5.2 Ornithological Survey

A diverse range of significantly large populations of wintering waterfowl use the catchment including Geese, Swans and 8 duck species. The duck numbers increase as the water level rises during the winter while numbers of Curlew, Golden Plover, Lapwing and Snipe decrease as they seek the drier areas of field and bog.

There are many breeding bird species using the site, some of which are listed in Table 1. The most significant is the corncrake which is threatened on a European and world wide level and is listed in Annexe 1 of the EC Bird Directive (79/409/EC), which offers protection to such species. Four males were heard during May and June of this year in the low sward area of Mannin Lake described in Section 5.1 and two were heard in the wet meadows along the west bank of Island Lake in 1991. Both sites offer ideal conditions for corncrakes - tall,lake edge wet meadow species (ungrazed) which supply cover and a food source. Both sites are grazed later in the year and this prevents scrub establishing and choking the wet meadow.

TABLE 1

List of breeding bird species found within the Mannin/Island Lakes catchment.

Mallard	Snipe
Curlew	Red-shank
Lapwing	Mute Swan
Black-headed Gull	Ringed Plover
Common Gull	Coot
Moorhen	Great Crested Grebe
Corncrake	Reed Bunting
Sedge Warbler	Heron

Other interesting bird species using the catchment include the Common Sandpiper, Peregrine Falcon, Hen Harrier, Barn Owl (in the ruins of Island House) and Ravens (in the deciduous woodland in the vicinity of Mannin House). The falcon, hawk and owl hunt the area and are Annexe 1 species because of their threatened and vulnerable status on a European and world wide level. There is a heronry in the Sycamores which grow on the largest crannog on Mannin Lake.

Counts of Wintering Waterfowl of the area have been carried out since 1980 and show little variation during that time (B. Waldron, Wildlife Ranger pers.comm.) Information on bird counts carried out in the catchment during 1991/92 and during the months September - December of this year is similar to that gathered for the previous ten years and was again supplied by the wildlife ranger (Table 1). Results for each species count are based on the average recorded during the winter months at the two lake basins. While the data in Table 1 applies to only two yearly counts the indications - based on comparisons of count numbers over twelve years - are that the populations are high and constant. This year the populations are significantly higher, probably due to very high levels of rainfall during November.

TABLE 1.

Qualifying Levels of Bird Populations required at Wetland Sites for International and National Importance. (Int. levels after Pirot et. al. 1989, and Smit and Piersma 1989). Average Numbers of Wintering Waterfowl at Mannin/Island Lakes site for 91/92 and full counts recorded during the winter months of 92/93 are given.

	INT.	NAT	1991/92	1992/93			
				Sept.	Oct.	Nov.	Dec.
Mute Swan	1800	70	20	N.A.	N.A.	N.A.	40
Whooper Swan	170	105	30	N.A.	N.A.	N.A.	62
Greenland W. Fronted Goose	220	115	70	N.A.	N.A.	N.A.	28
Wigeon	7,500	1,000	300	N.A.	N.A.	140	200
Teal	4,000	500	550	340	210	330	550
Mallard	20,000	500	1,000	650	185	650	1,070
Shoveler	400	50	20	N.A.	N.A.	43	30
Pochard	3,500	300	150	N.A.	N.A.	N.A.	86
Tufted Duck	7,500	200	70	N.A.	N.A.	N.A.	240
Goldeneye	3,000	100	20	N.A.	N.A.	N.A.	6
Golden Plover	10,000	1,000	1000	N.A.	N.A.	850	440
Lapwing	20,000	2,000	250	540	530	600	320
Snipe	10,000	?	500	350	355	154	84
Curlew	3,500	1,000	450	500	550	550	340
Pintail	700	50	N.A.	N.A.	N.A.	N.A.	26

N.A. means not applicable

Information on bird counts is supplied by B. Waldron Wildlife Ranger (after Sheppard, in press)

Table 1 also compares the numbers of wintering waterfowl of the catchment with the numbers required for designation of the site to National Importance (as defined by Sheppard in press) for a specific species. The populations of Teal, Mallard, Tufted Duck, Golden Plover and Snipe are probably of National Importance. However, information on yearly counts over a period of at least three years is necessary before the site can definitely be declared an ASI of National Importance. At any rate, Sheppard (in press) states that

"most sites in the Ballyhaunis group of lakes in Mayo and Roscommon could not be anything less than regionally important".

5.3 Mammals and Invertebrates

As noted in Section 4.3, there was no systematic recording of mammals or invertebrates. Otter spraints were seen along the river but particularly around the small ponds at the north east of Island Lake. Otter slides were seen around the lake edges and trails between them and the river indicate movement by the otters between lake and river.

A wide range of invertebrates were seen particularly, insects in the wet meadows and on marginal vegetation around the original lake-beds. There is a high diversity of plant species in the catchment supplying a range of host plants suiting various invertebrates and this combined with the fact that the area is free of herbicides and pesticides indicates the potential of the site for rare or even new Irish records of invertebrates.

6. DISCUSSION

6.1 Overall View

The wide range of habitats within the catchment are related and mutually complement each other. If stand-alone habitats were considered for ASI status, some would not qualify. Many habitats are distinguished representing aquatic, reedswamp, fen, transitional fen/raised bog, marsh/meadow, grassland and scrub/woodland vegetation in the catchment. It is the proximity of such a range of habitats supporting a wide species diversity that is a most important consideration in promoting the catchment to ASI status. 175 vascular plant species were recorded between the two visits. This is a very high number especially in view of the fact that all habitats seen and mapped were not recorded. Regular recording throughout the year would yield many more. The proximity of the habitats and their high diversity account for the large number and variety of wintering wildfowl using the site.

As a result of the drainage carried out 30 years ago the habitats/vegetation now tend to form mosaics or alternatively, gradual transitions - both structural and floristic - along hydrological gradients. Some communities are well defined eg. the fen band. Others such as the flush zone have few good character or even differential species while some communities appear as isolated pockets within a larger community.

It is difficult to define the boundaries of the vegetation communities found over such a large area when field work is only carried out on the ground. Aerial photography, supplemented with data collected on the ground achieves a

more accurate picture. Different hues of greens and browns in a photograph can be identified on the ground, classified, mapped and a species list given.

Throughout the catchment, no rare or protected species were found on the two occasions the site was visited. The potential for rarities does exist but it was not possible to survey all interesting habitats. A visit earlier in the year would probably yield some rare or protected species such as the Bee Orchid (Ophrys apifera), the Fly Orchid (O. insectifera) and the rare Bog-cotton. Many of the species that were found, while common throughout Ireland, have a restricted distribution due to the decline of their habitat. The member of the Botanical Society of the British Isles - Gerry Sharkey - who records the flora of east Mayo (vice-county 26), in 10km squares has not surveyed the area in detail but proposes to do so in 1993. Two new species records for east Mayo - vice-county 26 - were recorded during this study - Cicuta virosa and Epilobium angustifolium.

6.2 Habitats

The small lakes support abundant growths of Chara spp. and are typical of the Marl Lake Group as defined by Heuff (1984) in that they are high in calcium and apparently low to intermediate in nitrogen (very few macrophytes which require high amounts of nitrogen are present). They can therefore be classified as oligo-mesotrophic. Ducks and geese feed on the oospores of the lake charaphytes (Mooney, 1990).

The deepened canalised river flowing through the catchment appears to be enriched by nutrients. It supports large stands of Elodea canadensis, a plant requiring soils rich in mineral nitrogen (Ellenberg, 1979).

The large area of Schoenus dominated vegetation is described by Shimwell and Robinson (1992) as being the largest single stand in Ireland and more extensive than that at the southern end of Lough Corrib. Further interest in this community is generated by the existence of sub-communities within the base-rich fen - attributed to the fluctuating water levels. The fen area is not grazed thus ensuring that many species find a niche between the tussocks. The lack of grazing allows the bryophyte layer to thrive. Some of these mosses are used for feeding by the wintering bird population.

It is the natural progression for a marl lake to become overgrown by fen vegetation and eventually covered by a raised bog. The raised bog is partly drained and cut-over. However, at the junction of bog and lake, peat formation is ongoing. The developmental and climax vegetation of the bog can be seen in close proximity. Management will have to decide whether or not to employ remedial strategies to conserve this bog and enhance the ecological value of the catchment.

There is a range of grassland communities each reflecting different hydrological requirements. The management of these grasslands also varies - intensely, lightly grazed and ungrazed. A very high species diversity was found to occur on both the lightly grazed grassland and on the ungrazed wet meadow and gravelly soils. A wide range of insects were seen on and among the many flowers of the species-rich grasslands.

Also associated with the ungrazed grasslands is the colonisation by scrub species. Scrub is a valuable habitat in that it adds to the overall diversity of the site, provides food and cover for many birds and insects, defines the boundary of the catchment and will eventually develop into semi-natural woodland. However, there is always the possibility that the scrub, if allowed to spread over extensive areas, will choke out many of the other habitats. These other habitats - grasslands, rush communities, reeds etc. - provide food and cover for the wildfowl using the site and are already on the decline throughout the countryside as a result of drainage, reclamation and intensive agricultural practices. The structural element of the lake basin vegetation needs to be preserved.

There is little woodland except some small patches on the crannog sites and the dense Hazelwood at the north east of the catchment. They provide diversity to the overall site and are not normally associated with wetlands.

6.3 Birds and Animals

There are large numbers of wintering waterfowl using the catchment (Table 2). Five of these species reach Nationally Important populations. The number of Snipe recorded is quite high and it is interesting tho note that this figure is probably an underestimate as Snipe are very difficult to count. They have to rise from the ground to be seen and they only do this if disturbed at close quarters. The numbers of Swans, Pintail, Shoveler and Greenland White Fronted Geese are also quite high and sufficient to be of regional importance.

Other interesting bird species for which the site should be designated in order to offer them some protection include the Corncrake, Peregrine Falcon, Hen Harrier, and Barn Owl, (all Annexe 1 species). While numbers of these species are not high, the site is important as a hunting and breeding ground.

Many otters have been seen by the wildlife ranger as they move between river and lakes. They are on the decline in Europe and protected under the Bern Convention. Disturbance (they are very shy), loss of habitat, pollution and chemical weed control are the main reasons for this. The greatest threat to them in the catchment would be from the possible drying out of the remaining small lakes and disturbance.

Invertebrates in Ireland are generally under recorded and most surveys yield new Irish records. As this site has much of ecological diversity to recommend it, it probably supports many interesting invertebrate species. There was an abundance of colourful insects among the tall herbaceous plants. The Hazelwood should also yield a separate collection of species not normally associated with wetlands thus adding further to the diversity.

7. DEFINING THE BOUNDARY OF THE AREA OF INTEREST

This site may have to be protected from landuse in areas outside the catchment. There may be interference in the amount or nutrient status of any runoff from the surrounding hillsides and if further bog drainage is carried out. For this reason the slopes leading into the lake basins and the entire bog area may require inclusion in the site - regardless of the present ecological status of the actual slopes and bog.

On the slopes, the inclusion of the land as far as the field boundary just above the 300ft. contour line should be considered when deciding the overall extent of the area of interest. This is usually only one field away from the original lake-bed edge (Fig. 2). The many small fields on the slopes along the west and south sides of the catchment include lightly grazed fields, fields overrun by scrub and/or ferns, meadows and a few intensely managed fields. The inclusion of the lightly grazed fields and meadows in the site will increase its overall ecological value as well as going some way towards ensuring good runoff quality.

Intensely managed fields, though few, should not be excluded as they border the slopes of the lake edge. The landowners in the area have a positive attitude towards the proposed designation of the site and are aware that changes in their agricultural practices may be necessary (B. Waldron, Wildlife Ranger. pers. comm.).

Similarly, it is advised that all the bog within the confines of the 300ft. contour be included.

Where a road runs between the original lake-bed and the 300ft. contour line, it should define the site boundary.

A proposed boundary around the site is given in Fig.2.

However, before the boundary is defined, it is necessary that an assessment of each field along the proposed boundary line is carried out. Some original and mapped field boundaries may no longer exist while others may be new. Information can be gathered in the field on landuse and field boundaries and supplemented with further information from the relevant landowners. This will be a time-consuming task which will be rewarded by an indepth knowledge of the proposed ASI - inflows and their quality, outfalls, locations of breaks in boundaries, favourite nesting/feeding grounds of birds and animals etc.

8. CONCLUSIONS

The catchment/site has been arterially drained 30 years ago. Since that time, the ecology of the area has had a chance to recover and the resulting mosaic of habitats may be ecologically richer than the original lakes. The lake bed is still fed by springs ensuring that parts remain wet throughout the year and there is a depth of 5 - 15cms of water over the original lake-bed area during the winter. The canalised river running through the site is neither very deep nor wide so it does not severely drain the area. As the drains and outfalls fill in with time, the water levels in the catchment will rise. New drains should not be dug or existing ones deepened.

At present, the catchment is a good example of a large wetland with a range of distinct habitats which add diversity to the overall site. Though distinct, these habitats merge into each other according to hydrological requirements. It is this range of wetland communities supplying food and cover which attracts the very large numbers of wintering waterfowl.

Of themselves, the wetland habitats within the overall catchment are significant because they are declining in Ireland and throughout Europe as a result of drainage, reclamation and eutrophication. These habitats or vegetation communities include the rich fen which is reported as being the largest in Ireland, the nutrient-poor Chara lakes and the ponds with the relict Cladium mariscus community. Unimproved calcareous grassland, declining in Ireland as a result of intensification, adds diversity to the overall site. The presence of the Hazelwood and deciduous wood around Mannin House are not typical of wetland sites but add overall diversity to the catchment. Early flowering species and the invertebrates of the Hazelwood should prove interesting.

The catchment also supports Nationally Important populations of wintering waterfowl including Mallard, Teal, Tufted Duck, Golden Plover and Snipe. Significant populations of Swans, Pintail, Greenland White Fronted Geese, and Shoveler also occur. Some shooting is carried out in the catchment but does not seem to adversely affect the overall bird populations. If shooting were to intensify on a regular basis, there is the possibility that the birds would move elsewhere.

Corncrakes breed in the area and are protected under Annexe 1 of the EC Bird Directive (79/409/EC), which protects threatened or vulnerable European birds. Their preferred habitat is ungrazed wet meadow. Other Annexe 1 species found in the catchment include Peregrine Falcon and Hen Harrier which hunt in the site, the Barn Owl which roosts in the ruins of Island House and Greenland White Fronted Goose.

Otters were seen at the site as they move between river and lake. They are protected under the Bern Convention as a result of their European decline.

The site is very close to centres of population and is most accessible to schools. It is easily viewed from roads around the catchment. It is of ecological interest throughout the year - botanical during the summer and ornithological all year. It is also interesting from the point of view that an overall picture of the eskers (formed as a result of glaciation), in association with the lake and bog of the valley between them can be seen together in close proximity.

The proposed designation of the site to Area of Scientific Interest is the first step towards protecting its ecological value. The value is established by the diversity and richness of the habitats which are often on the decline, and the presence of protected otters and birds.

9. RECOMMENDATIONS

Guidelines towards the maintenance of the ecological diversity of the catchment include:

short term
- the filling of the pond at the east of Island Lake
- registering the land and not allowing shooting to any great extent. It could disturb the wintering waterfowl.
- no improvements to existing drains or digging of new ones. They would lead to water loss and the possible reduction in waterfowl numbers.

medium term
- continue with the bird counts of the wintering waterfowl as counts over a number of years are necessary to establish if bird-user numbers are constant.
- have a management plan drawn up which will take account of the best means of maintaining the ecological diversity of plants, birds, animals and insects while at the same time ensuring that the archaeological heritage and amenity value of the catchment is assured.
- get in touch with the county recorder of the Botanical Society of the British Isles. A further survey by him may yield rare and protected species, greater species diversity and possibly further new county records.
- encourage extensive grazing practices but do not eliminate grazing altogether. Grazing prevents competitive species dominating which would lead to a reduction in diversity and also prevents scrub from establishing.
- remove excess scrub where it is choking out diverse grassland habitats.
- define a boundary to the site. Each field has to be surveyed in order to establish whether the mapped boundary still exists or whether new boundaries have been established.
- carry out an ecological survey of thw Hazelwood
- carry out a study of the nutrient-poor Chara lakes

Plate 1. 11th October 1992. Looking across the northern end (from west to east) of Mannin Lake site. The original lake-bed, now covered in a mosaic of vegetation communities - reedswamp, fen, emergent, and wet meadow. The copse of trees is growing on a crannog. The Mannin/Glore River, flowing through the lake-bed is just behind it. Mannin House, surrounded by deciduous trees on the north east bank. Hazelwood is growing on the esker-like ridge jutting into the lake-bed. There are many small fields on the slopes of the east bank, the vegetation of which reflects varying intensities of landuse.

PLATE 2. 11th October 1992. Taken from the north west slopes of Mannin Lake, looking east across what was once the original lake-bed. Some fairly large lakes/ponds remain. Otters are frequently seen using these lakes/ponds and otter spraints are found on trails through the vegetation. The various wetland habitats of fen, reedbed, marsh, wet meadow etc. are represented by the different coloured vegetation types. Scrub is becoming established.

PLATE 3. 11th October 1992. Looking north east across the raised bog - now drained and cut-away in parts. This bog separates the Mannin and Island Lakes lake-basins. A fen stage, intermediate between lake and raised bog can be seen around the edge of the small lake. Scrub is becoming established on the bog.

PLATE 4. 11th October 1992. As for Plate 3 but looking east. The bog area between the two lake-basins is quite extensive. In the foreground, cattle graze some of the fields on the west slope of the catchment.

Plate 5. 10th October 1992. Taken from Island House, looking east across the original Island Lake lake-basin. Some ponds still remain. Around them, different wetland vegetation communities merge into each other. Scrub is also becoming established. Between the grazed fields and the wetland communities (in the foreground), a band of vegetation dominated by Festuca arundinacea (Tall Fescue-grass) is found.

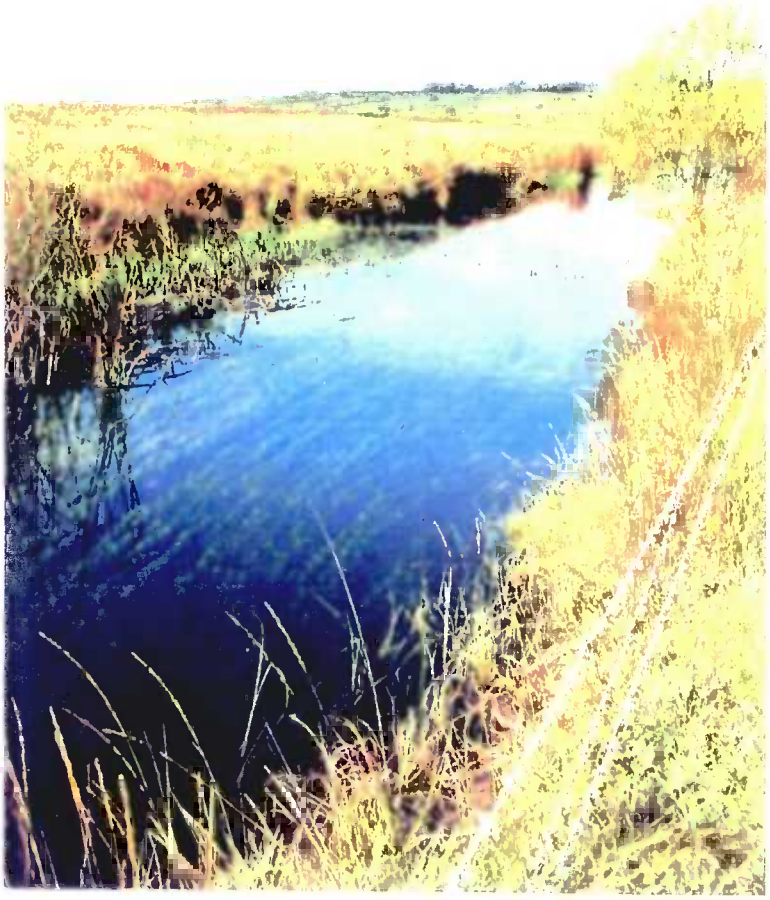


PLATE 6. 10th October 1992. North east of Island Lake site looking north north east along the Mannin/Glore River. Here it is dominated by Hippuris vulgaris (Mare's-tail). A reed fringe is beginning to develop.

PLATE 7. 11th October 1992. North east end of Mannin Lake site looking south south west along the Mannin/Glore River. Juncus subnodulosus (Blunt-flowered rush) dominated vegetation is found to the west of the river with an extensive reedbed and crannog to the south of it.

PLATE 8. 10th October 1992. Island Lade site looking south east. Scrub of Willow, Birch and Alder becoming established on the dry mounds - former spoil heaps - along the banks of the River Mannin/Glore. Coarse grasses and some wet meadow species grow in association with the scrub.

PLATES 9 & 10. 10th October 1992. Looking east at the north east end of the Island Lake site. One of two ponds, fenced off from grazing cattle. Cladium mariscus (Fen Sedge) is seen growing around the edge of the pond. Carex rostrata (Bottle Sedge), Equisetum fluviatile (Water Horsetail), Menyanthes trifoliata (Bog Bean) and Chara spp. (Stoneworts) are found in association with it.

PLATE 11. 10th October 1992. Looking west across the Island Lake site to the excavated pond at the east edge of the site. The dried shell-marl is very hard. West of the pond is the extensive are of Schoenus nigricans (Black Sedge) dominated vegetation. An interesting diversity of vegetation is found in association with it. Scrub is further west along the river banks. Island House is in the distance on the west bank.

PLATE 12. 11th October 1992. North east of Mannin Lake site looking south along the edge of the original lake-bed. The shore of the former lake is now a species-rich gravel habitat, including Anacamptis pyramidalis, Antennaria dioica, Carlina vulgaris and Centaurium erythraea. The extensive rich fen is dominated by Schoenus nigricans and Molinea caerulea.

PLATE 13. 11th October 1992. Taken from the east side of Mannin Lake site, looking north towards the deciduous trees of Mannin House. The vegetation in the foreground, is that of the drier upper zone of the rich fen. Cirsium dissectum grows in association with the Schoenus nigricans in the drier zone.

PLATE 14. 11th October 1992. Taken from the east bank of the River Mannin/Glore at the north east of the Island Lake site showing raised bog. The bog is found between the two lake-basins. Vegetation dominated by heathers and scrub is found on the drier sections along the river and drains. Wetter bog is found by the lake edge.

PLATE 15. 11th October 1992. Looking west at the north east of the Mannin Lake site showing a low, lightly grazed sward on the original lake edge. Remnants of calcareous grassland, fen and flush zones are found together. Westwards is the Mannin/Glore River and behind it, the crannog.

PLATE 16. 10th October 1992. Taken from the slopes on the west side of Island Lake, looking south east. The vegetation of the foreground is lightly grazed and supports a high species diversity. There is an extensive reed bed along the west side of the original lake-basin.

PLATE 17. 10th October 1992. Fairy Hill Mound and heavily grazed field at the north east of the Island Lake site. This field supports large populations of Cirsium arvense (Creeping Thistle). The Mannin/Glore River flows along the west side of the field.

PLATE 18. 10th October 1992. Taken from the road at the south east of Island Lake looking west. In sequence from east to west the vegetation of rough grassland, rich fen, flush zone, reedbed, scrub and in the distance, small fields can be seen as they merge into each other. Some of the small fields along the west side are lightly grazed, others dominated by ferns.

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APPENDIX 1

Species of some of the habitats found within the Mannin/Island Lake catchment in June and October 1992 (A = Mannin Lake, B = Island Lake).

LAKE	RIVER		DRAIN	REEDS		FLUSH		EMERG.		SCHOEN		LK.ED	BOG		SCRUB	W. MDW		CALC.		GRAVEL	FAI	RGH	
	A	B	B	A	B	A	B	A	B	A	B			B		B	A	B	A		B	B	
Achillea millefolium															X			X			X		
Agrostis canina													X										
A. capillaris													X										
A. stolonifera	X	X		X	X													X			X	X	
Alisma plantago-aquatica	X	X																					
Alnus glutinosa										X		X										X	
Anacamptis pyramidalis																	X		X				
Anagallis tenella																		X					
Angelica sylvestris				X	X	X	X			X	X					X							
Antennaria dioica													X				X		X				
Anthoxanthum odoratum													X			X	X	X					
Anthyllis vulneraria																						X	
Arrhenatherum elatius																	X						
Baldellia ranunculoides			X																				
Bellis perennis																		X					
Berula erecta	X		X																				
Betula spp.													X						X				
Blechnum spicant													X										
Brizia media												X					X	X	X		X	X	
Callitriche spp.	X	X	X																				
Calluna vulgaris													X										
Caltha palustris		X	X													X	X				X		
Cardamine pratensis					X	X	X				X							X			X		
Carex disticha																X							
C. elata								X															
C. flacca											X	X					X	X	X		X	X	
C. lasiocarpa				X	X	X	X																
C. lepidocarpa					X	X	X		X		X												
C. nigra																		X					
C. panicea						X	X				X	X					X						
C. pulicaris																		X					
C. rostrata	X	X	X	X		X	X	X	X				X			X		X			X		
C. sylvatica																	X		X				
Carlina vulgaris																			X			X	
Centauria nigra												X	X				X	X	X		X	X	
Centaurium erythraea																	X		X				
Cerastium fontanum												X						X			X	X	
Chenopodium album																						X	
Cicuta virosa								X	X														
Cirsium arvense															X						X	X	
C. dissectum										X	X		X										
C. palustre										X	X					X		X			X		
C. vulgare																					X	X	
Cladium mariscus																							
Cotoneaster spp.																				X			
Crataegus monogyna																				X	X		
Cynosurus cristatus												X						X	X		X		
Cytisus scoparius																						X	
Dactylis glomerata											X		X		X			X				X	

APPENDIX 1 cont.

Species of some of the habitats found within the Mannin/Island Lake catchment in June and October 1992 (A = Mannin Lake, B = Island Lake).

LAKE	RIVER		DRAIN	REEDS		FLUSH		EMERG.		SCHOEN		LK.ED	BOG	SCRUB	W. MDW	CALC.		GRAVEL	FAI	RGH
	A	B	B	A	B	A	B	A	B	A	B			B	B	A	B	A	B	B
Dactylorhiza fuchsii									X		X			X	X	X	X	X		
D. maculata													X							
D. incarnata											X									
Danthonia decumbens												X								
Daucus carota																X				X
Deschampsia caespitosa																		X		
Drosera rotundifolia													X							
Eleocharis quinqueflora											X						X			
Elodea canadensis	X	X																		
Epilobium angustifolium														X						
E. hirsutum															X					
E. parviflorum						X		X											X	
Epipactis palustris										X	X					X				
Equisetum fluviatile	X	X	X	X	X		X	X	X	X	X				X		X			
Erica cinerea													X							
E. tetralix													X							
Eriophorum angustifolium							X			X	X		X		X					
E. vaginatum													X							
Eupatorium cannabinum			X																	
Euphrasia spp.																X		X		X
Festuca arundinacea																X				
F. rubra						X					X	X		X	X	X			X	
Filipendula ulmaria					X	X	X					X		X	X	X	X		X	X
Galium palustre				X	X		X	X		X	X				X		X		X	
G. verum																X	X	X		X
Glyceria fluitans	X	X	X																	
Gymnadenia conopsea										X	X					X		X		
Heracleum sphondylium													X	X						
Hieracium pilosella agg.																X	X	X	X	
Hippuris vulgaris		X	X																	
Holcus lanatus							X				X		X	X	X	X	X		X	
Hydrocotyle vulgaris						X	X			X	X	X		X		X	X			
Hypericum maculatum																	X			
H. pulchrum													X							
H. tetrapterum														X	X		X			
Hypochoeris radicata													X				X		X	
Ilex aquifolium																			X	
Iris pseudacorus																X				
Juncus articulatus						X	X				X	X		X	X		X		X	
J. effusus														X	X	X			X	
J. subnodulosus				X		X		X		X				X			X		X	
Lathyrus pratensis															X					X
Lemna minor									X											
Leontodon autumnale												X				X		X	X	
L. hispidus											X					X				
Leucanthemum vulgare												X				X		X	X	
Linum catharticum										X	X	X				X	X	X	X	
Listera ovata											X					X		X		
Lolium perenne																			X	X
Lotus corniculatus												X	X			X	X	X	X	X

APPENDIX 1 cont.

Species of some of the habitats found within the Mannin/Island Lake catchment in June and October 1992 (A = Mannin Lake, B = Island Lake).

LAKE	RIVER		DRAIN	REEDS		FLUSH		EMERG.		SCHOEN		LK.ED	BOG	SCRUB	W. MDW	CALC.		GRAVEL	FAI	RGH
	A	B	B	A	B	A	B	A	B	A	B			B	B	A	B	A	B	B
Luzula campestris													X							
Lychnis flos-cuculi									X								X			
Lysimachia nemorum																	X			
Lythrum salicaria													X			X				
Mentha aquatica	X	X	X	X	X		X	X	X	X	X	X		X	X		X			X
Menyanthes trifoliata	X							X	X				X		X		X			
Molinea caerulea					X	X				X	X		X	X	X				X	
Myosotis scorpioides		X														X	X			
Myrica gale													X							
Myriophyllum spp.		X																		
Narthecium ossifragum													X							
Nasturtium officinale	X	X	X																	
Nuphar lutea	X	X																		
Odontites verna																			X	
Osmunda regalis													X							
Parnassia palustris				X						X	X	X				X	X			X
Pedicularis palustris							X	X	X	X	X									
P. sylvatica													X							
Phragmites australis	X	X		X	X		X		X		X			X	X				X	
Pimpinellia saxifraga																		X		
Pinguicula vulgaris						X	X			X	X	X					X			
Plantago lanceolata																X	X		X	
P. major																			X	
Platanthera bifolia													X				X			
Poa pratensis															X					
P. trivialis															X					
Polygala serpyllifolia												X	X							
P. vulgaris																X		X		X
Potamogeton coloratus		X				X														
P. natans	X	X																		
Potentilla anserina							X					X		X		X	X		X	X
P. erecta						X							X	X		X	X			
P. palustris								X			X		X		X		X			
P. reptans																		X	X	
Prunella vulgaris						X						X			X	X	X	X		
Prunus spinosa																			X	
Pteridium aquilinum													X							
Pulicaria dysenterica							X													
Ranunculus acris										X				X	X					
R. flammula			X		X	X	X	X	X	X	X			X			X		X	
R. repens												X		X	X	X	X		X	X
Rhinanthus minor											X					X				
Rosa spp.																		X		
Rubus fruticosus agg.													X					X	X	X
Rumex acetosa													X		X	X	X		X	
Rumex spp.																				X
Sagina nodosa						X														
Salix repens					X	X	X				X			X				X	X	
S. viminalis																			X	
Salix spp.													X							

APPENDIX 1 cont.

Species of some of the habitats found within the Mannin/Island Lake catchment in June and October 1992 (A = Mannin Lake, B = Island Lake).

LAKE	RIVER		DRAIN	REEDS		FLUSH		EMERG.		SCHOEN		LK.ED	BOG	SCRUB	W. MDW	CALC.		GRAVEL	FAI	RGH
	A	B	B	A	B	A	B	A	B	A	B			B	B	A	B	A	B	B
Sambucus nigra																			X	
Schoenus nigricans						X	X			X	X	X	X			X			X	
Scirpus caespitosis													X							
S. lacustris	X	X		X							X									
Senecio aquaticus					X	X	X				X	X		X			X		X	
S. jacobea																				X
Solidago virgaurea																		X		
Sonchus arvensis										X										X
S. asper																				X
Sparganium emersum	X																			
S. erectum		X	X					X												
Stachys palustris														X						X
Stellaria media																			X	
S. graminea													X			X	X		X	
Succisa pratensis				X		X	X			X	X	X	X	X		X	X	X	X	X
Taraxacum agg.															X					
Trifolium pratense																X	X			X
T. repens																	X			
Triglochin palustris						X	X			X	X									
Tussilago farfara										X	X							X	X	
Typha latifolia	X	X						X												
Ulex europaeus													X					X		X
Urtica dioica																			X	X
Utricularia spp.													X							
Vaccinium myrtillus													X							
Veronica beccabunga																			X	
Charaphytes					X	X	X						X							
Calliergeron cuspidatum										X	X									
C. gigantim				X	X					X	X									
Campylium stellatum										X	X									
Riccardia pinguis										X	X									
Scorpidium scorpioides										X	X									
Sphagnum palustre													X							
S. subnitens													X							
Fontinalis antipyretica		X																		