Biodiversity in Ireland

An inventory of biological diversity on a taxomomic basis.

Fauna

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Department of the Arts, Culture and the Gaeltacht.

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OVERVIEW

This report is first and foremostly a list of the fauna of Ireland. Included are the number of species known to occur in each group. This certainly can be considered incomplete as I have undoubtedly missed some species in my attempt to gather the information, and also by the fact, that a great many species have not been recorded as yet. Letters were sent to various people who work in different areas of the fauna. Because of the short notice of my communication and the short duration of this project, some replies have not been received as yet. If and when they do, they will be added to this report. In each group then, I have listed the interesting species as documented and from communications with people working in the area. I have also attempted to list some threatened species in the text, but the knowledge of this is very poor. Much work needs to be done to identify the threatened species and the precise threats which they are under. For the majority of the species which I have listed in the introduction as under threat or important, the information will have related, in the main, to work done a number of years ago. Things will certainly have changed, and will need to be reassessed by the professionals in the area. The Irish Vertebrate Red Data Book (Whilde, 1993) was an invaluable resource on the vertebrates in Ireland and certainly something similar needs to be done for the other animal groups. However, a Red Data Book can't be completed on fresh air, as our knowledge of the majority of groups is inadequate. Major surveys of the groups and an integrated approach to sharing this information would be of great benefit to this country. Conservation of habitat has a major role to play in the protection of the fauna, or parts of it at least, and this area seems to be developing in both the marine and terrestrial habitats. The flora and fauna of this country will undoubtedly become more important on an international scale as the years pass, but this isn't just a reference to an economic asset, but also an aesthetic one. From the literature checked, only about a dozen species were named as having become extinct and Whilde (1993) lists seven species of vertebrates that have been lost in Ireland. Although, relatively few, many species, of insects for example, have not been recorded in many years and their status is unknown. Many have undoubtedly declined in numbers and sites over the last century due to habitat fragmentation. It would not be unreasonable to conclude that species may have become extinct in Ireland, without our knowing.

INTRODUCTION

Red Data Book Categories

In the present text much reference is made to the Irish Vertebrate Red Data Book (Whilde, 1993), and in relation to these references the following terms, which are taken from that book, apply:

Extinct: Species not definately located in the wild during the past 50 years.
Endangered: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical low level or whose habitats are so drastically reduced that they are deemed to be in immediate danger of extinction.
Vulnerable: Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating.
Rare: Taxa with small populations that are not at present Endangered or Vulnerable, but are at risk.
Indeterminate: taxa known to be Endangered or Vulnerable or Rare, but where there is not enough information to say which of the three categories is appropriate.
Internationally Important: Taxa which are common and/or widespread in Ireland but are considered to be Rare or Threatened in the European Union.

Fauna

The faunal groups that occur in Ireland are listed along with the numbers of species that have been recorded for each. Note, however, that: (i) some of the groups were difficult to obtain information on, and the numbers provided are records of individual species that were present in the literature (indicated by ++) ; (ii) some groups (all marine) have the number of species that occur in the seas around Britain, Ireland and north-west Europe. This information was taken from the "Directory of the British Isles marine fauna" (Howson, 1987), and did not differentiate between Irish waters and that of other countries. The number of species in these groups may be an over estimate of the number in Irish waters (indicated by **.) (iii) in the list, there are groups of species which are undoubtedly underecorded (indicated by +).

	Phylum	**Major groups**	**Total species**
Kingdom Animalia			
Protozoa	(all groups)		614++
Mesozoa	Porifera		225
	Coelenterata		263
	Ctenophora		3
	Platyhelminthes	Turbellaria	107
		Trematoda	98+

		Cestoda	49+
Metazoa	Nemertea		39
	Nematoda		579++
	Nematomorpha		2
	Acanthocephala		13+
	Kinorhyncha		5
	Priapulida		1**
	Rotifera		315
	Chaetognatha		14
	Gastrotricha		3+
	Annelida	Polychaeta	342
		Oligochaeta	162+
		Hirudinea	14
	Pogonophora		15+
	Sipuncula		13**
	Echiura		6**
	Pentastomida		2
	Bryozoa		199
	Entoprocta		34**
	Phoronida		4
	Brachipoda		4+
	Mollusca		688
Arthropoda	Tardigrada		41
	Chelicerata	Arachnida	860
		Pycnogonida	19+
	Crustacea	Branchiopoda	82
		Ostracoda	207
		Copepoda	697
		Branchiura	2
		Cirripedia	29
		Malacostraca	767
	Myriapoda	Diplopoda	38
		Chilopoda	21
	Uniramia (Apterygota)	Thysanura	3++
		Diplura	6**
		Protura	5
		Collembola	203
	(Pterygota)	Ephemeroptera	34

	Plecoptera	19
	Odonata	22
	Orthoptera	15
	Dermaptera	2
	Psocoptera	45
	Mallophaga	98
	Anoplura	10+
	Hemiptera	843++
	Thysanoptera	5+
	Neuroptera	31
	Megaloptera	1
	Coleoptera	2100++
	Strepsiptera	1
	Siphonaptera	40
	Diptera	2,350++
	Lepidoptera	821
	Trichoptera	144
	Hymenoptera	586++
Echinodermata		73
Hemichordata		12**
Chordata	Urochordata	105**
	Agnatha	3
	Pisces	243
	Amphibia	3
	Reptilia	1
	Aves	161
	Mammalia	55

(Note for the Mammalia, that domestic breeds are not included.)

The total number of species on this list is 14,616. This number represents the number of species that have been recorded. It may not be close to the actual number of species in Ireland, when one considers the bacteria, protozoans, nematodes and some of the insect groups. If the Diptera (one order of insects) alone, are considered, this group was estimated to be represented by around 4,000 species in Ireland (Ashe *et al.*, 1988), but as yet only half of this number have actually been recorded.

The Irish fauna is said to be a depauperate British one. This in fact oversimplifies the situation. Ireland is a smaller island situated at the edge of western Europe, being influenced by the northern,

southern and Atlantic elements of the surrounding waters. The coastline is relatively long, and is longer than that of most European countries. Thus, the marine environment contains a very diverse array of fauna. Also, for its size, Ireland has a higher diversity of terrestrial habitats than some of the other European countries. This is due to the varied geology, and climate of the island. Some important habitats include: (i) the peat lands, of which Ireland has the highest number of raised bogs in Europe; (ii) the wetlands and aquatic systems, which are typical of our geology and climate, are important in the context of pristine environments; (iii) some specialist habitats, such as the karst limestone of the Burren, Co. Clare and the turloughs (non-permanent lakes) which are almost uniquely Irish. Because of such varied habitats, Ireland has a diverse freshwater and terrestrial fauna.

Some notable elements of the fauna

Endemic species are species that are only found in a certain area, such as an island, mountain or a country. Endemic species are of great interest and are often important within the context of conservation, both at the national and international level, because of their uniqueness. In Ireland, we have a number of endemic species:

(1) *Niphargus wexfordensis*, an amphipod (Crustacea), which was only recently recorded from Co. Wexford (from one deep well at present). This subterranean form was described as a new species and is distinctly Irish.

(2) *Margaritifera margaritifera durrovensis* (Mollusca), a form of the freshwater pearl mussel *M. margaritifera*, which may or may not be a separate species. However, *M. m. durrovensis* which is a hard water form is unique to Ireland. It is only recorded from part of the River Nore. In recent times the organism has suffered a major decline, and is on the verge of extinction (Moorkens & Costello, 1994).

(3) *Proteocephalus pollanicola*, a parasitic tapeworm (Platyhelminthes), is an intestinal parasite of the pollan (fish). This is the only known endemic helminth parasite species from freshwater fish in Ireland. It has been recorded from the pollan of Lough Neagh.

As well as truly endemic species, Ireland has a number of endemic subspecies on its faunal list. These include:

(1) *Niphargus kochianus irlandicus* (Crustacea: Amphipoda), which is a subspecies of *N. kochianus*. The subspecies is endemic to the limestone regions of central Ireland. This genera becomes especially interesting when the endemic species *N. wexfordensis* (mentioned above) is considered, as *N. wexfordensis* occurs in the limestone of Co. Wexford which is separated from the limestone of central Ireland. Thus, isolation may have caused the divergence of the species/subspecies in this genera.

(2) *Alosa fallax killarnesis*, a fish known as the "goureen" or Killarney shad, is a subspecies of the twaite shad, *Alosa fallax*. This subspecies is a unique, land-locked, dwarf form of the twaite shad and is only found in the Killarney lakes (Lough Leane and Muckross lake).

(3) *Coregonus autumnalis pollan*, a fish, known as the pollan, is a unique coregonid species. The Irish pollan population is the only one in western Europe, and is almost unique in being non-migratory and confined to freshwater lakes (*i.e.* land-locked). The Irish pollan has been shown to be identical to the Arctic Cisco species of Alaska.

There are also a number of distinctive bird sub-species present (permanently or in their migratory phase). These bird sub-species are:
(6) Greenland White-fronted Goose; (7) Light-bellied Brent Goose; (8) Mediterranean Shearwater; (9) Cormorant; (10) Bewick's Swan; (11) Teal; (12) Red Grouse; (13) Black-tailed Godwit; (14) Yellow Wagtail; (15) Dipper; (16) Coal Tit; (17) Jay.

A number of butterfly and moth species have distinct Irish subspecies:
(A) Butterflies:
The Burren form of the dingy skipper, *Erynnis tages baynesi*; the marsh fritillary forms, *Euphydres aurinia scotica* and *E. a. hibernica*; the Irish wood white subspecies is *Leptidea sinapsis juvernica* ; forms of the green-veined white are *Pieris napi fasciata* and *P. n. hibernica* ; the orange-tip of Ireland is a distinct subspecies *Euchloe cardarmines hibernica* ; Irish specimens of the meadow brown are known as *Maniola juetina iernes* ; Irish specimens of the large heath butterfly are *Coenonympha tullia scotica* and *C. t. polydama.*

(B) Moths:
The sandhill rustic, *Luperina nickerlii knilli* ; the Burren green moth, *Calamis tridens occidentalis*; the Irish subspecies of the poplar lutestring *Tethea or hibernica* ; the Irish subspecies of the commonly found muslin moth is known as *Cycina mendica rustica* ; the Irish subspecies of the grey moth, *Hadena caesia mananii*; three subspecies of the pod lover moth occur in Ireland, *Haedena lepida capsophila, H. s. suffusa* and *H. s. obsolescens*; the marbled green moth, *Cryphia muralis westroppi*, is an extremely variable moth, and a number of extreme colour forms have been collected from a few localities. *Euphyia bilineataisolata* was first recorded on Tearaght Island off the Blaskets and is also found on Inisvickillane, also off the Blasket Islands, Co. Kerry; the transparent burnet, *Zygaena purpuralis sabulosa*, occurs in a number of forms throughout Britain and Ireland, the subspecies is usually *Z. p. hibernica.*

Some other species also have interesting forms which are not classed as subspecies including:
(1) Brown trout, *Salmo trutta* : Analyses of Irish brown trout have demonstrated that genetically distinct populations occur within a single water body. For example, in Lough Melvin, Co. Sligo, there are three reproductively isolated populations known as the gillaroo, sonaghan and ferox forms of trout. L. Melvin is perhaps one of the last remaining examples of what may have been a widespread phenomenon.

(2) Arctic charr, *Salvelinus alpinus* : In the past a number of forms of this species of fish, from different water bodies were classed as separate subspecies. Dwarfed forms occur in Lough Finn, Co. Donegal and Lough Coomasaharn, Co. Kerry. The latter population is considered to be unique in Ireland and Britain.

Two subspecies that are found in Ireland and in other locations are:
(1)*Gammarus duebeni celticus* (Crustacea: Amphipoda) is a subspecies of *G. duebeni*. This subspecies occurs in Ireland and Brittany (France) only.
(2) *Mustela erminea hibernica*, the Irish stoat, is a subspecies that is found in the Isle of Man and Ireland only.

Other interesting species on Ireland's faunal list

A number of gastropods (Mollusca) have restricted distributions in Ireland. Such forms include the Kerry slug, *Geomalacus maculosus*, which is found in parts of west Cork and Kerry. Otherwise, it is found in parts of northern Spain and Portugal. The genus *Geomalacus* contains two species, both of which are confined to Iberia (northern Spain and Portugal), with *G. maculosus* occurring in Ireland also. Thus the world range of the species and the genus is restricted. Other species of gastropod that have a limited restriction in Ireland include: *Pomatias elegans*, *Oxychilus helveticus*, *Cochlodina laminata*, *Ashfordia granulata*, *Catinella arenaria*, *Semilimax pyrenaicus*, *Arion owenii*, *Vertigo pusilla*, *V. moulinsiana*, *V. lilljeborgi*, *V. geyeri*, *V. angustior* and *Viviparus viviparus*. Four of the five *Vertigo* species above that are listed in The British Red Data Book list (Bratton, 1991).

Austropotamobius pallipes, the freshwater crayfish (Crustacea) is relatively common in Ireland, but the species has been devastated in Britain and Europe due to an introduced fungal disease. Although the disease has occurred in Ireland, the effects have been less severe than in Britain and Europe. The Irish populations probably represent the largest in Europe. *Bufo calamita*, the natterjack toad (Amphibia), is Ireland's only toad and rarest amphibian. It is found in only one small region of Co. Kerry. The numbers of the species have declined in recent years. All the species of bat (Mammalia) are an important part of Ireland's fauna. Of the seven species in the country, Ireland has the highest national population of the lesser horshoe bat (*Rhinolophus hipposideros*) and Leisler's bat (*Nyctalus leisleri*) in Europe.

A number of species of spider (Chelicerata: Aranae) have a limited distribution in Ireland: *Hyptiotes paradoxus*, *Sitticus floricola*, *Dipoena melanogaster*, *Baryphyma duffeyi*, *B. gowerense*, *Carorita paludosa*, *Porrhomma rosenhaueri*, *Centromerus persimilis*, *Tegenaria gigantea* and *T. atrica*. A number of millipedes (Myriapoda: Diplopoda) species are distributed mainly in Ireland and Britain. Examples include *Nanogona polydesmoides*, *Ophyiulus pilosus* and

Chordeuma proximum. Outside of Ireland, the latter species is only known from Britain and France.

Certain species of insect are regarded as sensitive indicator species, i.e. they typify clean water conditions (unpolluted). Examples of such species in Ireland include the mayflies of the genus *Ecdyonurus* and *Rhithrogena*, and stoneflies such as *Perla bipunctata* and *Dinocras cephalotes*. The mayfly, *Ameletus inopinatus*, had only been recorded from a mountain stream in Co. Wicklow, to 1995, but has since been recorded at a site in Donegal. The glacial relict populations of the stonefly species *Capnia atra* and *Diura bicaudata* and the stream populations of *Dinocras cephalotes* are important elements of the Irish fauna.

The Irish damselfly, *Coenagrion lunulatum* (Insecta: Odonata) is a northern European species that was recorded from Ireland in 1982. This represented the first recordedord of the species in Britain and Ireland. In Europe the species is in decline due to pollution and drainage. The water bug, *Sigara fallenoidea* (Hemiptera: Heteroptera) is not found in Britain, but occurs in Canada. The Irish distribution is quite distinctive as the species is confined to a number of lakes.

Some beetles (Insecta: Coleoptera) have a restricted distribution in Ireland. Examples include *Carabus clatratus* (relict species); *Hygrotus quinquelineatus; Hydroporous scalesianus; Graptodytes species; Laccornis oblongus* (this species occurs inland in Ireland, but is normally a coastal species in Britain, and one of the best areas in Europe for this species is near Mullingar); *Noterus crassicornis* (relict species); *Atheta picipes*, *Gyrophaena strictula*, and *Aloconota sulcifrons* (which are typical of well developed woodland); *Micropepulus caelatus* ; *Pyropterus nigroruber* (part of Ireland's old forest fauna); the ladybird *Hippodamia tredecimpunctata* (one recent Irish record, and is possibly extinct in Britain; the click beetle *Selatosomus melancholicus* (which is not found in Britain); *Otiorhynchus auropunctatus, Barypeithes curvimanus, Caenopsis fissirostris, C. waltoni* and *Anthonomurus brunnipennis* are species of curculionid beetle that are present in Ireland, but have limited ranges in Europe.

Some interesting Diptera (Insecta) in Ireland include: *Antichaeta brevipennis* (recently recorded and is on the British Red Data Book list of threatened insects); *Dicranota guerini* and *D. lucidipennis* which are notable species (because they may indicate, where found, sites of conservation value); *Dixella attica; Machinus cowini* (a relict of some sandy soil scrub biotope); *Boreoclytocerus tonnoiri* (a rare species recorded from one site in Ireland and one in Britain); *Mormia satchelli* (recorded from Kildare, with a site in Germany being the only other location in Europe); *Atrichobrunettia angustipennis* (a member of possibly the rarest genus in Europe, which has been recorded from Ireland); *Xylophagus ater* (relict species of ancient woodland).

The butterflies and moths (Insecta: Lepidoptera) of Ireland contain many interesting forms which are local races of a species. This group is also important in the wider European context, because of threats to species there. Three species of caddis fly (Insecta: Trichoptera) that are recorded in Ireland, are unknown in Britain. Another species, *Limnephilus pati*, recorded in Ireland for the first time during 1995, is a species that is very rare and threatened in Europe. In Ireland, the species is known from three counties.

Thus, Ireland has many interesting species, with the above only touching on some of the important ones. For nearly all groups, it is difficult to give a synopsis of what are the important species in an Irish context. However, there is no doubt, that there are many. In Appendix I, a list of marine fauna and biotopes which are considered to be of conservation interest is given (this information was supplied by BioMar, Trinity College, Dublin and Dr E. Sides, National Parks and Wildlife Service, Dublin). In Appendix II, there is a list of threatened beetles (family Carabidae) and dipteran flies (of five families) (this information was supplied by Dr M. Speight, National Parks and Wildlife Service, Dublin). The Irish Red Data book on vertebrates (Whilde, 1993) details the status of the fish, amphibians, reptile, birds, and mammals which are considered to be under threat in Ireland. This publication was an is an invaluable step in conservation in Ireland, and is indicative of the need for Red Data books on the invertebrates or certain groups of invertebrates.

Threats to the fauna

Firstly, there are a number of general threats which affect all members of the fauna, either directly or indirectly. They are listed below. After this, from the material available, threats specific to groups or species are listed.

Habitat loss

The loss of our forests throughout the last few thousand years, and particularly in recent centuries, exhibit how a habitat can be lost. There is no doubt, that a major part of the associated woodland fauna, was also lost. Presently, 8% of the country is forest cover, which is the lowest in Europe (EPA, "State of the Environment in Ireland", 1996 publication). With few exceptions, the bulk of the native terrestrial fauna has suffered range contraction and fragmentation. This has been due, in large measure, to the habitat loss and to the impacts of an increasingly mechanised agricultural system over the last 2,000 years, and particularly in the last one 100 years or so. In present day Ireland, agricultural land constitutes by far the greater part of the terrestrial environment. Land reclamation and development is a major threat to the existing non-agricultural habitats that occur in Ireland. Ireland has the best remaining raised bogs in Europe, whilst also having a number of turlough habitats which are more or less unique to this island. There is a very diverse fauna associated with the different habitat types in Ireland, and therein lies the key to species diversity, which is habitat diversity. Monoculture is the opposite of diversity. Overgrazing of the peatlands,

heathlands and coastal habitats is also a threat in Ireland today. As well as causing the loss of characteristic species, the accelerated erosion of peat can also cause problems in the aquatic environment (affecting the chemistry and sediment in the water).

Pollution

Ireland's estuarine and coastal waters directly receive around four fifths of the country's sewage and industrial waste water discharges, as well as agricultural and other wastes carried down by the rivers. The pollution of inland waters is caused mainly by incorrect disposal of farmyard slurries, sewage and industrial effluent. These liquid wastes contain large quantities of organic matter, nutrients, metals and persistent substances. The organic matter can deplete the oxygen in the water, while the nutrients cause eutrophication. In the freshwater aquatic systems, salmonid waters can be seriously affected. The result is that the diversity of a system decreases. Salmonid species such as Arctic charr and brown trout are very sensitive to oxygen levels and hence are the first fish species to leave a system. At the macroinvertebrate level, pollution causes many changes, as firstly, the most sensitive species of the insect groups (for example stoneflies) disappear as they cannot tolerate the changes in the water. Other pollution forms include chemical and oil. Chemical treatment of timber in buildings is known to affect bats. Herbicides and insecticides affect not only the intended pest species, but also other harmless insect species, and higher up the food chain, animals such as the grey partridge and barn owl are affected. Oil pollution is a threat to the marine environment and its associated fauna. Spillages at sea, although modern day clean ups are fast and effective, pose a major threat to the coastal and littoral fauna.

All groups represented in our fauna are affected by pollution. It is not only the larger birds, fish or mammal species, but also the invertebrate groups. In fact, once the latter is affected, it follows that the vertebrates will be affected in some way or other, whether as a direct result of the pollution or indirectly because of dependence on the invertebrate fauna. If one considers the plight of the freshwater pearl mussel, *Margaritifera margaritifera durrovensis*, and summise that the species has declined due to overfishing or pollution. A part of the picture, that is missed is the dependence of this species on other species. *M.margaritifera* larvae (known as glochidia) are parasitic on the gills of salmonid fishes. Thus if a river loses its salmonid species (whether by pollution/angling pressure), then it follows that the larvae will not survive and the species in that particular location will not survive either. In fact no species can be looked at in isolation, as all are dependant on another species, whether it be flora or fauna. A species which affects all others around it, by its presence or absence, is known as a key species. These species are a very important part of a community.

Introduced species

The spread of introduced species is usually at the expense, and may even cause the extinction of native species. Throughout the history of the island, man has introduced species which were

beneficial to him. Neolithic man introduced the domestic animals, such as goats, sheep and cattle. This continued to modern times where many mammal and fish species have been introduced, mainly as sport species. The effects of introduced species such as these can be seen today, the feral goats having been derived from the introduced species, the fish and game species are now widespread (such as the pike in inland waters and rabbits in terrestrial systems). However, along with the deliberate introduction of species, there have also been some accidental introductions. One of the most recent arrivals is the New Zealand flatworm, *Artioposthia triangulata*, which has the potential for causing widespread ecological damage as it appears to prey selectively on the native earthworms. This species, was recorded in Northern Ireland in the early 1960's and has become widespread there. It has also extended its range to the south and has been recorded from west Cork, Kildare, Dublin, Kilkenny, and Galway, as well as some of the more northern counties. Trading in plants may well have been the source of its original introduction and subsequent spread in this country. Because it feeds on earthworms, which are vital to soil fertility, nutrient cycling and the breakdown of organic matter, *A. triangulata* may pose a serious threat to Irish agriculture. The free movement of trade in shellfish throughout the European Union can result in the introduction of exotic pest species as well as diseases to shellfish in Ireland.

Disturbance and noise

Disturbance and noise are one of the environmental pressures from recreational activities, which may affect the fauna of a given area. Examples include the disturbance of breeding birds and the disturbance of hibernating bats.

Specific threats to groups or species

From the above, it is true to say that independent of group, the major threats facing the fauna of Ireland today are habitat loss and/or pollution. Whilde (1993) has listed the major threats to the vertebrates, whilst some of the threats to individual species of non-vertebrates is included in other literature such as the British Red Data Books.

Group	**Threats**
Phylum Chordata	
Class Mammalia	
Whiskered Bat, *Myotis mystacinus*	Chemical treatment of roof timbers / pointing of bridges / disturbance / insecticides and pesticides / agricultural intensification.
Natterer's bat, *Myotis nattereri*	Habitat destruction / chemical treatment of roof timbers / disturbance / insecticides and pesticides / agricultural intensification.

Lesser horshoe bat, *Rhinolophus hipposideros*	Loss of summertime sites / disturbance during hibernation.
Daubenton's bat, *Myotis daubentoni*	Pointing and reinforcing of bridges.
Leisler's bat, *Nyctalus leisleri*	Exclusion from roosts.
Pipistrelle, *Pipistrellus pipistrellus*	Exclusion from roosts.
Brown Long-eared bat, *Plecotus auritus*	Deliberate exclusion / loss of feeding areas (woodland).
Pine Marten, *Martes martes*	Loss of woodland / hunting.
Ship rat (or Black rat), *Rattus rattus*	Deliberate extermination.
Class Aves	Habitat destruction (drainage, pollution) / disturbance / pesticide contamination / egg collecting / predation / human pressures (land-use and agricultural practices changes; hunting).
Class Amphibia	
Natterjack toad, *Bufo calamita*	Habitat destruction (drainage, pollution, land development) / sea water encroachment / pond dessication / storm destruction of sand dunes / livestock trampling / fish predation.
Class Pisces and Agnatha	
Sea Lamprey, *Petromyzon marineinus*	Pollution / barriers to migration.
River Lamprey, *Lampetra fluviatilis*	Pollution / arterial drainage activities.
Brook Lamprey, *Lampetraplaneri*	Pollution / arterial drainage activities.
Allis Shad, *Alosa alosa*	Pollution (including thermal) / barriers, dams.
Twaite Shad, *Alosa fallax fallax*	Pollution / barriers to migration.
Killarney Shad, *Alosa fallax killarnesis*	Pollution in Lough Leane.
Arctic Charr, *Salvelinus alpinus*	Continued deterioration of water quality / competition with brown trout and cyprinids / rearing of juvenile salmon in freshwater cages.
Pollan, *Coregonus autumnalis pollan*	Continued habitat deterioration / competition with cyprinids.
Smelt, *Osmerus eperlanus*	Estuarine and coastal pollution.
Atlantic Salmon, *Salmo salar*	Overfishing.
Phylum Coelenterata	Lagoon species may be prone to pollution or dessication due to high summer temperatures.

Phylum Bryozoa

Lophopus crystallinus (freshwater)	Habitat loss / water pollution / increased turbidity / loss of submerged aquatic plants.

Phylum Mollusca

Molluscs inhabit the terrestrial, freshwater and marine environments. They occupy a variety of habitats, depending on the species, and so any change to the habitat may affect them. Aquatic species will be affected differently by pollution depending on their sensitivity and tolerance. The following is a very small selection of the species and their threats. They are all terrestrial except for the freshwater mussel forms.

Class Bivalvia

Freshwater pearl mussel

(i) *Margaritiferamargaritifera*	River pollution / overfishing / silt loading from dredging / loss of salmonids.
(ii) *Margaritifera margarariti feradurrovensis*	River pollution / overfishing / silt loading from dredging / loss of salmonids.

Class Gastropoda

Catinellaarenaria	Drainage / habitat disturbance.
Succinea oblonga	Habitat disturbance.
Vertigo moulinsiana	Fen drainage / river management schemes / habitat disturbance.
Vertigo lillejeborgi	Drainage / acidification / raising of water level.
Vertigo geyeri	Habitat change.
Vertigo angustior	Drainage / any disturbance to the hydrological conditions.

Phylum Myriapoda	Destruction of woodland / agricultural intensification.

Phylum Crustacea

Order Mysidacea: *Mysis relicta*	Eutrophication / other forms of water pollution.
Order Isopoda: *Armadillidium pictum*	Removal of rock.
Order Amphipoda: *Gammarus insensibilis*	Pollution / reclamation / dessication.
Niphargus wexfordensis	Pollution of ground water (including sewage).

Phylum Chelicerata

Subphylum Arachnida

Order Pseudoscorpiones

Neobisium carpenteri	Alteration of land use / marine pollution.

Order Aranaea

Sitticus floricola	Eutrophication of moss.

Baryphyma duffeyi	Drainage / reclamation of marshes.
B. gowerense	Drainage / reclamation of marshes.
Caroritapaludosa	Drainage.
Porrhommarosenhaueri	Microclimate in its cave habitat.

An interesting point about the spiders is that in the British Red Data book (invertebrates other than insects), spiders accounted for 86 of the 144 species listed.

Phylum Arthropoda

Subphylum Unirmia

Class Insecta

Order Ephemeroptera	Eutrophication / other forms water pollution.
Order Plecoptera	Eutrophication / other forms water pollution / dams.
Order Odonata	Drainage / pollution.
Order Hemiptera: Suborder Heteroptera (aquatic forms)	Eutrophication / Habitat loss.

Order Coleoptera

There are a great variety of beetles, and depending on the type of habitat that they live in, will face different pressures. The following is a list of a very small number and their threats.

Chlaenius tristus	Drainage.
Graptodytes species.	Drainage / habitat loss.
Atheta picipes	Loss of dead trees, tree stumps, and their associated fungi.
Pyropterus nigroruber	Loss of dead wood for their larvae.

Order Diptera

This group also contains a huge variety of species facing a great variety of pressures. The following are three from a total of over 2,000 species.

Dixellaattica	Habitat change.
Machinus cowini	Sand dune disturbance.
Xylophagus ater	Loss of old woodland and pasture woodland.
Order Lepidoptera	Habitat loss.
Order Hymenoptera	Habitat loss.

Phylum Echinodermata

The purple sea-urchin, *Paracentropus lividus* Overfishing.

Species listed in EU and International Agreements

The table below shows the species which are listed in the Bern Convention, EU Habitats Directive, EU Birds Directive or which are protected in Ireland.

	EU Habitats Dir. (Annex)	Bonn Conv. (Annex)	Bern Conv. (Annex)	Ireland
MAMMALS				
Whiskered bat *Myotis mystacinus*	IV		II	P
Natter's bat *Myotis nattereri*	IV		II	P
Lesser horshoe bat*Rhinolophus hipposideros*	II, IV		II	P
Daubenton's bat *Myotis daubentoni*	IV		II	P
Leisler's bat *Nyctalus leisleri*	IV		II	P
Pipistrelle bat *Pipistrellus pipistrellus*	IV		III	P
Brown long-eared bat *Plecotus auritus*	IV		II	P
Hedgehog *Erinaceus europaeus*	III			P
Irish hare *Lepus capensis*	V		III	
Pine marten *Martes martes*	V		III	P
Badger *Meles meles*	III			P
Otter *Lutra lutra*	II, IV		II	P
Common seal *Phoca vitulina*	II		P	
Grey seal *Halichoerus grypus*	II		P	
Porpoise *Phocaena phocaena*	II		II	P
Bottle nose dolphin *Tursiops tursiops*	II		II	P
AMPHIBIANS				
Natterjack toad *Bufo calamita*	IV		II	P
Common frog *Rana temporaria*	V		III	P
FISH				
Sea lamprey *Petromyzon marineinus*	II		III	
River lamprey *Lampetra fluviatilis*	II, V		III	
Brook lamprey *Lampetra planeri*	II		III	
Sturgeon *Acipenser acipenser*	II		II	
Allis shad *Alosa alosa*	II, V		III	
Twaite shad *Alosa fallax fallax*	II, V		III	
Killarney shad *Alosa fallax killarnesis*	II, V		III	
Pollan *Coregonus autumnalis pollan*	V		III	
Atlantic Salmon *Salmo salar*	V		III	

MOLLUSCS				
Kerry slug *Geomalacus maculosus*			II	
Freshwater pearl mussel *Margaritiferamargaritifera*	II		III	
Vertigo angustior	II			
Vertigo geyeri	II			
Vertigo moulisiana	II			
CRUSTACEANS				
Freshwater crayfish *Austropotamobius pallipes*	II		III	P
BUTTERFLIES				
Marsh fritillary *Euphdryas aurinia*	II		II	

	EU Birds Dir. (Annex)	Bonn Conv.	Bern Conv.	Ireland
BIRDS				
Red throated diver *Gavia stellata*	I		II	P
Black-necked Grebe *Podiceps nigrocollis*	I		II	P
Gadwall *Anas streera*	II	II	III	Q
Pintail *Anas acuta*	II, III	II	III	Q
Garganey *Anas querquedula*	II	II	III	P
Shoveler *Anas clypeata*	II, III	II	III	Q
Pochard *Aythya ferina*	II, III	II	III	Q
Goosander *Mergus merganser*	II	II	III	P
Merlin *Falco columbarius*	I	II	II	P
Black-tailed Godwit *Limosa limosa*	II	II	III	P
Greenshank *Tringa nebularia*	II	II	III	P
Short-eared Owl *Asio flammeus*	I		II	P
Ring Ouzel *Turdus torquatus*			III	P
Wood Warbler *Phylloscopus sibilatrix*			II	P
Bearded Tit *Panurus biarmicus*			II	P
Hen Harrier *Circus cyaneus*	I	II	III	P
Grey Partridge *Perdix perdix*	II, III		III	P

Corncrake *Crex crex*	I		II	P
Red-necked Phalarope *Phalaropus lobatus*	I	II	II	P
Roseate Tern *Sterna dougallii*	I		II	P
Nightjar *Caprimulgus europaeus*	I		II	P
Corn bunting *Miliariacalandra*			III	P
Golden Plover *Pluvialisapricaria*	I, II, III	III	III	P
Dunlin *Calidrisalpima*		II	III	P
Little Tern *Sterna albifrons*	I		II	P
Barn Owl *Tyto alba*	I		II	P
Tree Sparrow *Passer montanus*			III	P
Twite *Carduelis flavirostis*			III	P
Storm Petrel *Hydrobates pelagicus*	I		II	P
Whooper Swan *Cygnus cygnus*	I	II	II	P
Barnacle Goose *Branta leucopsis*	I	II	II	P
Chough *Pyrrhocorax pyrrhocorax*	I		II	P
Peregrine *Falco peregrinus*	I	II	II	P
Light-bellied Brent Goose *Branta bernicla hrota*	II	II	III	P
Greenland White-fronted Goose *Anser albifrons flavirostis*	I, II, III	II	III	P

(P = protected species; Q = quarry species).

SPECIES INVENTORY

Bacteria

These organisms are hard to identify as species by microscopy, and studies are now focusing on their DNA to classify them. After one century of microbiology, only 4,000 species have been assigned worldwide, and an estimated number of species in Ireland is in the order of 50,000 to 100,000 (pers comm Dr R. Powell)

Protozoa

Protozoans are complete animal organisms contained within a single cell. They include solitary and colonial, free-swimming, sessile, parasitic and symbiotic forms. They are very small (microscopic) and are generally restricted to wet or moist environments. Thus, they abound in the marine and freshwater habitats, and as parasites. There are over 50,000 or so known species. The superphylum is usually divided into: (1) phylum Sarcomastigophora; (2) phylum Ciliophora; and (3) phylum Sporozoa.

Phylum Sarcomastigophora

This group contains all the flagellate and amoeboid forms. There are freeliving forms as well as some parasitic species.

Subphylum Mastigophora

This group contains the flagellates. 60 species of freshwater flagellates were recorded during the Clare Is survey (Dunkerly, 1913). Parasitic forms include members of the genus *Trypanosoma*. *T. granulosum* is found in the blood of eels in Ireland (Zintl *et al.*, 1996).

Subphylum Sarcodina

This group contains the amoebae. There are several groups of sarcodine, including: order Rhizopoda (amoeboid forms) ; order Foraminifera (which secrete elaborate shells of mainly calcium carbonate); order Heliozoa (known as the "sun animalcules") and order Radiolaria (an entirely marine group, that have a siliceous skeleton). Hopkinson (1910) recorded 50 species of rhizopod from Co. Wicklow. 287 species of marine Foraminifera were recorded during the Clare Island survey (Heron-Allen & Earland, 1913) from along the shore sands and shallow water dredging. 150 species of freshwater and terrestrial Heliozoa were recorded during the survey, including a number of species from the Mayo mainland (Wailes & Penard, 1913). These animals were recorded from moss. This compares with 6 marine heliozan species, from Clare Island. Parasitic sarcodinids are mainly intestinal inhabitants of man and other invertebrates. The majority

are assigned to the genus *Entamoeba*, represented in man by *E. histolytica* (causing amoebic dysentry) and *E. coli* in the colon.

Phylum Microsporida (or Sporozoa)

This phylum contains exclusively parasitic protozoans, many of which attack freshwater fishes and amphibians. Examples include members of the genus *Gregarinidae*, which are parasitic in worms, crustacea and other invertebrates (excluding molluscs and are also absent from vertebrates): *Myxobolus* genus; *Coccidia* occurring in the rabbit; *Pirosoma bigeminum* which causes the infectious haemoglobinuria of cattle (known as red-water fever or blood murrain in Ireland). The cattle tick, *Ixodes bovis*, is the vector for this parasite.

Phylum Ciliophora

This group contains the ciliates, which are characterised by having cilia (for locomotion) at some point in their life cycle 8,000 species have been described globally. Genera represented in Ireland include the freshwater *Paramecium, Spirochona, Vorticella, Trichodina and Stentor. Kerona polyporum* is a common epizooic form on *Hydra.* 39 species of freshwater ciliate were recorded during the Clare Island survey (Dunkerly, 1913). Mulisch *et al.* (1986) recorded 11 species of folliculinid ciliate (a group of filter-feeding ciliates which are mainly marine), one of which was new to science. Myriad ciliates are found in the rumen of herbivorous mammals such as sheep and cattle. The ciliates have a symbiotic relationship with their hosts, in that the ciliates get shelter and a food supply while the vertebrates benefit from the protein and other nutrients which are synthesised by the protozoa. The protozoa have the ability to breakdown the otherwise indigestible portions of the food. Another example of symbiosis are the protozoa which occur in the guts of wood-eating insects. Parasitic forms include *Opalina ranarcum* and *Nyctotherus cordiformis*, which are found in the rectum of the frog (Patten, 1932). *Balantidium coli* is normally found in the intestine of pigs, and causes dysentry in humans.

Metazoa

These are multicellular and mobile organisms that develop from embryo's. Metazoans comprise almost all of what are generally considered to be animals.

Phylum Porifera

This phylum contains the animals known as the sponges. The majority of sponges are found in the sea, but a small number of species occur in freshwater. The sponge body consists of a mass of cells permeated by interconnecting canals. Water is drawn through these channels by special

flagellated cells and oxygen is removed by absorption while food particles are filtered off. The water is expelled via apertures known as osculi. The sponge body is supported by a network of siliceous needles, known as spicules, which have a characteristic size and shape in each species and are valuable when identifying species. The group is divided into two classes; (1) class Calcarea; and (2) class Demospongiae. 6 species of freshwater sponge are listed as occurring in Ireland (Simon, 1978). 219 species of marine sponges are recorded from Ireland (van Soest & Weinderg, 1980). 77 of these species are littoral & upper sublittoral. 60 species have been recorded on the south and west coast, whilst 81 species have been recorded in Lough Hyne.

Phylum Coelenterata (or Cnidaria)

This group contains the jellyfishes, sea anemones and corals. It is primarily a marine group, but a few genera of hydra (belonging to the Class Hydrozoa) occur in freshwater. Cnidarians are animals of simple structure which occur in two basic forms: (a) sessile polyps, which may be solitary or colonial; and (b) free-swimming medusae (jellyfishes). They capture their prey, and defend themselves, with tiny stinging organs known as nematocysts. Three classes are recognised: (1) class Scyphozoa - jellyfish; (2) class Hydrozoa - hydras; (3) class Anthozoa - sea anemones and corals.

Class Hydrozoa (freshwater)

Hydras are very common microscopic animals that abound in almost any permanent body of clean water. They are found attached to any firm stratum that allows them to fish a volume of water with their tentacles. 5 species of freshwater hydrozoans are listed as occurring in Ireland (McCarthy, 1983).

Class Hydrozoa, Class Anthozoa and Class Scyphozoa (marine)

Stephens (1905) listed approximately 250 species of marine Coelenterata as being recorded from Irish waters. Picton (1985) added 8 species of Anthozoa to this list to bring the total to 258 species.

Phylum Ctenophora

This phylum is an entirely marine and primarily planktonic group, with only 3 species recognised in British Isles waters (Evans & Foster-Smith, 1987).

Phylum Platyhelminthes

This is a large phylum of predominantly parasitic worms, although one class, Turbellaria, consists of common, free-living worms. The group contains worms, which are soft bodied and

unsegmented. Typically, the body is flattened, often elongated, with distinct dorsal and ventral surfaces, and usually with a definite "head-end". The group contains three classes: (1) Class Turbellaria - flatworms; (2) Class Trematoda - flukes; (3) Class Cestoda - tapeworms.

Class Turbellaria

Southern (1936) listed 103 species of Turbellaria as being recorded from Ireland. This consisted of 72 marine, 28 freshwater and 5 terrestrial species (two species occur in both marine and freshwater). There have been four additions since, three to the terrestrial species in recent years and one to the freshwater fauna, bringing the total to 107 species.

The land planarians (Order Tricladia: Suborder Terricola) are represented in Europe by a single family, the Rhynchodemidae. In Ireland there are two indigenous species, five introduced and one which may be indigenous or introduced. The introduced forms include the Australian flatworm *Geoplana sanguinea* and the New Zealand flatworm *Artioposthia triangulata*. This latter species was introduced in the early 1960's and is now well established in Northern Ireland and has been recorded at various locations in the south of the country. There is concern about the affect of this flatworm as it poses a serious threat to earthworm populations, upon which it appears to selectively prey (Blackshaw, 1992, cited in McCarthy, 1995). *Kontikia andersoni* has affinities with a species group otherwise confined to the Indo-Pacific but has not so far been recorded outside the British Isles, and thus it is hard to say if this species is native or introduced. (Anderson, 1986.)

Class Trematoda

This group contains the flukes, which is one of the major groups of metazoan parasites. Flukes parasitize all the vertebrate groups and some invertebrate, and some species use both to complete their life cycle. The group can be divided into: (1) order Monogenea, which are flukes that have a single host, and are usually ectoparasites on the skin or gills of their hosts; (2) order Digenea, are flukes that have two or more hosts during their lifecycle, and usually are endoparasites (for example in the intestine). Examples include the liver fluke, *Fasciola hepatica* in sheep and cattle. In a checklist of parasites recorded from the freshwater fish of Britain and Ireland, a total of 20 species were listed as occurring in Ireland (Kennedy, 1974) . When one considers the number of marine fish in Irish waters (about 220), then it would not be unreasonable to estimate at least 50 species of flukes and this may be a very low estimate. Cabot (1969) listed 13 species from charadriiform (waders) birds at Galway Bay, Co. Galway. From the literature checked, the total number recorded is at least 98 species.

Class Cestoda

This group contains the tapeworms, which are endoparasitic in the small intestine of vertebrates. The majority are long and ribbon-like in form and are mostly intestinal parasites of carnivores. Examples include the pig tapeworm *Taenia solium*. In a checklist of parasites recorded from the

freshwater fish of Britain and Ireland, a total of 17 species were listed as occurring in Ireland (Kennedy, 1974; Chubb, 1987). From the literature checked the total number recorded is at least 49 species. Cabot (1969) listed 25 species from charadriiform (waders) birds at Galway Bay, Co. Galway. One very interesting cestode is *Protocephaluspollanicola*, which has been recorded from the pollan (fish) in Lough Neagh. This is cestode is the only known endemic helminth parasite species from freshwater fish in Ireland (McCarthy, 1972).

Phylum Nemertea

This group contains the organisms known as the "ribbon" or "proboscis worms". Ribbon worms resemble flatworms in their general texture and mode of locomotion, but are much more elongated when extended. Their characteristic feature is the proboscis, a long, tubular mobile organ (at rest it is drawn inside the body) which is used for sensing and capturing the prey. Nemertines are common marine worms with numerous species, but in freshwater only a handful of genera are known, one of which has been recorded in north-west Europe. Southern (1913) listed 37 marine species as occurring in Ireland. One freshwater species is listed for Ireland (von Sebastian, 1987). The introduced land nemertine *Argonemertes dendyi* is known to be fairly widespread in Ireland (Cawley, 1994). This species is a native of south-western Australia, where it is quiet rare.

Phylum Nematoda

The Nematoda, known as the "roundworms" are an immensely successful and widespread group. The group includes a vast number of free-living species which occur in all moist or aquatic habitats, and an even greater number of parasitic species which infest plants and animals. Most are microscopic or only a few millimetres long, some parasitic forms being the exception. They have a colourless cuticle covering their elongate bodies. In some environments, the numbers of individuals can be millions of individuals per square metre.

Marine

There are 450 British Isles species of chromadorids (free-living nematodes) recorded from the marine environment. We can expect the vast majority of these to be recorded in Irish waters also. During the Clare Island survey 59 species were recorded (Southern, 1913).

Land and Freshwater

With regard to free-living soil and plant forms, there may be several hundred or perhaps thousands of species (pers comm. Dr C. Griffin). Perhaps one of the more important parasites (of plants) are the potato cyst nematodes of which there are two species in Ireland (pers comm, Dr J. Moore). In a checklist of the freshwater nematodes in Britain (Maitland, 1977), 97 species are listed, and many of these may occur in Ireland.

Parasitic species

Parasitic nematodes are found in a wide variety of vertebrate and invertebrate hosts. Examples include *Ascaris lumbricoides*, which is found in the small intestine of various mammals, including man and pigs. Kennedy (1974) lists 10 species as occurring in Irish freshwater fishes, whilst Cabot (1969), lists 10 species from charadriiform (waders) birds at Galway Bay, Co. Galway. From the literature checked, at least 30 species have been recorded, but there are undoubtedly many more than this.

Phylum Nematomorpha

This group contains the poorly known freshwater organisms called the "horsehair" worms. They bear a superficial resemblance to the nematodes, differing in their blunt-ended pigmented bodies. During the Clare Island survey, 2 species were recorded (Southern, 1913).

Phylum Acanthocephala

This group contains the parasitic "spiny-headed" worms. Members of the group are all endoparasitic in the gut of vertebrates, and have an intermediate arthropod host (such as the crustacean amphipods). They have a characteristic proboscis which has rows of hooks, which is used for attaching to the hosts intestinal wall. Kennedy (1974) lists 7 species of acanthocephalan as being recorded from Irish freshwater fishes. Cabot (1969) listed 2 species from charadriiform (waders) birds at Galway Bay, Co. Galway. From the literature checked, at least 13 species of acanthocephalans have been recorded.

Phylum Kinorhyncha

This small group consists of entirely marine organisms that burrow in the surface layer of marine mud or live in the interstitial spaces of marine sand. 5 species were recorded during the Clare Is survey (Southern, 1913).

Phylum Priapulida

These are a small marine group of unsegmented worms with a chitinous cuticle. The priapulids live and burrow in soft sediments. Only 15 living species are known worldwide, one of which has been recorded from the British Isles. (Howson, 1987.)

Phylum Rotifera

This group contains the species known as the "wheel animalcules", the name being derived from a distinctive ciliated region on the head. A few genera occur in the sea, but the majority are freshwater animals that are abundant in any wet or moist habitat. Many species are free-swimming whilst others are sessile or semi-sessile and some species are epizooic on crustaceans or insects. 315 freshwater species have been recorded from Ireland (Horkan, 1981). The group are an important indicator species in studies of eutrophication.

Phylum Chaetognatha

The chaetognaths also known as the "arrow-worms" are common animals found in marine plankton. Most are found in tropical waters, but the phylum is represented in the plankton of all oceans. 14 species are recorded from Ireland (Praeger, 1972).

Phylum Gastrotricha

The gastrotrichs, or "hairybacks", are a small phylum of marine and freshwater organisms that inhabit the interstitial spaces of bottom sediments and superficial detritus, the surfaces of aquatic plants and animals, and the water films of soil particles. They are bottle-shaped with a forked posterior end. The group is divided into (1) order Macrodasyida, which is composed of marine and brackish water species, and (2) order Chaetonotida, which contains all freshwater species and some marine forms. The gastrotrichs are common in freshwater but are not often seen due to their secretive habits and small size (microscopic). 3 species of freshwater gastrotrichs are listed as have been recorded in Ireland (d'Hondt, 1978.)

Phylum Annelida

This phylum contains the segmented worms (earthworms, lug worms, etc.) and leeches. They are macroscopic, mostly free-living, elongated and contractile, cylindrical or flattened worms. The body is divided into a number of segments.

(1) Class Polychaeta

Polychaetes are almost exclusively marine. The total number of polychaetes recorded from Irish waters was approximately 340 (O'Connor, 1981). There have been two additions since, bringing the total to 342.

(2) Class Clitellata

These are common freshwater and terrestrial worms, but a number of species also occur in the marine environment. They are characterised by the clitellum, a glandular, often collar-like thickening of the body wall covering several segments in the genital region.

(a) Subclass Oligochaeta

Family Enchytraeidae

At present 99 species of these "white worms" are recorded for Ireland (B. Healy, pers comm).

Family Lumbricidae

23 species of lumbricid or "square-tailed" worms were recorded upto 1979 (Cotton, 1979a; Cotton, 1979b). Cotton (1992) recorded two new species from Ireland, *Microscolex phosphoreus* (luminescent worm) and *Dendrobaena attemsi*. The former is a South American species whilst the latter is European. *Eisenia hortensis* is also an introduced species. Thus the total stands at 25 species.

Family Tubificidae

This family contains the "sludge worms". Kennedy (1964) listed 17 freshwater species as being recorded in Ireland. Over 30 marine species are listed in Howson *et al.* (1987) as occurring in British Isles waters.

Families Nadidae, Aelosmatidae and Lumbriculidae

Southern (1909) listed 9, 2 and 2 freshwater species respectively as occurring in Ireland. McCarthy (1974) added a species of nadid to bring it to 10 for that family. 11 marine Nadidae are recorded in Howson *et al.* (1987) for British waters.

(b) Subclass Hirudinea

This group contains the leeches, which are recognisable by their muscular, contractile bodies and the suckers, one at each end. The suckers are used to adhere to any firm substrate. Leeches are common in most freshwater habitats, usually being found clinging to a firm substratum out of the light. Some species suck the blood of various vertebrates or invertebrates, becoming temporary parasites. There are at present 13 species of freshwater leeches recorded from Ireland. There are also doubtful records for two other species. 15 species are recorded from Britain. (McCarthy, 1975.) One marine species has been recorded in Irish waters (Southern, 1913).

Phylum Pogonophora

This small group of marine animals are tubicolous, tentaculate worms which lack a gut. The tubes are generally threadlike, as is the body. The majority of the pogonophores live in sediments on the

continental slopes, whilst some species occur in shallower water. At least 15 species occur in Irish waters (O'Connor, 1981).

Phylum Sipuncula

This is another small marine group, of unsegmented worms. 13 species are currently recognised from the British Isles, although there are undoubtedly more species (Howson, 1987).

Phylum Echiura

This small group of marine worms were once classified with the sipunculans and priapulids in the Gephyrea. At present 6 species are known from British waters (Howson, 1987).

Phylum Pentastomida

This is a little known group of parasites. Hassett & McCarthy (1983) recorded the presence of *Reighardiasternae* (in gulls) in Ireland, and mention that the only other pentastomid recorded from Ireland is *Linguatulaserrata* (from dogs and foxes).

Phylum Bryozoa

This phylum contains the "moss animals", which are colonial and sessile, usually fixed to a substratum. The colonies consist of fine branching tubes up to 1mm in diameter, which form encrusting or erect structures, or are gelatinous masses. Food particles are gathered and passed to the mouth on water currents produced by ciliated tentacles. The group can be divided into three classes, (1) class Gymnlaemata and (2) class Stenolaemata, which comprise all the marine and a few freshwater species, and (3) class Phylactolaemata which are only found in freshwater habitats. There are 192 Irish marine species (Wyse Jackson, 1991) and 7 freshwater species (Smyth, 1994). This compares with a worldwide figure of 4,000 species for the marine and 35 for the freshwater habitats.

Phylum Entoprocta

These organisms are tiny, stalked animals with non-retractile tentacles, forming simple or branched attached colonies. The phylum contains a few marine genera and one rare freshwater one, which is absent from Britain and Ireland. They are associated with other forms such as the sponges, bryozoans, polychaetes and sipunculids, in all of which the host animal generates a feeding or respiratory water current of benefit to the commensal. 34 marine species are recorded in the

Directory of British fauna (Howson, 1987), thus the number in Irish waters is probably less than this.

Phylum Phoronida

The phoronids are a marine group, that live within a chitinous tube which is either buried in sand or attached to a substratum. They are cylindrical in shape and are filter-feeders. 4 species are recorded from around Ireland. (Ryland, 1992.)

Phylum Brachiopoda

This group contains the "lamp shells", which resemble bivalve molluscs, in that they possess a calcareous shell of two valves. They are all marine forms, and are found from the intertidal zone to the deep sea. Most species live attached to rocks or other firm substrata, but some forms, such as *Lingula*, live in vertical burrows in sand and mud bottoms. 18 species are listed as occurring in British Isles waters (Foster-Smith, 1987) and 4 species are listed as occurring around the Irish coast (Hayward & Ryland, 1991).

Phylum Mollusca

Molluscs are relatively large invertebrates, common and often abundant in marine and freshwater, also occurring in terrestrial ecosystems. The majority of species are characterised by their shells, which is the primary means of identifying them. This group contains seven classes, which includes forms such as oysters, squids, octopus, snails, slugs, nubibranchs and chitons.

Terrestrial and freshwater

Two classes occur in terrestrial and freshwater habitats: (1) Class Gastropoda - snails and limpets, and (2) class Bivalvia - mussels and cockles. Ross (1979) listed 90 species of land and 52 species of freshwater mollusc in Ireland. The following material is taken from the literature, and encompasses what appear to be the most important species in Ireland.

(1) Class Gastropoda

In Ireland the Kerry slug *Geomalacus maculosus* is found in parts of West Cork and Kerry. It occurs within the Devonian old red sandstone areas and disappears where there is limestone. In woodland it is found on lichen and moss-covered tree trunks. Otherwise, it is found in parts of Northern Spain and Portugal. Only three genera belonging to the slug family Arionidae occur in Europe. One of these, *Geomalacus*, is represented by two species, both of which are almost confined to Iberia (Northern Spain and Portugal), with *G. maculosus* occurring in Ireland also. Thus, the world range of the species is restricted, as is the world range and species diversity of the

whole genus. (Platt & Speight, 1988.) Hence, *G. maculosus* is a species of national and international importance.

Pomatias elegans known as the round-mouthed snail (or land winkle) is a southern species found all round the Mediterranean and extending North to southern Germany, through France to Denmark and Britain, where it is limited to parts of southern England (Graham, 1988). It was added in 1976 to the Irish list, and was recorded first in Co. Limerick. *Oxychilus helveticus* was added in 1978 from a number of sites in Limerick. *Cochlodina laminata* is an old deciduous woodland species and is much rarer in Ireland than in Britain due to lack of suitable habitats. *Arion lusitanicus*, the "Lusitanian" slug was only known from seven vice counties up to 1979. *Ashfordia granulata* is a rare species and is recorded from Co Waterford (Anderson, 1992). *Catinella arenaria*, the wetland snail, is listed as endangered in Britain, and is of very local occurrence in the rest of Europe where it is classified as vulnerable. This species is known from four sites in the Britain. In Ireland, it has been recorded from several base rich fens in the Irish midlands and at several sites on the west coast. (Tattersfield, 1993.) Tattersfield was unsure of the status of this species in 1993, in that he thought some of the fen areas may have been drained. The Pyrenean glass snail *Semilimax pyrenaicus* is found in limited areas of the French Pyrenees and in Ireland, and is considered to be a native species (Anderson, 1991). In the same note Anderson also considers *Arion owenii*, which has a north-westerly distribution in Ireland, to be a native species. *Arion fasciatus* is recorded from the north east of Ireland only. *Pseudamnicola confusa* was recorded in 1983 from two sites by the River Barrow and previous to this the species had not been recorded since pre 1950. Apparently the species has become extinct in many sites in the British Isles. (Holyoak, 1983) *Vertigo moulinsiana* is restricted to a few sites in the west of the country. *Vertigo geyeri* is restricted to a few locations in central Ireland on flat lowland fens. *Vertigo pusilla* is recorded from only a small number of sites, but these are widespread. *Vertigo angustior* has only been recorded from a few locations in the east and south-east of the country. Other land snails with limited distribution are *Arinta arbustorum* (confined mainly to the north of the country), *Helicigona lapicida* (recorded from one southern location), *Testacella maugei* (southern and eastern distribution). (Kerney and Cameron, 1994) The river snail *Viviparus viviparus* is absent from Scotland, west Wales and the most northern and southern parts of England. Elsewhere it extends throughout Europe, but is not found in Iberia, southern Italy or the northern parts of Scandinavia. The species has a very limited distribution in Ireland.

(2) Class Bivalvia

Because of the virtual extinction of *Margaritifera* over most of its European range the Irish species must be highlighted as, probably, we have the most extensive remaining stocks in all of Europe. The form that generally occurs in Ireland is *Margaritifera margaritifera*, the "freshwater pearl mussel". If *Margaritifera* still survives in the River Nore (*M. margaritifera* var *durrovensis*) it is also very deserving of conservation as a hard water form. The form, *M. margaritifera durrovensis*

was first described in 1928 from the River Nore, near the town of Durrow, Co. Laois. In contrast to the more widespread *M. margaritifera*, which inhabits soft-waters, *M. m. durrovensis* is confined to hard-water. Whether it is considered as a species or subspecies the form is unique to Ireland, and it is one (of two) species that is considered to be endemic to Ireland and thus can be considered as a very important component of the Irish fauna. The species has been considered highly endangered and on the edge of extinction for the last number of years. Moorkens & Costello (1994) recorded 420 individuals in 1994, a decline from an estimated 2,000 in 1990 and a "flourishing colony" in the 1920's. This sharp decline as recorded by Moorkens & Costello (1994) suggested according to them, the imminent extinction of this animal. At present it is not known if *M. m. durrovensis* is still present at this site. *M. m. durrovensis* has been singled out by the Bern Convention as in need of immediate research attention (Bern Convention Invertebrates Group, 1990). It was not listed separately in the Habitats Directive of the European Union (Council of the European Communities, 1992), perhaps due to the uncertainty as to whether it was a species or subspecies. Two species of *Margaritifera* are listed in the Directive, *M. margaritifera* and *M. auricularia*, but only the latter was identified as a priority for conservation. *M. auricularia* is a hard-water southern European species which is extinct in Britain. In contrast, *M. margaritifera* is a soft-water species which has become extinct in parts of Europe but retains healthy populations in remote parts of Ireland, Scotland, and northern Europe. *M. m. durrovensis* is at least as closely related to *M. auricularia* as it is to *M. margaritifera*. Both *M. auricularia* and *M. m. durrovensis* share common characteristics distinguishing them from *M. margaritifera* (for example hard-water habitat and some physical characteristics). Whatever their exact taxonomic status, all experts agree that the protection of this species is a priority. (Moorkens & Costello, 1994.) *M. margaritifera* is a protected species in Ireland which may only be collected under Government licence.

The swan mussel, *Anodonta cygnea*, is similar in so many respects to the duck mussel, *A. anatina*, that its status as a separate species must be doubted. Depending on whether it is considered as distinct or not there are either three or two species of the superfamily Unionacea in Ireland, compared with 6 (or 5) in Britain. The other species is *Margaritifera margaritifera*, discussed above. (Lucey, 1995) Lucey examined 1,812 sites on 398 rivers and streams, and 21 sites on 11 rivers (2.8%) yielded *Anodonta* species. In an earlier study, Lucey (1993) had recorded *M. margaritifera* from 14.6% of the rivers/streams examined. *Anodonta* species are absent from the south-west of the country, and this can be attributed, at least in part to the lack of suitable habitats with its largely non-calcareous waters, while *M. margaritifera*, which has a preference for such habitats (Lucey, 1995).

Marine

Nichols (1900) listed 546 species of marine molluscs as occurring in Irish waters, 67 of which were confined to the deep water. Nichols considered that the nudibranchs *Lamellidoris ulidiana* and *Eolis sanguinea* were peculiar to the Irish fauna.

249 species of marine Mollusca have been recorded from Strangford Lough, Northern Ireland, since 1969, and this represents approximately 80% of the Northern Ireland marine molluscan fauna (Nunn, 1991a). Most of the molluscs occurring in Strangford Lough are not endemic to the area. However, it is the only known recent site in Ireland for *Risso lilacina porifera*, *Philinoglossa helgolandica*, *Hedylopsis brambelli*, *Cranella decussata* and *Limatula subauriculata*. In addition two species rare elsewhere in Ireland, are found here - *Doto cusidata and Tragula fenestrata*. *Risoella globularis* appears to be present at a number of sites on the north and west coasts of Ireland, but it is only locally common in Strangford Lough. The chiton *Acanthochitona crinitus*, rare elsewhere, is present in unusually high numbers in the intertidal zone, as is *Calliistoma zizyphinum lyonsii* (which is considered to be a species of significance in the fauna of Northern Ireland).

Nunn (1991b) considers that there are approximately 182 molluscan species in Lough Hyne, Co. Cork and around 172 species in Mulroy Bay, Co. Donegal. 70 species of Opisthobranchia were recorded from L. Hyne (Wilson & Picton, 1983). Nunn (1993) recorded two individuals of the nudibranch *Aeolidiella alderi*, which were of different colour, from Mulroy Bay and Lough Hyne. *A. alderi* is a rare nudibranch, with less than 15 specimens recorded around Ireland, although the species is thought to be present around most of the coastline. Nunn (1990) also recorded a number of specimens of another rare nudibranch *Hancockia uncinata*, at St. John's Point, Co. Donegal, which has been only sporadically recorded from the British Isles, and this represented the second location in Ireland.

Phylum Tardigrada

This group contains the microscopic animals known as the "water bears". The tardigrade body is a plump cylinder covered by a layer of flexible, translucent cuticle. Four pairs of stumpy mobile legs protrude from the body, each bearing several hooked claws, the shape of which is important for identification. They occur in both marine, freshwater and on suitable terrestrial habitats such as mosses, lichen and non-aquatic algae. Marine forms are found most commonly inhabiting the interstitial spaces of sands and sediments. At present 37 freshwater species of tardigrade have been recorded (Baxter, 1979; Morgan & King, 1975), whilst 4 species occur in the marine environment of Ireland (Morgan, 1980).

Phylum Chelicerata

This group contains forms which are one of the three principal evolutionary lines of living arthropods. The body is divided into a head-thorax and abdomen. Chelicerates are mostly

terrestrial animals comprising such groups as the spiders, harvestmen, mites and ticks. In the marine environment the group is represented by the sea-spiders and mites.

Class Arachnida

Order Aranae

This terrestrial group contains the spiders. The end of the abdomen bears a group of modified appendages, the spinning organs, called spinnerets, which are used to spin webs for the capture of prey. Based on a provisional checklist (McFerran & Ross, 1993), 368 species of spider have been recorded from Ireland. Of these, McFerran & Ross considered that 268 species required confirmation. 3 species have since been added to bring the total to 370 (approximately). McFerran lists the Irish species recorded in volume 3 of the British Red Data Books (Bratton, 1991) as :

(i) Family Uloboridae: *Hyptiotes paradoxus*, which occurs mainly on yew or in the vicinity of yew trees and also evergreens (especially box and holly), is known from fewer than ten sites. The only record in Ireland is from Co. Cork; (ii) Family Salticidae: *Sitticus floricola*, this spider is only known from two areas in Ireland (Co.'s Galway and Tipperary), one swampy locality in England (Cheshire) and one in Scotland; (iii) Family Theridiidae: *Dipoena melanogaster*, of which only one specimen has been recorded on Scots pine, Co. Limerick; (iv) Family Linyphiidae: *Baryphyma duffeyi* and *B. gowerense*, having both been recorded from a salt-marsh in Co. Kerry. *Carorita paludosa*, which occurs in *Sphagnum*, litter, cut grass, sedge and in marshy areas. This spider has been recorded from one site in Ireland (Co. Clare) and two in England. *Porrhomma rosenhaueri*, which is an extensive cave-dweller and in Ireland has been recorded only from Mitchelstown caves, Co. Tipperary. This species was not recorded in Britain until recently. *Centromerus persimilis*, possibly a subterranean spider recorded in one Irish (Co. Carlow) and two British localities.

The large house spiders of the genus *Tegenaria* have localised distributions in Ireland. *T. saeva* is confined to Northern Ireland (Armagh and Antrim), whilst *T. gigantea* is found only in Northern Ireland (Armagh and Antrim) and Dublin, and *T. atrica* is recorded from the east, west and south of Ireland. (Oxford & Chesney, 1994)

Order Opiliones

This group contains the harvestmen and daddy longlegs. 15 species are recorded from Ireland compared to 21 in Britain although there are undoubtedly more species (Mackie, 1972).

Order Pseudoscorpiones

These are tiny arachnids which live in leaf mold, in soil, beneath bark and stones, and in moss. At least 3 species are recorded from Ireland. *Kewochthonius halberti* was discovered in 1915 under stones around the high water mark on the Dublin coast, and subsequently in Britain. *Neobisium*

carpenteri was recorded around 1910 from Co. Cork. The species, also occurs in Britain, but may be a subspecies, thus making *N. carpenteri* endemic to Ireland. The species aggregate, in any case, is included in the British Red Data Book (Bratton, 1991).

Order Acari

This group contains the mites and ticks which are represented in the marine, terrestrial and freshwater environments. They are small arthropods, with oval bodies, with four pairs of jointed legs. Their most striking characteristic is the apparent lack of body divisions, and they are often brightly coloured. They are the most important arachnids in terms of human economics. Numerous species are parasitic on humans, domestic animals, and crops; and are detrimental to food and other products. Many species are also free-living. Examples include the dust mites and the hair follicle mites. From the literature checked the total number of Acari recorded from Ireland is approximately 472.

Suborder Prostigmata

This group contains some parasitic species of plants, animals and forms which are free-living in the marine and freshwater environment. The total number of marine species (Halacaridae) recorded from Ireland is 50 (Somerfield, 1991; 1988). In Somerfield (1991), thirty seven species were recorded from twenty sites around Ireland. Four of these species were new to the British Isles and two were new to Ireland. According to Somerfield the halacarid fauna of Ireland is entirely consistent with Ireland's geographical location within the zoogeographical region known as the boreal Atlantic. The littoral Halacaridae should, he says, be of considerable value in establishing natural zoogeographical boundary zones because of morphological differences between species groups from different regions. Some interesting species recorded were: *Scaptognathus trouessarti* which may be endemic to Ireland, as it is only recorded from the Irish coast. *S. trideus* is a species that inhabits coarse well aerated gravels. It was not previously recorded from Ireland, and the only known locality in Britain is from gravels near the Eddystone lighthouse. Elsewhere it has been recorded from the coast of France. *Thalessarcha procera* has been recorded from Ireland but is unknown from British waters.

Lough Hyne, Co. Cork is known to be a particularly rich environment for marine organisms and Somerfield's study showed that it also has a diverse and apparently unusual halacarid fauna, yielding two species new to the British Isles and two to Ireland. *Copidognathus consimilis*, previously known from one locality in France occurred in large numbers in L. Hyne along with *C. tricorneata*, also previously unknown from Britain. *Thalassarachna hexacantha* and *T. longipes* were also new to the Britain and Ireland. Halbert (1920) lists 77 species of intertidal Acarina as occurring from Ireland.

Halbert (1944) listed 218 species of freshwater mites (Hydracarina) as occurring in Ireland. 68 species were recorded from Killarney (Conroy, 1984). Of these a species new to science was recorded, *i.e. Torrenticola hibernica*, whilst two other species were also new to Ireland.

Suborder Mesostigmata

Acari of this suborder are among the most abundant and diverse groups of arthropods in many Irish habitats. 168 species of terrestrial Acari were recorded from Clare Island (Halbert, 1915). Bolger (1990) considers two families from this group. Firstly, the family Veigaiidae are one of the most abundant groups of microarthropod predators in the litter and soil layers of woodland. 20 species are recorded from Ireland, as compared to 35 from Britain. And secondly, the family Macrochelidae are also found in forest soils, but are particularly common in accumulations of rotting organic matter such as compost, dung and tidal debris. 10 species are recorded for this group in Ireland as compared to 11 from Britain.

Thinozercan michaeli is only known from Ireland, and is probably an endemic species, which is adapted to a sandy intertidal habitat. In 1982, the known geographical distribution of *T. michaeli* was restricted to the intertidal in three locations in Ireland: Westport (Mayo), Howth (Dublin), and Lough Hyne (Cork), and is rare at these three sites. It is possible that *T. michaeli* is a primitive and isolated species which has survived in a specialised habitat characterised by low competition pressure. (Athias-Binche, 1982.) Hyatt (1988), recorded two species from Ireland which were new to Britain and Ireland.

Suborder Ixodida

This group contains the parasitic ticks, 14 species are recorded from Ireland (pers comm Dr Tom Kelly). There is 1 species in both the genera *Argas* (on bats) and *Ornithodorus* (on birds), and 12 species of *Ixodes* (on birds, mammals and the reptile *Lacerta vivipara*).

Suborder Astigmata

Included in this group are the scabies (mange or itch) and the feather mites. The mange mite *Sarcoptes scabei* infects mammals including man. This mite (1mm long) burrows into the skin where it lays its eggs. The eggs hatch, the young burrow into the skin and this gives rise to the inflammation and itch.

Class Pycogonida

This marine group contains the sea-spiders. The name is derived from the spider-like appearance of these creatures. There are many littoral forms as well as deep water species, and the majority are found in cold waters. 31 species have been recorded from British waters within the 200m isobath (Bamber *et al.*, 1987). King *et al.* (1971) recorded 19 species from the littoral of Galway Bay.

Phylum Crustacea

These are arthropods with clearly segmented bodies, which are usually divided into head, thorax and abdomen. Crustaceans exhibit a diversity of form and are fundamentally aquatic animals, with great numbers of marine and freshwater species but relatively few on land. Dr Mark Holmes, of the Natural History Museum (Dublin), kindly allowed me to go through his personal file on Crustacea which he has been compiling for the last 25 years. This gives a very accurate number of all the crustacean species which have been recorded to date from the terrestrial, freshwater and marine environment in or around Ireland. From this, there are approximately 1,778 species of crustaceans recorded from Ireland. Following is the list from the records of Dr Mark Holmes, and then a small number of groups are considered.

Subclass Branchiopoda (fairy shrimps and water fleas) 82 species
Subclass Ostracoda (seed shrimps) 207 species
Subclass Copepoda (water fleas)
- Order Calanoida 180 species
- Order Misophriidae 1 species
- Order Harpacticoidea 278 species
- Order Cyclopoida 85 species
- Order Mormonilloida 9 species
- Order Siphonstomatoida 71 species
- Order Poecilostomatoida 73 species

Subclass Branchiura (fish lice) 2 species
Subclass Cirripedia
- Order Thoracica 28 species
- Order Rhiocephala 1 species

Subclass Malacostraca ("true" shrimps, prawns, crabs, etc.)
- Order Leptostraca 3 species
- Order Stomatopoda 2 species
- Order Bathynellacea 1 species
- Order Cumacea 52 species
- Order Tanaidacea 16 species
- Order Isopoda 126 species
- Order Amphipoda 301 species
- Order Mysidacea 71 species
- Order Euphausiacea 16 species
- Order Decapoda 177 species

(1) Subclass Branchiopoda

Order Cladocera

These animals are known as the "water fleas". Duigan (1990) lists 41 freshwater species as being recorded from Ireland. The Cladocera of turloughs are also important. *Ilyocryptus acutifrons* is considered rare in Ireland, whilst *Eurycercus glacialis* was first recorded in Ireland from four turlough-like waterbodies in the area immediate to Gort town, Co. Galway, and the distribution of the species can now be extended to Co. Roscommon. (Duigan & Frey, 1988). In Britain, this species has only been recorded recently from one site, and is included in the British Red Data Book (Bratton, 1991).

Order Anostraca

Tanymastix stagnalis, the fairy shrimp, was first recorded in Ireland in 1975 (Young, 1975) from a turlough in Galway, and has subsequently been recorded from pools in Clare and Roscommon.

(2) Subclass Ostracoda

The Ostracoda or "seed shrimps" are small bivalved crustaceans which may be found living in all types of aquatic habitats (*i.e.* freshwater, brackich and marine). There are four extant orders of the sub-class, but only one, the Pedocopia, contains freshwater representatives. Douglas & McCall (1992) list a total of 59 species of freshwater ostracods as being recorded in Ireland. This compares to 89 species recorded in Britain. Three species, recorded from Ireland are not known in Britain. These are *Cypriodropsis helvetica*, *C. picta* and *Nannocythere* species.

(3) Subclass Copepoda

This group contains the copepods. They are small crustaceans with a cylindrical shaped body terminating in a forked tail. They are abundant in both the marine and freshwater environments.

Order Harpacticoida

These animals are primarily aquatic and predominantly benthic, and may be found in marine, brackish and freshwater habitats, and even semi-terrestrial environments such as damp moss and leaf-litter. In the provisional list provided by Holmes & O'Connor (1990), 278 species representing 25 families are listed. Those authors compared the Irish list with that of a work on the European Atlantic seaboard, and only 18 Irish species (*i.e.* 16.5%) are recorded from the European list of 109. The marine species *Leptosyllus celticus* was recorded from northern Brittany and the west coast of Ireland (Bodin & Jackson, 1987).

Order Poecilostomatoida

The poecilostomatoids also occur in marine, brackish and freshwater habitats, and are usually found in some sort of association with other animals. Ecologically they can be divided into three

groups : the invertebrate associates, the planktonic species and the fish parasites. In the checklist of this group by Holmes & Gotto (1992) 74 species are recorded, representing 19 families.

(4) Subclass Malacostraca

Superorder Peracarida

Order Amphipoda

This group contains the "shrimps" or "hoppers". In their review of the Amphipoda, Costello *et al.* (1989) list 307 species of marine, freshwater, terrestrial and subterranean species as occurring in Ireland or Irish waters. 297 species are considered to be definite records whilst 10 need confirmation. One of the doubtful species has since been confirmed (de Grave & Wilkins, 1994). Five species have been introduced to Irish waters, 3 freshwater (*Gammarus pulex, G. tigrinus* and *Crangonyx pseudogracilis*), 1 terrestrial (*Arcitalitrus dorrieni*) and 1 marine (*Corophium sextonae*). The introduced *G. pulex* is displacing the native *G. duebeni* in habitats where they both occur. 373 species are recorded from Britain. 12 species have been recorded in Irish, but not British waters. Most of these have a southern or western distribution around the Irish coast. Also absent from Britain is the endemic *Niphargus wexfordensis* and the two subspecies *Niphargus kochianus irlandicus* and *Gammarus duebeni celticus*. Minchin & Holmes (1993) recorded *Caprellaandreae* as a new species to Ireland and de Grave & Wilkins (1994) recorded *Corophium multisetosum* as the first freshwater corophid to Ireland. Thus, the total stands at 301 species definitely recorded.

Niphargus wexfordensis, is a very interesting species in that it is only found in Co. Wexford (*i.e.* endemic to Ireland) and was recorded for the first time in 1994 (Karaman *et al.*, 1994). It is a subterranean species which was found in a deep well in Co. Wexford. Karaman *et al.* conclude that it may be of relevance that the limestone of Wexford, in which it occurs, is isolated from the limestone which occupies the centre of Ireland, where *Niphargus kochianus irlandicus* is found. *N. k. irlandicus* is a subspecies of *N. kochianus* and is unique to Ireland. In Britain, another species known as *Niphargus glennei* is endemic there and is included in the British Red Data Book (Bratton, 1991).

15 gammaridean amphipods have been recorded in Irish inshore waters, which compares to 22 in Britain (Costello *et al.*, 1987). *Gammarus duebeni* is the common brackish and freshwater amphipod in Ireland. It is an important source of food for fish. There are two subspecies, the brackish water form *G. duebeni duebeni* and the freshwater form *G. duebeni celticus*. *Gammarus pulex* was introduced into Northern Ireland in 1958 and 1959, and has subsequently spread through the catchments of Northern Ireland. This species replaces *G. duebeni* where they coincide (Holmes, 1978). The first record for southern Ireland, is that of Cheating (1989) from Co. Wicklow. The gammarid, *Gammarus duebeni celtics* is a subspecies of *G. duebeni* which is restricted to Ireland and Brittany, France. The marine *Gammarus insensibilis*, known as the lagoon shrimp, has only been found in Lough Hyne, Co. Cork. The species is known from a

dozen sites on the east and south coasts of England, and is included in the British Red Data Book (Bratton, 1991).

Mysis relicta, known as the opossum shrimp, is listed as threatened in the British Red data Book (Bratton, 1991) where it occurs at only one site. In Ireland, the species is recorded from a number of lakes. The species was introduced into Europe as food for trout. *Crangonyx pseudogracilis*, is an introduced North American amphipod (freshwater). *Arcitalitrus dorrieni* is a terrestrial amphipod native to Australia and was recorded during the 1930's in Ireland in Kylemore Abbey, Co. Galway and has is now also found in Mayo, Dublin, Down and Kerry (O'Hanlon & Bolger, 1994).

Order Isopoda (terrestrial)

The terrestrial isopods are the "woodlice", which occur under stones etc. 28 species of woodlice were recorded in Ireland (Doogue & Harding, 1982). Irwin (1992) added *Metatrichoniscoides* sp. to the list to bring the total to 29 species. *Armadillidium album* is a category 3 (rare) isopod of Harding and Sutton's British red data list. In Ireland it is not a very common species, and was recently recorded in Dundrum Bay, Co. Down, which is the second most northerly record of the species in Europe, and no other sites are known north of Dublin. (Anderson, 1995.)

Superorder Eucarida

Order Decapoda

The freshwater crayfish *Austropotamobius pallipes* has a western European distribution, occurring in Portugal, Spain, France, the Dalmatian hills of former Yugoslavia, Britain, and Ireland. In mainland Europe, where other native and introduced crayfish species occur, it is apparently restricted to hill streams. In Ireland and England, where it is the only crayfish species, it is widespread, and occurs in streams, rivers and lakes, in a wider range of habitats than elsewhere. (Reynolds, 1984) Although relatively common, the species is under threat from a lethal fungal disease which has devastated native stocks throughout Britain and Europe. The plague was introduced to the affected countries via an immune North American crayfish species for aquaculture. The disease has also caused the collapse of some Irish lake populations. However, if the disease is truly here, then its affects have been less severe than in Britain and Europe. The Irish crayfish populations probably represent the largest population of the species in Europe.

Superorder Syncarida

Order Bathynellacea

Bathynella sp. was recorded for the first time in Ireland in Co. Kerry (Gledhill & Gledhill, 1984). This species is a small, eyeless crustacean which is exclusively subterranean in habit. It is a rare form and has only been recorded from 6 vice counties (five in Britain and one in Ireland).

Phylum Arthropoda

Subphylum Myriapoda

Myriapods include the centipedes and millipedes, which have a body composed of a head and an elongated trunk with many leg-bearing segments. Most myriapods require a humid environment, and live beneath stones, wood, soil and humus.

(1) Class Diplopoda

This group contains the millipedes, which form an important component of the decomposer community of soil and litter fauna in many ecosystems in temperate and tropical areas, but are absent from polar and tundra regions. 38 species are presently recorded from Ireland. One other species, *Oxidus gracilis*, is known only from inside glass houses and can therefore be considered to be a recent accidental introduction. 50 species are recorded from Britain. A number of species have the centre, or a centre, of their distribution in Ireland and Britain. Examples include: *Nanogona polydesmoides* which otherwise is recorded only from Belgium and France; *Ophyiulus pilosus* is virtually absent from western continental Europe; *Tachypodoiulus niger* is a southern species, being absent from central Netherlands/Germany northwards; whilst the montane species *Adenomeris gibbosa* (French Pyrenees) and *Melogona scutellare* (French Pyrenees and French, Swiss and Italian Alps) are also found in Ireland; and other than Ireland *Chordeuma proximum* is known only from Britain and France. Millipedes with an extreme western distribution and which are common in Ireland, such as the ones listed above, are not currently under threat, but the importance of these Irish populations should not be overlooked when considering species conservation in a wider European context. (Doogue *et al.*, 1993)

(2) Class Chilopoda

This group contains the centipedes. 21 indigenous species are recorded for Ireland, which is approximately 50% of the British list. *Hydroschendyla submarina* is a rather uncommon littoral species found at Clare Island whilst another littoral species, *Geophilus fucorum*, was recently confirmed as Irish (Bilton, 1990; Barber, 1985).

Subphylum Uniramia

Class Apterygota

This group of insects are without wings. Four orders are recognised in the Apterygota, but their relationship to each other is not clear.

Order Thysanura

This group contains the "bristle tails". Examples include the silverfish, *Lepisma saccharina* found in kitchens of houses. Other Irish species include the marine *Petrobius maritimus* and the silverfish. *Trigoniophthalmus alternatus* is a rare species.

Order Diplura

These animals, known as the "two-pronged bristle tails" were formerly grouped with the Thysanura. 12 species are recorded from the British Isles. *Campodea lankestri* was recorded in Ireland in 1989.

Order Protura

These animals are minute white soil-living creatures. The name means "simple tail". According to Blackith & Good (1991), the available records are likely to be a gross under-representation of the occurrence of Protura in Ireland. They are generally regarded as species of undisturbed habitat, where they can be diverse and reach high population densities, for example, in permanent pasture, marshy meadows, caves, conifers and deciduous forest. 5 species of proturan are identified from Ireland. There are approximately 233 species recorded worldwide at present (Blackith & Good, 1991).

Order Collembola

This is the largest group of Apterygota and members are known as the "springtails". They are common insects of the soil and litter layers, and a few species are found on water. They are characterised by a forked lever-like appendage, folded beneath the rear of the body. When this appendage is released they are projected into the air, and travel by this means. There are at present 203 species recorded from Ireland (Bolger, 1986; pers comm. Dr Tom Bolger).

Class Pterygota

This subclass contains all the winged insects. However, some species are wingless, but are descended from pterygotes.

Order Ephemeroptera

The Ephemeroptera are the group of insects known as the "mayflies" or "dayflies". The forewings are large, whilst the hindwings are small or absent, and both sets are held vertically when at rest. The aquatic nymph is characterised by having three tails. The adults do not feed and live for only a few days at most. 34 species are recorded at present from Ireland (Connolly & McCarthy, 1993), representing 8 families. This compares to the 48 species recorded in Britain. *Ameletus inopinatus*, the only "arctic-alpine" member of the order in the British Isles had until 1995 only been recorded from mountainous fast flowing streams in Co. Wicklow. Lynch *et al.*. (1995) have recorded the species from Glenveagh National Park, Co. Donegal. The "arctic-alpine" label for the species may be an overstatement as it has been recorded just above sea-level in other countries. The species according to those authors is probably under-recorded in Ireland, but is an important element of the Irish ephemeropteran family.

Biotic indices of organic pollution in rivers generally incorporate data on ephemeropteran abundances, as they are regarded as sensitive indicator species. Species of the genus *Ecdyonurus* and *Rhithrogena*, which include forms such as *Ephemera danica*, are the most sensitive species. They require clean water conditions (well oxygenated and unenriched) to survive. Because populations of ephemeropterans are under increasingly threat in Europe, it is important that the water quality in Ireland be maintained.

Order Plecoptera

The members of this group are known as the stoneflies. The aquatic nymphs are characterised by having two tails. Stonefly nymphs typically inhabit fast-running, stony streams and rivers in upland areas where they live beneath stones, in aquatic mosses or in drifts of accumulated debris. 19 species of stonefly are recorded in Ireland, representing seven families . Of the stoneflies recorded from Ireland, eleven (58%) are widespread in Europe (*i.e.* in 1987), five (26%) are southern European, one (5%) is northern European and two (11%) have an arctic-subalpine distribution. One species has a circumpolar distribution. Illes (1978) listed 387 species of Plecoptera as occurring in Europe. 33 species are recorded from Britain (Costello, 1987).

Protonemura praecox is a southern and central European species, which is present in parts of county Wicklow, but there are no confirmed records for anywhere else in Ireland. *Capniaatra* is an arctic-subalpine species (subalpine in that it does not occur in the central Alps) (Illes, 1978). In Ireland it appears to be confined to a few lakes. This species is considered to be a glacial relict. *Perlodes micreocephalus*, is a species which has only two records, and further records are necessary to establish if it is still extant in Ireland. The existence of this species in the Netherlands and Switzerland was considered seriously threatened in the 1980's. *Siphonoperla torrentium* is unique in being more frequent in British and Irish areas than it is in European zones. *Dùra bicaudata* may also be considered to be a glacial relict, and is an arctic-subalpine species. (Costello, 1987)

Costello (1987) considers that the Irish stonefly fauna appears to have survived well in contrast to the dramatic extinctions in mainland Europe. However, local extinctions have occurred, particularly through arterial drainage and organic pollution. So long as such effects remain localised and short -term, recolonisation of most species from adjacent unaffected habitats should occur. Notably the glacial relict lake populations of *C. atra* and *D. bicaudata* and stream populations of *Dinocras cephalotes*, deserve special protection. Some of their habitats are already affected, and others threatened by the increasing use of upland waters for hydroelectric schemes and as a public water supply. Their occurrence is of considerable scientific and historic value (Costello, 1987).

Biotic indices of organic pollution in rivers generally incorporate data on plecopteran abundances, as they are regarded as sensitive indicator species. The presence of stoneflies indicate high water quality. The largest and most sensitive is the carnivorous *Perla bipunctata* which only occurs where the substratum is suitable, and may not be present in the lower reaches of rivers. The other perlid *Dinocras cephalotes* is also very sensitive to the effects of organic pollution, but is much less commonly distributed in Irish rivers. Because populations of plecopterans are under increasing threat in Europe, it is important that the water quality in Ireland be maintained, especially if the more sensitive species are to remain.

Order Odonata

This group contains the dragonflies and the damselflies. The larvae of all Irish Odonata are aquatic, and this need for open water is undoubtedly the single most important factor influencing their distribution. The most important habitat feature which the members of the group require are firstly areas of unpolluted freshwater in which the larval stage lives, and secondly rich feeding areas close to the breeding site for the adults to feed in. The order is divided into (1) suborder Anisoptera (dragonflies) and (2) suborder Zygoptera (damselflies).

There are presently 22 resident species of Odonata in Ireland. Bog pools and lakes are the most important habitats. Rivers are the poorest habitat but are of interest as they support one species which does not occur on lakes or bogs, namely *Caloperyx splendens*. *Coenagrion lunulatum*, known as the "Irish damselfly" was added to the Irish list by Cotton in 1982, and this was the first record of the species from the British Isles. It is primarily a Northern European species where it is in decline due to pollution and drainage (Speight & Legrand, 1984). In Finland, it is most common north of the Arctic circle, so the presence of the species in Ireland is unusual. It was recorded from two sites in Ireland, a small bog-pool at low altitude near Sligo town, and on Scragh Bog, Co. Westmeath, and presently it is recorded from seven sites (Nelson *et al.*, 1989). *Coenagrion pulchellum* can be considered rare in Ireland but widespread in Co. Fermanagh (Nelson , 1989). *Brachytron pratense*, the "hairy dragonfly" is much less common in Britain than in Ireland. *Lestes dryas* is a widely distributed but local species of damselfly in Europe, Asia and North America. In Great Britain, it is now believed to be very rare or extinct and in Ireland it has only been recorded from a small number of sites east of the Shannon, and is therefore of conservation interest. (O'Connor *et al.*, 1983)

Order Orthoptera

This order contains the grasshoppers, crickets and cockroaches. 15 species are recorded from Ireland, most of which are rare or occur in the south of the country only. Overall, 52 species of orthopteroid insects are recorded from Britain and Ireland. (Marineshall & Haes, 1988) The Large Marsh grasshopper *Stethophyma grossum* is a very local insect which has been recorded from five

counties, where it occurs in *Molinia caerulea* dominated bog in sheltered localities at low altitude. This insect is included in the British Red Data Book for insects (Shirt, 1987). However, the species is considered to be under-recorded in Ireland and thus it is difficult to assign it to any particular status category, but may well be classed as vulnerable here (Foss & Speight, 1989). Examples of other rare species are the short winged conehead, *C. dorsalis* and Rosel's bush cricket, *Metrioptera roselii* (which is recorded from Co. Waterford). The house-cricket, *Acheta domesticus* is a very rare species in Ireland today, and there is only one post 1960 recorded by O'Connor (1992).

Order Dermaptera

This group contains the "earwigs". They are brownish elongate insects, being characterised by a pincing forceps at the posterior of the body. Only 4 species are native to the British Isles and 2 species are known to occur in Ireland (Good, 1980), *Labia minor* and *Forficulaauricularia*.

Order Psocoptera

This group contains the "booklice", which are small or minute soft-bodied insects, which live in vegetation or among dried materials. Some of the wingless forms resemble some of the parasitic lice and hence the name "booklice" or "dustlice". The total number recorded from Ireland is 45 species (Fahy, 1970; Smithers & O'Connor, 1991; Irwin, 1992). *Pteroxanium kellogii* is a southern species recorded from Co. Cork and southern England (Fahy, 1970).

Order Mallophaga

These are small and minute insects that live as ectoparasites on birds and mammals. They are known as the "biting lice" or the "bird lice" because they are found primarily on birds. Biting lice feed mainly on particles of skin, fur and feathers, whilst some species take blood. The group is divided into: (1) suborder Amblycera and (2) suborder Ischnocera. 98 species have been recorded from Ireland. There are over 500 species in Great Britain (Butler & O'Connor, 1994.) Cabot (1975) collected 15 species on Charadriiform birds from Galway Bay.

Order Anoplura

These small and minute animals are known as the "sucking lice". They are parasites of mammals, and feed on the blood of the host, by piercing the skin with their sucking mouthparts. At least 10 species have been recorded from Ireland (O'Mahony & Classens, 1944). Such parasites include the human louse, of which there are two forms (a) the head louse, *Pediculus humanus capitis*, and (b) the body louse, *P. h. humanus*. The only other human-infesting louse is the "crab" louse, *Pthirus pubis*. The body and crab lice are rarely recorded and are almost extinct in Ireland. The

head louse however, is relatively common. One family is specific to seals, and the members of the genus *Linognathus* affect sheep and cattle.

Order Hemiptera

The Hemiptera is a large order of mostly terrestrial insects known as the "true bugs". They are small to large sized insects of widely differing shapes and habits, but all possess piercing mouth-parts adapted for sucking the body fluids of plants and animals. About 1,650 species occur in the British Isles. The majority feed on plants and there are among them some serious agricultural pests, including the aphids which not only damage the plants directly but transmit viral diseases. The order is divided into two distinct sub-orders: (1) suborder Heteroptera and (2) suborder Homoptera. From the literature checked, a total number of 843 species of Hemiptera are recorded, although there are probably many unrecorded species.

Suborder Heteroptera

This group consists of over 40 families and contains such forms as the colourful shieldbugs, capsid bugs, bedbugs, and all those bugs that live on or in water. Halbert (1935) listed 253 species of Heteroptera (aquatic and terrestrial, representing sixteen families) as occurring in Ireland. Of these 43 were aquatic species whilst 210 were terrestrial. There are at present 49 species of aquatic heteroptera recorded from Ireland, representing eight families (Nelson, 1995), which is an addition of six species since Halbert. Regarding terrestrial species, Walton (1986) recorded *Sigara connemareae* as new to the Irish list, from, as the name suggests, Connemara.

Nelson (1995) reviewed the aquatic heteroptera for Northern Ireland. In that study 40 species were recorded, including a number of important species which can be considered rare, and their populations in Northern Ireland represent an important segment of the British and Irish populations. The important species were *Corixa iberica*, *Limnoporous rufoscutellatus* and *Sigara fallenoidea*. *L. rufoscutellatus* is only recorded from a few Irish sites (Clare, Kerry, Fermanagh, Tyrone and Antrim). *S. fallenoidea* is not found in Britain, but occurs in Canada and rarely in Northern Scandinavia (O'Connor & Norton, 1977). The Irish distribution for this species is quite distinctive, occurring on the Shannon lakes, Lower L. Erne, L. Inchiquin (Co. Clare), L. Neagh and L. Beg (Northern Ireland). Another important Irish species is *Microvelia pygmaea* which was recorded by Walton (1981) from three sites in Cork. Otherwise the species is only known from south-west England.

The conservation needs of the aquatic Heteroptera largely depend on the maintenance of water quality in sites. The species which are most likely to suffer declines are firstly those of oligotrophic and acidic sites which face the threats of cultural eutrophication and habitat loss. Another threat is the introduction of fish, which is known to have a significant negative impact on

the populations of corixids in particular. A second group of species under threat in Northern Ireland, according to Nelson (1995), is the relatively small number of species found in coastal ponds and lagoons and in particular *Sigara stagnalis* and *S. lateralis*. Few sites are suitable for these and many are artificial. Continuing land reclamation around the margins of the major sea-loughs in Northern Ireland constitute a major threat to these areas.

Suborder Homoptera

This group contains over 20 families. The homopteran bugs bear little resemblance to the heteropterans. The only real similarity is the mouth-parts. This group ranges from the minute aphids and scale insects to the large cicadas. Two distinct divisions or series are recognised in the suborder: the Auchenorrhyncha (cicadas and hoppers) and the Sternorrhyncha (aphids and others).

Series Auchenorrhyncha

This group contains the insects known as "leafhoppers" and "planthoppers". 188 species are recorded from Ireland (de Courcy Williams, 1989 (a), 1989 (b); Kirby, 1991). The Burren limestone region of Co. Clare, a unique area of limestone pavements with grasslands, scrub and woodlands, harbours an exceptional fauna. Halbert (1935) listed 151 species of Homoptera belonging to the Cicadina and Psyllina as occurring in Ireland. (The Cicadina contains the three families: Cercopidae, Jassidae and Fulgoridae; whilst the Psyllina belong to the second series of Homoptera below).

Series Sternorrhyncha

This group contains the aphids or "plant lice" and associated forms. There are 200 species of aphid representing eight families (contained in the superfamily Aphidoidea) recorded from Ireland, as compared to 526 species from Britain. More species are thought to be present here. Of the 200 species some are undoubtedly introduced as they are specialist on exotic plants (Carter *et al.*, 1987).

Order Thysanoptera

This group contains the minute insects known as "thrips", which are commonly found in flowers. About 150 species are native to the British Isles. In Ireland, I have seen reference to 5 species, but would expect a lot more. *Frankliniella occidentalis* is an introduced pest species that is found in garden centers.

Order Neuroptera

The Neuroptera, also known as the "lacewings", are a group of freshwater and terrestrial insects. They are small flies with four large, delicate, wings. In Ireland, 31 species belonging to 5 families

have been recorded (Barnard *et al.*, 1991). 57 species are recorded from Britain (O'Connor & Barnard, 1987). *Chrysopa abbrevita* is a rare and local species having been recorded in Dublin and Wicklow only. *C. perla*, is a species in need of confirmation as there have been no records since 1910. *Mallada flavifrons* and *Hemerobius artifrons* are local species with no recent records. *H. nitidulus* is a local species, having being recorded from Kerry and Kildare. *Micromus angulatus* has been only recorded from the southern half of Ireland. *Psectradiptera* is only known from three specimens (Donegal and Wexford). *Sisyra dalii* has been recorded from four counties (throughout Ireland), but there have been no recent records. *S. terminalis* is evidently a local species, having been recorded from only Dublin and Kerry. *Psectradiptera* is a lacewing with markedly reduced hindwings and is rarely recorded.

Order Megaloptera

This group contains the "alderflies", the larvae of which are common inhabitants of still or flowing waters, where they live buried in silt or decaying vegetation or under stones. One species, *Sialis lutaria*, is listed as occurring in Ireland (Aspock *et al.*, 1978).

Order Coleoptera

This group contains the beetles, which normally have two pairs of wings, the front pair being hard and sclerotised (known as elytra). The hindwings are membranous and usually folded underneath the elytra. With more than 350,000 named species, this order is the largest of all insect orders, over 4,000 of which occur in Britain. The beetles have invaded all habitats and exploited all food resources. The order includes plant-feeders (with many important wood-borers), scavengers, predators and parasites. European beetles belong to two main suborders, (1) suborder Adephaga, and (2) suborder Polyphaga. Dr Jim O'Connor, of the Natural History Museum (Dublin) allowed me to count the number of beetles recorded in Ireland from an as yet unpublished paper and from this there are approximately 2100 species of beetle recorded, comprising 83 families (Anderson, Nash & O'Connor, unpublished). Based on a note of O'Connor (1995) in the Irish Naturalist Journal, the number of aquatic coloeptera in Ireland is approximately 167 species. A list of threatened species of Coleoptera (representing the family Carabidae) in Ireland are included in Appendix II. This data was provided by Dr M. Speight, National Parks and Wildlife Service, Dublin.

Suborder Adephaga

This group contains eight families. Some are dealt with in the following.

Family Carabidae

This family contains the "ground beetles". 212 species of carabid beetle are listed as occurring in Ireland (Speight *et al.*, 1996; pers comm Dr M Speight). *Carabus clatratus* is a relict species which is recorded in only a few locations from Ireland. It is suggested that this species has been lost to

areas in Northern Ireland, due to the affects of afforestation on the physical and biological characteristics of blanket bog, such as the lowering of the water table and consequent loss of specialised habitat (Cameron, 1994, cited in McFerran *et al.*, 1995). Speight (1977) considers the recording of the ground-beetle *Chlaenius tristis* as interesting, since it is considered to be extinct in Britain, and like other fenland species, this beetle has suffered greatly as a result of drainage operations.

Family Dytiscidae

Hygrotus quinquelineatus is a flightless species living in ponds and drains in fen areas, and it seems to be far commoner in Ireland than it is in Britain (Bilton, 1988). *Hydroporous glabriusculus*, is a flightless post-glacial relict species being recorded in the Scottish Borders and flooded periglacial hollows in the Norfolk Breckland, in Britain. The beetle was discovered new to Ireland from four old mesotrophic fens around Mullingar, and these records constituted an important extension in the known distribution of a species which is rare in much of its range due to the pollution and drainage of ancient fens (Bilton, 1988). *Hydroporous scalesianus*, like *H. glabriusculus*, is also a flightless relict species occurring in ancient fens. Modern British records exist only for Norfolk with two outlying sites in Cumberland and Durham. This species is a rare and endangered species across most of its range and the Irish sites (Scragh Bog, Co. Westmeath, and Fen, near Moninstown, Co. Westmeath) are of international importance (Bilton, 1988). *Graptodytes bilineatus*, is a beetle associated with a few sites in the southern coastal districts of Britain. The mild Atlantic climate of Ireland is probably what allows the species to penetrate inland areas from which it would usually be absent in Britain. *Graptodytes bilineatus* is unknown in such situations in Britain, so the Irish sites are of great interest and important. *Laccornis oblongus*, is another flightless species of ancient mesotrophic fens and bogs. It is rare in Britain. It occurs in several sites around Mullingar, which seemingly is one of the best areas in Western Europe for this species. (Bilton, 1988) *H. obsoletus* is a rare beetle of subterranean waters (river species) for which there is one modern Irish record (Bilton & Lott, 1991).

Family Noteridae

Noterus crassicornis is a very local relict brachypterous species of ancient lochs and old fen areas (Bilton, 1988).

Family Hygrobiidae

Hygrobia herrmanni, the "squeak beetle", is a species with few Irish records (Bilton & Lott, 1991). This is a species of stagnant water whose larvae feed largely on *Tubifex* worms, which live in anaerobic mud.

Superfamily Staphylinoidea

Family Staphylinidae

There are published records for 568 species of Staphylinidae in Ireland (Good, 1990). Good and Giller (1990) recorded 98 species from cereal and grass fields in south-west Ireland. Seven species, common on cereal crops in this study, but not on European cereal crops are *Omalium excavatum, Atheta triangulum, A. amicula, Stenus clavicornis, S. picipes, S. similis* and *S. ossium.* 79 species of the genus *Atheta*, known as marsh beetles, have been recorded from Ireland (Good, 1994). Good & Butler (1995) list three species which are characteristic of well developed woodland habitat: *Atheta picipes, Gyrophaena strictula,* and *Aloconota sulcifrons.* The saproxylic fauna and other woodland insects are poorly represented in Ireland (Speight, 1985). Nevertheless, many of the species which occur in Ireland and in other parts of western Europe are restricted to limited areas of old woodland landscape. Polypore fungi are an important habitat for staphylinid beetles and probably a whole range of invertebrates. Conservation measures of large diameter dead wood (fallen trunks and stumps) are needed to maintain polypore fungi and their associated invertebrate communities. *Micropepulus caelatus* is one of the few beetle species recorded from Ireland for which there are no modern records for other parts of the British Isles (Hammond, 1980).

Family Hydraenidae

The river species *Hydraena rufipes* had not been recorded in Ireland for 50 years until Bilton & Lott (1991) recorded the species from the Dunkellin river, Co. Galway. The species appears to prefer base-rich clear water.

Superfamily Curculionoidea

Family Curculionidae

This group contains the weevils. Morris (1993) lists 246 species as definitely Irish, with 22 other species in need of clarification. Morris states that no Irish weevil species are currently designated under domestic or European legislation for special protection, and considers that no such treatment is appropriate. Some species do, however, occur in nature reserves and protected areas in Ireland. Morris goes on to draw attention to the few species which are specialties of the fauna, and considers that they may contribute at some future time to an account of nationally notable species, which has been done for Britain. There are no endemic species in Ireland, and a few species that occur in Ireland, have very limited ranges in Europe include *Otiorhynchus auropunctatus, Barypeithes curvimanus, Caenopsis fissirostris, C. waltoni* and *Anthonomurus brunnipennis. O. auropunctatus* inhabits hedgerows, and therefore is not a member of a natural community, and thus needs no conservation; *B. curvimanus* is rare with obscure habits, and the first step in its conservation is to discover an extant population; *Caenopsis* species, which is rare in western Europe. They will probably be conserved adequately in existing or proposed reserves, particularly in the south-west ; *A. brunnipennis* is a common and widely distributed species and no special consideration need be given to its conservation. Morris then concludes by saying that weevils, particularly those inhabiting types in protected sites such as calcareous grasslands or peatlands, are

probably adequately conserved (Morris, 1993). *Bagous brevis* is a species which is listed as endangered in Britain and has been recorded on a couple of occasions in Ireland (Bilton & Lott, 1991).

Otiorhynchus auropunctatus is a well known "Lusitanian" species and is recorded from only one specimen in Britain, but is often abundant within its limited range in Ireland, where it has been recorded from seven counties (Wicklow, Dublin, Meath, Louth, East Donegal, Derry and Kildare). Six of these are maritime counties (Morris & O'Connor 1992).

Superfamily Cantharoidea

Family Lycidae

There is only one member of this family known in Ireland. It is *Pyropterus nigroruber*, which forms part of Ireland's remnant old-forest fauna. On the continent it is regarded as a montane and northern species. The species has been known in Ireland for more than 100 years, and has only been recorded in the Killarney valley and at Kenmare (Speight, 1990). Speight considers that this distribution is typical of a relict species, as exhibited by old-forest insects in Ireland. Because of the restricted distribution of this species, although it has persisted in the same small area for the last 100 years, Speight thinks that it shonld be eligible for inclusion on lists of organisms vulnerable to extinction in Ireland. The larvae develop in dead wood and this must be maintained in the area where this insect occurs (part of which is in the Killarney National Park). In Britain *P. nigroruber* has been recorded from only a few sites and is included in the British Red Data book for invertebrates (Shirt, 1987). It is also scarce in other parts of Europe (Speight, 1990).

Superfamily Cucujoidea

Family Coccinellidae

This group contains the ladybirds. According to Speight (1990), the ladybird *Hippodamia tredecimpunctata* is listed as "rare" in Britain (Shirt, 1987) and a later paper considered the species extinct in Britain. Speight (1990) put on record a recent occurrence of this species from All Saints bog, Co. Offaly. This is the only known present-day Irish locality. The species had been recorded in 1902, but there had been no records since. On the continent the insect is widely distributed. The rare *Clavier guttata* was recorded in Killarney in the 1920's, but not since (O'Connor, 1990, book review).

Superfamily Elateroidea

Family Elateridae

This group of beetles is known as the "click beetles". They are particularly useful as ecological as ecological indicators and also include some notable crop pests. According to Mendel's atlas (1988), 31 species are recorded from Ireland (although there have been additions since), which compares to 82 species recorded from Britain. One of the elaterids found in Ireland, *Selatosomus*

melancholicus, is not known in either Britain or Northern France. It is one of a small number of insect species which occur at sea level along the west coast and at high altitudes in the mountains of central Europe.

Family Nitidulidae

Records of the genera *Glischrochilus* and *Soronia* (Speight, 1989) in Ireland consist of 3 species of the former and 2 of the latter. One of the *Glischrochilus* species recorded in Ireland, *G. quadripunctatus*, is associated with conifers of the genus *Pinus*, and not with deciduous trees (the normal habitat). The presence of this beetle is of some interest as the saproxylic fauna of conifers is lacking almost in its entirety from Ireland. This probably represents a recent arrival rather than a survival of the indigenous old pine fauna.

Superfamily Chrysomeloidea

Family Cerambycidae

This group contains the "longhorn beetles", of which 20 indigenous species are recorded from Ireland. In contrast, the cerambycid fauna of Britain stands at 57 species, while that of Northern France stands at 111 species (Speight, 1988). *Anoplodera sexguttata*, is a species with only one Irish record from north Kerry in 1948. This species is rarely seen anywhere in western Europe. In Britain and Sweden, *A. sexguttata* is among the insects regarded as "vulnerable" and in Ireland, this species has to be regarded as endangered, if not extinct. *Aromia moschata*, has been recorded repeatedly from one small part of Co. Kerry (and as an imported species). It is now very localised within much of its European range. In Ireland Speight (1988) considers that *A. moschata* would fall into the vulnerable category. *Callidium violaceum* is recorded from Kerry and is listed as vulnerable in Britain. Speight (1988) considers that it should be considered as endangered in Ireland. Other species that are listed in Speight (1988) which are considered to be vulnerable/endangered are: *Clytus arietis, Grammoptera variegata, Lamia textor, Leptura aurulenta, L. quadrifasciata, Pseudallosterna livida, Stenurella melanura* and possibly *Tetrops praeusta.*

Order Strepsiptera

These stylopids are minute insects whose early stage are spent as parasites of other insects. The forewings are reduced, whilst the hindwings are broad and membranous. One species has been recorded in Ireland (Anderson *et al.*, unpublished).

Order Siphonaptera

This group contains the "fleas", small wingless insects with the body flattened from side to side. The are primarily ectoparasites of mammals but are also found on birds, their mouthparts being adapted for blood-sucking. 40 species of flea have been recorded in Ireland, which breaks down

into: (a) 6 bat flea species, (b) 18 terrestrial mammal species, and (c) 16 species of bird flea (one of which is a tropical form and unlikely to breed here) (Sleeman *et al.*, unpublished; Sleeman & Smiddy, 1994; Smiddy &Sleeman, 1993). This compares with a total of 56 from Britain (Claassens & O'Rourke,1966).

Order Diptera

This group contains the "true-flies". Theses are insects with only one pair of membranous wings, the best known being the house-flies and blue-bottles. Forms with aquatic larvae include craneflies, midges, gnats, mosquitoes, horse-flies, and hover-flies. The species of Diptera possessing aquatic larvae probably outnumber all other aquatic insects together. Dipteran larvae also occur in moist habitats, from truly terrestrial (in the soil or plants), in animal carcasses, dead timber, etc. The group is divided into three suborders, (1) suborder Cyclorrhapha, (2) suborder Nematocera, and (3) suborder Brachycera. A total of 95 families are known to occur in the British Isles (Ashe *et al.*, 1988). Ashe *et al.* (1988) estimated that the number of dipteran species in Ireland was 4,000, of which half were as yet unrecorded. At that time, 40 families had species lists and accounted for 1790 species. Based on the literature checked, the total presently is approximately 2,350 species. This is still well under the estimated number. A list of species threatened species of Diptera (representing six families) in Ireland are included in Appendix II. This data was provided by Dr M. Speight, National Parks and Wildlife Service, Dublin.

Family Sciomyzidae

These flies are known as the 'snail killing flies'. 52 species presently occur in Ireland (Speight *et al.*, 1992; and one addition in 1995), which compares with 65 species in Britain (Speight *et al.*, 1992). *Antichaeta brevipennis* was recently recorded from Ireland (Speight, 1990) in the Murrough, Co. Wicklow. This is a seldom seen insect and is included by Shirt (1987) on the British Red Data book for insects. The adult habitat is of thickly vegetated parts of wet woodland. Speight considered that it was difficult to come to any firm conclusion as to the status of *A. brevipennis* in the island. However, because of the few records of the species from anywhere in Europe he suggests that this fly should be considered as a candidate for any Irish Red Data list of insects, that is unless future study shows the species to be more frequent that is presently known.

Family Drosophilidae

Leucophenga maculata was recently recorded from Ireland (Speight, 1990). This is the only *Leucophenga* species known from temperate parts of western Europe. This fly is primarily an insect of ancient deciduous forest, whose larvae have been bred from various saproxylic fungi. Given the scarcity of old deciduous trees in Ireland, it was not surprising that it remained unrecorded here until 1990. Speight (1990) considered it unlikely that this drosophilid will prove widely distributed in the island.

Family Limoniidae.

This group contains the "craneflies" of which approximately 115 species have been recorded in Ireland (Ashe *et al.*, 1991; Ashe *et al.*, 1988). Two of the species on the Irish list, (subfamily Pediciinae) *Dicranota guerini* and *D. lucidipennis*, are regarded as "notable" species by Falk (1991). By using the presence/absence data of such endangered, rare or notable species, it is possible to give a measure of the conservation value at particular sites.

Family Anisopodidae

There are 6 species of this family recorded from Ireland (Ashe, 1988). *Mycetobia obscura* was recorded by Ashe (1988) from a wet rot hole in oak, and was the first record of an anisopodid new to the Britain and Ireland in over sixty years. This species is now known from Ireland, Denmark, Sweden and parts of the former Soviet Union.

Family Fanniidae

Along with the checklist of Nash (1979) and the two new records of Blackith & Blackith (1991), the Irish list now total 26 species. *Fannia norvegica*, is a distinctively northern species known only from Norway, Scotland and a number of localities in England and Wales. The species is considered to be rare (Blackith & Blackith, 1991).

Family Chamaemyiidae

Acrometopia wahlbergi is as yet known in Ireland only from Scragh Bog, Co. Westmeath (Speight & Cogan, 1979).

Family Dixidae

There are at present 12 species of dixids in Ireland which compares with 14 species recorded in Britain (Ashe,1985; Ashe & O'Connor,1990). *Dixella attica* is rare in Britain, and was recorded in this country by Ashe & O'Connor in 1990. Those authors indicate that it may indicate a site of unusual ecological interest. It was recorded from a small lake near Causeway, Ballyteige, Co. Wexford. *D. serotina* is recorded from Clare, Offaly, Wicklow, Dublin and Offaly, and may be another species that indicates a site of unusual ecological interest. *D. filicornis* is only known from a single locality in Co. Laois. *D. autumnalis* is recorded from Clare, Wexford, Galway and Kildare. *Dixa nebulosa* is only recorded from four localities (two in Kerry, and one each from Co. Louth and Co. Meath). *D. submaculata* is known from Dublin, Leitrim, Wexford,Wicklow, Cork and Kerry.

Family Dolichopodidae

150 species approximately, were known to occur in Ireland (Blackith *et al.*, 1989). The dolichopodid, *Campsicnemus compeditus*, seems unlikely to be under threat as it does in Britain

(Speight, 1990). *Systenus pallidus* is a form of *S. pallipes* which is on the British Red Data list (Speight, 1989).

Family Chironomidae

The number of chironomids recorded from Ireland up to 1988 was 371 (Ashe, 1987; Heneghan & Murray, 1987; Morgan & Murray, 1988; Bond, 1988). This compares to approximately 600 species from Britain.

Family Mycetophiloidae

According to Chandler (1987), there were at that time 257 species of Irish fungus gnats. Chandler (1987) considered that the British fauna was approximately 500 species.

Family Sarcophaginae

This group contains the "flesh-flies", of which 14 species of sarcophagines are recorded from Ireland and another 3 species are considered to be adventitious. This compares with approximately 34 species in Britain and 58 in France. Several sarcophagine species are implicated in the spread of diseases to domestic stock and occasionally of humans but none of the species involved are found in Ireland. The majority of these species are common. *Pierretia soror* is an essentially Mediterranean species confined in this country to western localities where calcareous rocks outcrop. (Blackith & Blackith, 1994)

Family Asilidae

Only 3 species of Asilidae or 'robber flies' are known from Ireland. By contrast 26 species occur in Britain, twelve of which reach Scotland. *Machinus cowini* reaches the nothern edge of its range in Ireland and the Netherlands, and is almost confined to coastal dune systems. In Ireland it may be largely restricted to east coast dune systems. This species has only been found in a very few European countries, and is not known in Britain. It has in fact been recorded from more Irish counties than continental European locations. It would appear that this species is an endangered relict of some sandy soil scrub biotope that has all but disappeared over much of the European range of this insect. This would make *M. cowini* of both biogeographical and conservation interest in Ireland. *Neoitemus cyanurus* is the only Irish woodland asilid. It has a widespread distribution in continental Europe. The third species, *Philonicus albiceps* is also known from only coastal dune systems in Ireland (Speight, 1987).

Family Oestridae and Family Gasterophilidae

These families contain the bot and warble flies and are important because their larvae cause myiasis in mammals. 6 oestrid species and 2 gasterophilid species have been recorded from Ireland (Sleeman, 1980). Another oestrid species, *Hypoderma trandi* is probably extinct in Ireland.

Family Tachinidae

The larvae of this group are internal parasites of various arthropods. 51 species are recorded from Ireland in comparison to 233 species confirmed from Britain (Nash, 1979).

Family Syrphidae

This group contains the "hoverflies" of which 171 species are recorded as occurring in Ireland (pers comm. Dr M. Speight). The majority of species are found in woodland, woodland edge, deciduous woodland, and damp grassland (Speight *et al.*, 1975). 3 species are presumed to be extinct. In Appendix II, 28 Irish species are listed as being threatened (this list is provided by Dr M. Speight, National Parks and Wildlife Service, Dublin).

Family Simuliidae

This group contains the "black flies". Fahy (1972) lists 15 as being recorded from Ireland.

Family Empididae, Family Hyboidae and Family Microphoridae

These families contain the "dance flies". The latter two families have been recently recognised and the total for the three families is 174 species (Lavery *et al.*, 1993).

Family Psychodidae

60 species of psychodid, also known as "moth flies", are recorded from Ireland. *Boreoclytocerus tonnoiri* is a rare species, which has been recorded from one location in both Ireland and Britain. The species is known from Czechoslovakia, Austria, Greece and former Yugoslavia. *Mormia satchelli* was found in Co. Kildare and the only other European examples are from the Jura in Germany. *Atrichobrunettia angustipennis*, recorded in Co. Kildare is the most northerly for a genus that is potentially the rarest in all Europe and its distribution seems centered on the Mediterranean islands. It is also known from Belgium. *Paramormiaerminea* is a very rare species that appears to be associated with the otter in some way. *Szaboiella hibernica* is another rare species (Withers & O'Connor, 1992).

Family Xylophagidae

Xylophagus ater is a rare Irish species, confined to relict areas of ancient woodland and pasture woodland in the wetter hillier parts of Ireland. It has so far only been recorded from five counties, including the National Parks of Killarney and Wicklow, but may be expected to be found in other areas (Alexander, 1992). Alexander considers that this species should be considered as a candidate far an Irish Red Data Book, when one is produced.

Family Culicidae

This group contains the mosquitoes. 18 species are recorded from Ireland. On a worldwide scale mosquitoes are important since they are the vectors of the protozoan which cause malaria. In

Ireland the present medical importance is due to the irritability of the bites, since some people are allergic to them. In the past they did carry the benign type of malaria in Ireland, and today the main concern is of the importation of the disease in imported mosquitoes. They also carry the *Myxoma* virus which causes myxomytosis in rabbits (Ashe *et al.*, 1991).

Family Hippoboscidae

This family contains a group of blood sucking diptera, of which 9 species have been recorded in Ireland (O'Connor & Sleeman, 1987).

Order Lepidoptera

This group comprises the butterflies (Macrolepidoptera) and moths (Microlepidoptera). The adults are familiar insects, characterised by their broad wings and the long proboscis which is carried rolled up beneath the head. The larvae are the caterpillars, found on terrestrial plants, while some are aquatic. The group is divided into (1) suborder Macrolepidoptera - butterflies, and (2) suborder Microlepidoptera - moths.

(1) Suborder Macrolepidoptera

There are 28 permanently resident butterfly species, some of which are very local in their distribution. The number is made up from 8 browns (or satyrs), 6 fritillaries and vanessids, 3 blues, 1 copper, 3 hairstreaks, 6 whites (or pterids) and 1 skipper. In addition to these there are three summer migrants which although varying greatly in numbers, occur in most years. They are the red admiral, the painted lady and the clouded yellow. Another six species are found as migrants only on very rare occasions. Two species are now extinct in Ireland, the large copper *Lycaena dispar rutilus* (which was introduced in 1913) and the heath fritillary *Mellicta athalia* (Lavery & Lavery, 1987), whilst the mountain ringlet *Erebia epiphron* is rarely recorded (Nash & Samson, 1990).

Except for the Burren, Co. Clare, the dingy skipper (*Erynnis tages*) is nowhere very abundant, whilst it does occur in a number of other counties. The Burren specimens are referred to as the sub-species *E. tages baynesi*. Two forms of the marsh fritillary occur in Ireland, *Euphydres aurinia scotica* and *E. a. hibernica*, the former being said to be more abundant than the latter. A number of the other species have distinct Irish sub-species : The Irish wood white subspecies is *Leptidea sinapsis juvernica* ; forms of the green-veined white are *Pieris napi fasciata* and *P. n. hibernica* ; the orange-tip of Ireland is a distinct subspecies *Euchloe cardarmines hibernica* ; Irish and British gatekeeper butterflies have been defined as the subspecies *Pyronia tithonus britanniae* ; Irish specimens of the meadow brown are known as *Maniola juetina iernes* ; Irish specimens of the large heath butterfly are *Coenonympha tullia scotica* and *C. t. polydama*. The different sub-species of butterfly in certain localities/regions occur because of the genetic isolation of the different

populations, giving rise to distinct "races" of a species (Hickin, 1986). Lavery (1993), when considering the status of the marsh fritillary, *E. aurinia*, concluded that it cannot, realistically, be regarded as a threatened species in Ireland, but that man induced habitat loss and habitat modification which have caused its decline elsewhere in Europe are occurring in Ireland. He recommends that consideration be given to protection of the few Irish sites supporting very large populations of this species, which is currently regarded as internationally threatened and is on Appendix II of the Bern Convention. It is associated with certain types of old pasture, and is widespread in Ireland, although extremely localised.

(2) Suborder Microlepidoptera

Bond (1995) lists the Irish checklist of Microlepidoptera at 793 species. This represents 51% of the current British total. The proportion of British species present shows considerable variation between families in the group. There is a relatively high proportion (70%) of the family Elachistidae present, which probably reflects the relatively extensive and varied range of grassland present in Ireland. The lower numbers of the families Coleophoridae and Gelechiidae present is probably associated with the number of species dependent on deciduous trees in these families, as the number of deciduous woodland species present in Ireland is in general markedly lower than in Britain. Bond considers that increases and decreases in distribution, introductions and extinctions are undoubtedly occurring continously in the Irish Lepidoptera (as in other invertebrate groups). Introductions of new species can be recognised where the species are dependent on foodplants which are not native. Bond gives the example of the increase of the number of species feeding on conifers and a striking example of introduction and range expansion is *Blastobasis lignea.* This species was first recorded in 1911 and it now appears to have spread to all parts of Ireland. In terms of decrease, there appears to be a decrease in the abundance of species feeding wholly on dead or decaying wood, or associated fungi. Of the 7 species in this category which have been recorded from Ireland, there are few recent records of the tineids *Nemapogon clematella* and *Triaxomera fulvimitrella.* There are also few, if any recent records of the oecophorids *Alabonia geoffrella, Schiffermuelleriella similella* and *Batia lambdella.* (Bond, 1995.)

Many Irish moth species are local in distribution and have distinct Irish forms: The white prominent, *Leucodonta bicloria,* is not only the rarest of the twenty five species of the family Notodontidae found in Ireland and Britain, but is also one of the most local and rarest of all moths. It was recorded first in Killarney in 1858, but the last record was in the 1940's (Hickin, 1986) ; the dew moth, *Setina irrorella,* is a local species, but where it occurs it is abundant (such as in south Galway, the Burren, Co. Clare and in the Aran Islands ; the Irish subspecies of the sandhill rustic, *Luperina nickerlii knilli* is confined to the coasts of the Dingle peninsula in Kerry and the Aran Islands, where it occurs in the sandhills ; the Burren green moth, *Calamis tridens occidentalis,* occurs as the name suggests in the Burren, Co. Clare ; the Irish subspecies of the

poplar lutestring *Tethea or hibernica* is found in Ireland locally where aspen occurs in Donegal, Fermanagh, Sligo, Cavan, Mayo, Galway, Wicklow and Kerry ; the Irish subspecies of the commonly found muslin moth is known as *Cycina mendica rustica* ; the Irish subspecies of the grey moth, *Hadena caesia mananii* is local but not uncommon in a number of maritime localities around Ireland, from Donegal to Clare, Kerry, Cork and Waterford ; three subspecies of the pod lover moth occur in Ireland, *Haedena lepida capsophila, H. s. suffusa* and *H. s. obsolescens*; the marbled green moth, *Cryphia muralis westroppi*, is an extremely variable moth, and a number of extreme colour forms have been collected from a few localities. *C. m. castarrea* is found in Cork, as is *C. m. similis* and *C. m. nigra* has been recorded in Co. Kerry ; the yellow shell moth is also another very variable moth. *Euphyia bilineata isolata* was first recorded on Tearaght Island off the Blaskets and is also found on Inisvickillane, also off the Blasket Islands, Co. Kerry. The subspecies *E. b. hibernica* and *E. b. testaceolata* have been recorded on the Kerry and West Cork coast ; the netted pug moth, *Eupithecia venosata plumbea*, is confined to the coastal districts of Clare and Kerry and the Blasket Islands, Co. Kerry ; the speckled yellow moth, *Pseudopanthera macularia*, occurs in a number of counties, being especially abundant in the Burren, Co. Clare ; the transparent burnet, *Zygaena purpuralis sabulosa*, occurs in a number of forms throughout Britain and Ireland, where it is very local. Abundant colonies occur in Clare and Galway, where limestone is to be found ; the subspecies is usually *Z. p. hibernica*; the Welsh clearwing moth, *Aegeria scoliaeformis*, occurs in Killarney and Kenmare, Co. Kerry (Hickin, 1986).

Order Trichoptera

These are known as the "caddis" or "sedge" flies. The larvae (nymphs) are aquatic. The group is divided into forms that build a case (of sand, small stones, twigs, shells, leaves or pieces of vegetation) and are known as cased-caddis, or those that are free-living as nymphs (caseless caddis). Caddises are found in most clean aquatic habitats, from cold, fast-flowing mountain streams to lowland ponds and ditches. The nymphs are an important item in the diet of fishes, amphibians and many invertebrates. To the angler they are one of the most important groups as trout take both larva and adults. The following is mainly from O'Connor, 1987, when he reviewed the Irish Trichoptera.

A total of 144 species, representing 16 families, have been authentically recorded in Ireland. The Irish fauna represents about 74% of those of Britain and the western English Lowlands, while it is about 67% of the Central English Lowlands. The Irish trichopteran fauna is formed from different components of the European fauna. Three species recorded in Ireland (*Tinodes maculicornis, Apatania auricula* and *Limnephilus fuscinervis*) have not been recorded in Britain. *Limnephilus fuscinervis* is a widespread species, whilst *Tinodes maculicornis* occurs in five counties and *Apataniaauricula* is widespread in Kerry with a record from Co. Clare. In this checklist 38 species have been recorded from six or less counties. The remainder of the species were considered to be

widespread. Some of the rare species and the area they are recorded from include: *H. tigurina* - the pupae of this species have been collected from the River Caragh, Co. Kerry; *Cyrnus insolotus* - this species occurs in Lough Derrygeeha, Co. Clare; *Setodes argentipunctellus* - known only from two adjoining lakes in Co. Kerry, where it was first discovered over one hundred years ago; and *Leptocerus tineiformis* - a recently recorded species (1990) from Pollardstown Fen, Co. Kildare. Three species, not recorded for nearly 100 years are: *Ylodes reuteri* - Wexford (1902); *Athripsodes bilineatus* - Westmeath (before 1900); and *Oligotrichastriata* - Roscommon and Westmeath (early this century).

O'Connor (1987) quotes a number of references that point to the increasing destruction of Irish wetlands by arterial and field drainage, turf production, afforestation and the intensification of agriculture. O'Connor (1987) considers it timely that protection should be considered for the rarer Irish Trichoptera, (he lists *H. tigurina* and *C. insolutus* as suitable candidates for protection, and notes that the Irish population of *S. argentipunctellus* lies within the Connemara National park).

Limnephilus pati was recorded recently from Co. Tipperary (O'Connor & Bond, 1995). This is a very significant discovery as this species of trichopteran is very rare and is a threatened species in Europe. In Ireland, it was known only from three sites in Co.s Donegal, Mayo and Westmeath, the most recent record being July 1894. In Britain the only extant population was on the Isle of Man and the species is on the British Red Data book. Outside the British Isles, *L. pati* is known only from two sites in Germany. *L. tauricus* was recorded from Ireland recently (O'Connor & Bond, 1995) from Co. Tipperary, at the same site as *L. pati*, and is accorded the same rare and endangered status on the British lists.

Order Hymenoptera

This is the second largest order of insects and its principal members are wasps, bees and ants. Less well known are the few aquatic species, all of which are parasites on either the egg or larval stages of other aquatic insects. They are extremely varied in size and appearance but the order can be split into (1) suborder Symphyta, which have no waist and (2) suborder Apocrita, in which there is a very narrow waist. From the literature checked the total stands at 586 species.

(1) Suborder Symphyta

This group contains the "saw-flies", of which there are at least 201 species recorded from Ireland as compared to 430 from Britain (Moller, 1975).

(2) Suborder Apocrita

This is the larger of the two suborders and it contains some of the most advanced insects, including the bees, wasps and ants. There are two sections within the suborder: (a) the Parasitica and (b) the Aculeata.

(a) Section Parasitica

Superfamily Ichnemonoidea

This is a very large group of parasitic insects, who play an important role in controlling insect numbers and are responsible for destroying huge numbers of insect pests. There are two families, the Ichneumonidae and the Braconidae.

Family Ichneumonidae

The provisional checklist of Irish Ichneumonidae now includes 167 species, 95 of which require confirmation (Boston & Nash, 1989).

Family Braconidae

There are at least 21 species of this family, as O'Connor *et al.* (1991) lists 7 new species from Ireland and has records for 14 more.

Superfamily Cynipoidea

Family Cynipidae

44 gall-causing cypinids on oak (*Quercus*) are recorded for Ireland (O'Connor, 1995; O'Connor *et al.*, 1993). *Andricus quercusalicis* causes serious damage to the acorns of *Quercus robur*. *Andricus kollari* was introduced in 1860 and is now widespread in the country (O'Connor & Ashe, 1993).

Superfamily Diapriidae

Subfamily Diapriinae

The Diapriidae is one of the larger families of parasitic Hymenoptera in the British Isles. There are at present 68 species recorded in Ireland (O'Connor & Ashe, 1992).

(b) Section Aculeata

In his list of the aculeate hymenopterans, Stelfox (1927) listed the following numbers of species for the 6 families in the group and compared it with that of Britain (in brackets):

Apoidea (Bees)	80	(234)
Specieshecoidea (Solitary and digger wasps)	32	(93)
Vespoidea (True wasps)	26	(67)
Chrysididae (Jewel or ruby tailed wasps)	3	(24)
Bethylidae	16	(105)

Stelfox considered that the Irish fauna (171 species) is simply a depauperate British Isles fauna (554 species), with, some racial characteristics, for example *Megachile willughbiella* var *hibernica*, perhaps due to isolation, or a different origin for some species. They are a sun-loving group and Stelfox considered that not many more species would be added to the Irish list. In Ireland the honey bee, *Apis mellifera*, consists of British Isles, Italian, Dutch as well as our own native Irish stock. Collingwood (1959) listed 17 species of Formicidae as occurring in Ireland, 3 species more than Stelfox above. In a more recent paper Nash *et al.* (1990) lists 168 species for the aculeate superfamilies Pompiloidea, Specieshecoidea and Apoidea.

Bombus sylvarum is one of the rarer species of Irish bumblebee with few published records. Another bumblebee *Bombus monticola* was first recorded in Ireland in 1974 by Speight (Anderson, 1990) and is typically a species of upland heaths and moorland. It is widespread in western Britain, but has only been recorded on few occasions in Ireland (Anderson, 1990).

Superfamily Chalcidoidea

This group of aculeates are parasites or hyperparasites, attacking eggs, larvae, and pupae of a wide range of other insects. *Ablaxia anaxenor* has been recorded once in Co. Kerry, and is a very rare species.

Phylum Echinodermata

Echinoderms are exclusively marine organisms and are largely bottom dwellers. The group contains such forms as starfish, sea-stars, brittle stars, and echinoids such as the urchins. The most striking characteristic is their radial symmetry, which takes the form of five arms radiating from a central disk, or more globular forms, again with structures arranged in five rows. The skeleton usually bears projecting spines or tubercles that give the body surface a warty or spiny appearance. Nichols (1902) listed 86 species as being recorded in Irish waters. In a more recent paper, 73 species are recorded from Ireland (O'Connor & Tyndall, 1986). The purple sea urchin, *Parancentropus lividus*, is currently listed in the IUCN Red Data Book (1992) as a commercially threatened species. Overfishing of this species has implications beyond its absence from an area. It is a "key" species in that it affects the plant and animal community around it. Hence, if the species is over exploited, the surrounding community structure would change.

Phylum Hemichordata

The hemichordates are worm-like marine animals, that once were considered a subphylum of the chordates. 12 species are listed as occurring in the British Isles (Howson, 1987).

Phylum Chordata

Most chordates are vertebrates. Two subphyla, the Urochordata and Cephalochordata, lack a backbone, but have a dorsal hollow nerve chord at some point in their life cycle.

Subphylum Urochordata

These are commonly known as tunicates, most of which are sessile, the body being covered by a complex secreted tunic. 105 species are listed as occurring in the British Isles (Picton, 1987). A number of specimens of *Synoicum incrustatum* were collected between 1982 and 1986 from the north coast of Ireland. It was previously known only from northern Scandinavia and from the Faroes, therefore considerably extending southwards the known distribution of this species. (O'Connor, 1989) Another species of the genus, *S. pulmonaria*, is also found in the area.

Subphylum Vertebrata

This group contains all the animals which have a backbone (*i.e.* vertebrates), and includes fish, amphibians, reptiles, birds and mammals.

Class Pisces and Class Agnatha

In total there are approximately 246 species of fish recorded from Ireland and the surrounding seas (3 species of Class Agnatha (lampreys) and 243 species of Class Pisces). Fish species tend to spend their lives in either freshwater or in the sea. However, there are a number of species which spend time in both environments in order to complete their life cycle. For example, the European eel, *Anguilla anguilla*, spends the majority of its life in freshwater and returns to the sea to breed (catadromous life cycle) whilst the Atlantic salmon, *Salmo salar*, returns to freshwater, after one or more years in the sea, to breed (anadromous life cycle). 17 species of fish occur exclusively in freshwater, and 210 species are exclusively marine, while 19 species spend at least some time in marine and freshwater (Whilde, 1993; Quigley & Flannery, 1996).

Freshwater

Ireland's freshwater fish fauna is a mixture of species composed of: (a) pre-glacial relict populations; (b) post-glacial colonizers; (c) species introduced and spread by man; (d) seasonally occurring euryhaline and diadromous species; and (e) occasional vagrants from other biogeographical zones. However, despite its diverse origins, Ireland's freshwater fish fauna is relatively poor in comparison with 55 species in Britain and 221 in the rest of Europe. 18 species

are considered to be indigenous to Ireland and about 14 species are thought to have been introduced and spread by man during historical times. The distribution of 16 species is widespread, while 15 occur locally, and 6 species are thought to be rare. (Quigley & Flannery, 1996).

Whilde (1993) listed 9 species which are considered to be threatened, while one species, the Atlantic Salmon *Salmo salar*, was considered to be of international importance. Of the nine threatened species, three were considered to be in each of the following categories Endangered, Vulnerable and Indeterminate. They are:

(1) Sea Lamprey, *Petromyzon* marinus (Indeterminate): this is a native anadromous species which inhabits deep offshore waters, shallow inshore waters, estuaries and easily accessible rivers. The adult is parasitic on a wide variety of fish, and occasionally cetaceans. The sea lamprey breeds in the unpolluted lower reaches of larger rivers. Non migratory populations have been recorded in Loughs Conn and Corrib and the reservoirs of the River Lee. In Europe it has declined dramatically in some areas because of pollution and the erection of river barriers.

(2) River Lamprey, *Lampetra fluviatilis* (Indeterminate): this is a native anadromous species which inhabits shallow inshore waters and accessible rivers. The adult is parasitic on a couple of fish species. It breeds in unpolluted freshwater lakes and streams. In Ireland the species is at the north-western edge of its range, and it occurs throughout Europe.

(3) Brook Lamprey, *Lampetra planeri* (Indeterminate): this species is possibly an introduced species which is non-migratory. The species is fairly widespread in Europe, but in Ireland is confined principally to the Erne catchment, Co. Fermanagh and in small streams in limestone regions.

(4) Allis Shad, *Alosa alosa* (Endangered): this anadromous species is a member of the herring family and is considered to be native. It occurs in rivers and coastal waters from south Norway southwards to the west coast of Italy. It has become almost extinct in the north of Europe and very rare in the south. This species is under substantial threat across its whole range. It is not known if the species is still extant in Ireland although it is possible that the species may spawn in some of our rivers.

(5) Twaite Shad, *Alosa fallax fallax* (Vulnerable): this is a native anadromous species which is also a member of the herring family. The twaite shad, *Alosa fallax*, is represented in Ireland by two subspecies, this and the Killarney shad (see no. 6). There are only a small number of known spawning populations, which are confined to a number of rivers along the south and south-west coast (Slaney, Barrow, Nore, Suir and Blackwater). It occurs in rivers and coastal waters from north Norway southwards to the west coast of Italy. Lake forms have been recorded in Albania

and Italy. The coastal population has decreased dramatically in recent years and in the mouths of north European rivers it is considered to be almost extinct and vulnerable elsewhere.

(6) Killarney Shad, *Alosa fallax killarnesis* (Endangered): the Killarney shad also known as the "Goureen" is a unique "land-locked" dwarf form of the twaite shad which is only found in the Killarney lakes (Lough Leane and Muckross lake). It is thus one of our endemic fish subspecies, that occurs nowhere else.

(7) Arctic Charr, *Salvelinus alpinus* (Vulnerable): this indigenous species is a relative of salmon and trout, which represents an arctic-alpine element of the Irish fauna. In Ireland the Arctic Charr is considered to be a landlocked glacial relic of an otherwise anadromous, circumpolar species. Here the species is at the southern edge of its range and has probably been genetically isolated for about 10,000 years. The species has been recorded from a number of lakes along the north-western, western, south-western and eastern (one location) parts of Ireland. Pre 1930's the species had also been recorded from a number of midland lakes but these have become extinct over the last century, probably because the species is particularly sensitive to any deterioration in water quality. Various "races" of this species occur, between the different lakes, showing different morphological variations although they are regarded as forms of *Salvelinus alpinus*. This range of variation should be bome in mind as should the spectrum of ecological conditions in which these different forms have evolved and presently exist. The Arctic Charr of Lough Finn, Donegal and Lough Coomasaharn, Kerry are dwarfed and the latter population is considered to be unique in Ireland and Britain. Recently there was some concern about the population in Lough Conn on the Corrib catchment. The Arctic Charr has a circumpolar distribution, and is found landlocked in a number of lakes in Britain. There were considered to be two hundred small, locally isolated and declining populations in Britain, whilst in Europe the numbers of this fish were considered to have declined and are now considered endangered.

(8) Pollan, *Coregonus autumnalis pollan* (Endangered): the pollan is an indigenous landlocked coregonid (white fish) species which is thought to have colonised Ireland after the last Ice Age. The Irish pollan population is the only one in western Europe and is almost unique in being non-migratory and confined to freshwater lakes. The pollan has been shown to be identical to the Arctic Cisco species from Alaska, suggesting that they are conspecific and that they have been separated only since the last glaciation. Studies have also shown that the species is distinct from the two British species, Vendace and Gwyniad. The pollan is currently found in only four lakes situated on three river catchments in Ireland: Lough Neagh (where it used to be fished commercially); Lower Lough Erne; Lough Derg and Lough Ree (once found in large numbers on the Shannon lakes). Although the species was previously found in Upper Lough Erne, it is now thought to be on the verge of extinction there. There are no other pollan populations in Europe, so as our only endemic fish, the species is significant to the Irish fauna. There are anadromous

populations in western Arctic Canada, northern Alaska and Siberia where they are widespread and common.

(9) Smelt, *Osmerus eperlanus* (Vulnerable): the smelt is considered to be a native anadromous species, but has only been recorded from six locations in Ireland: Shannon estuary; Fergus estuary; Foyle estuary; and Larne and Belfast Loughs. It may occur in other Irish rivers particularly along the south coast. The smelt occurs from the Baltic to the Bay of Biscay and is considered to be moderately common though locally distributed. In Britain the species has gone into decline and disappeared from many rivers, mainly as a result of pollution and overfishing. In all there are said to be twenty nine river systems with smelt in Britain and Ireland.

(The above is from Quigley & Flannery, 1984; Quigley & Flannery, 1996; Whilde, 1993.)

Atlantic Salmon, *Salmo salar* (Internationally important): Ireland has a widespread and abundant population of Atlantic Salmon, which is not considered to be threatened at present. The salmon of each river system are genetically different, as they have become adapted to specific rivers, but are all of the *Salmo salar* species (pers comm. Dr N. Wilkins), and constitute an important asset to the freshwater fish of this country. In salmon farming the fast growing "Mowi" is used and this is originally of Norwegian stock.

Analyses of Irish brown trout, *Salmo trutta*, populations have demonstrated the genetic complexity and large amounts of variation within and among populations. Genetically distinct populations have been found within a single water body. For example in Lough Melvin, Co. Sligo, you find three reproductively isolated populations, known as the "gillaroo", "sonaghan" and "ferox" forms of trout. Lough Melvin is perhaps one of the last remaining examples of what may once have been a widespread situation of different populations of a species living in the same water body. There are also differences between the brown trout and its anadromous form, *i.e.* the sea trout, which show that both forms have a recent common origin. Care should be taken when restocking trout of mixed origin so that the bridges between natural populations are not broken down. (Fleming & Ferguson, 1983) Crozier & Strange (1986) were able to achieve diagnostic separation of the brown trout (*Salmo trutta*) and Atlantic salmon (*S. salar*) and their interspecific hybrid sea trout.

Estuarine

Estuaries provide important habitats for several species of euryhaline fish. Ireland's group of euryhaline fishes represents a mixture of species, including some of international importance. The total number of euryhaline species in Irish waters is at least 31 species. This includes 12 diadromous species, which penetrate into freshwater during part of their life cycle, 3 non-migratory landlocked species, and 16 essentially marine and/or estuarine species. 24 species are regarded as indigenous (*i.e.* native), six species occur as occasional vagrants from other

biogeographical zones and one was introduced by man during the last century. Quigley & Flannery (1995a) consider that over one third of the euryhaline species are threatened for one reason or another.

The vagrant group includes 6 rare species: sturgeon, *Acipenser sturio*; tarpon, *Tarpon atlanticus*; anchovy, *Engraulis encrasicolus*; humpback (or pink) salmon, *Oncorhynchus gorbuscha*; thin-lipped grey mullet, *Liza ramada*; and golden grey mullet, *L. aurata*. The sturgeon is regarded as extremely endangered throughout its natural European range and requires to be protected on an international basis. Rainbow trout, *Salmo gairdneri*, were introduced into Ireland in the 1880's. They have been used as an angler's fish and as a farmed species, and because of farm escapees have given rise to feral populations. There has been an increasing concern about the current status of three other commercially exploited species which have all exhibited serious population declines in recent years: sea trout, *Salmo trutta*; eel, *Anguilla anguilla*; and sea bass, *Dicentrarchus labrax*.

Seven euryhaline species are included in the Bern Convention and EU Habitats Directive, six of which have been dealt with above (from the Red Data Book on Irish vertebrates: sea lamprey; river lamprey; allis shad; twaite shad; Killarney shad; pollan). Very little is known about the true status of many of our euryhaline species.
(taken from Quigley, 1995a.)

Marine

Ireland's inshore marine fauna is composed of a diverse array of species derived from several biogeographical zones. 230 species of fish in total have been recorded from around the Irish coasts, 98 of which were regarded as common and 132 as uncommon. The uncommon group was further subdivided as follows: 62 rare; 21 scarce; 31 local; and 18 indeterminate. The uncommon group was made up of 53 indigenous species, 23 deep-water species; 51 warm-water species and 5 cold-water species. Many of our species are typically cool-temperate in range and are found virtually around the whole coast at most times of the year. However, superimposed on this is the significant warm-water Lusitanian element of the fauna and the cold-water boreal species. The Lusitanian species are usually at the northern limit of their range in Irish waters, either as residents or as summertime migrants, or both. They are normally abundant south of the Bay of Biscay and in the Mediterranean. Although Boreal species usually extend only as far south as the North Sea, some migrant species occur in Irish waters from time to time and a few occur as residents. The North Atlantic Drift is also responsible for carrying many sub-tropical vagrant species into Irish waters, whilst our fish fauna is also supplemented by a small number of deep-water species from the edge of the continental shelf. Some of these deep-water species are known to migrate into relatively shallow inshore waters on a regular basis, and it is possible that these inshore waters may provide important breeding and nursery areas for some deep-water species.

14 species of marine fish are considered threatened. Some of these species, which are estuarine or estuarine/freshwater have been dealt with above. The species which have not been are: basking shark, *Cetorhinus maximus*; undulate skate, *Raja undulata*; white skate, *Rajaalba*; common skate, *Raja batis*; red mouthed goby, *Gobius cruentatus*; and *Gobius couchi*. The basking shark was a commercially exploited species in the past. During a survey in 1993, basking sharks were observed around the whole Irish coast, but were most frequently reported in the south-west off Co. Kerry, off the Dublin coast and off Co. Antrim (Berrow & Heardman, 1994). The red mouthed goby has been recorded for the south-west coast only, the largest known population is found in Lough Hyne (Minchin, 1995).

Despite the subjective element in identifying rare fishes, their status needs to be examined as it is becoming increasingly apparent that uncommon species and particularly those on the edge of their distribution can provide essential indicators of environmental change.
(Taken from Quigley & Flannery, 1995b, unless otherwise stated.)

Class Amphibia

Three species of amphibian occur in Ireland: the common frog, *Rana temporaria*; the natterjack toad, *Bufo calamita*; and the smooth (or common) newt, *Triturus vulgaris*. Whilde (1993) lists the natterjack toad as endangered and the common frog as internationally important in the Irish Vertebrate Red Data Book.

(1). Natterjack toad, *Bufo calamita* (Endangered): this species is Ireland's only toad and rarest amphibian. It is found in just one area in Co. Kerry. Here it lives in coastal sand dunes and breeds in lakes, pools and drains containing water which ranges from fresh to brackish. In Ireland the species is at the north-western limit of its range. According to O'Connor & Jeal (1986) extensive land drainage, in all probability, reduced the distribution of the species between 1973 and 1986. In Britain, where it is classed as vulnerable, it was formerly widely but locally distributed. However, the species has declined dramatically there, and is today found at fewer than forty breeding sites. The species is restricted in Europe to sixteen countries, and is abundant in Portugal, most of Spain and western France.

(2). Common frog, *Rana temporaria* (Internationally important): this species is considered to be widespread and common in Ireland, but vulnerable in the rest of Europe. The drainage of wetlands, bogs and water pollution may be affecting the species in some areas of Ireland.
(From Whilde, 1993, unless otherwise stated.)

Class Reptilia

One species of reptile is native in Ireland, the viviparous lizard, *Lacerta vivipara*. This species has a widespread distribution in Ireland occurring in all types of dry habitats and favours sandy or rocky places. It also seems to thrive in bogs. The Irish Wildlife Federation are conducting a survey of this species at present. Another species of lizard, the slow worm, *Anguis fragilis*, was discovered in the Burren in the mid 1970's (McCarthy, 1976). This species is not a native and was probably introduced.

O'Riordan (1972) listed 3 species of turtle that have been stranded on the Irish coast. They are, the leathery turtle *Dermochelys coriacea*, Kemp's Ridley turtle *Lepidochelys kempi*, and the loggerhead turtle *Carettacaretta*. Turtle strandings are relatively rare along the Irish coast, but occur as does the accidental capture of species in fishing nets.

Class Aves

In total, 403 species of birds have been recorded in Ireland since 1900. Of these, 168 species were considered for inclusion in the Irish Vertebrate Red Data book, since they regularly breed or overwinter in Ireland (Whilde, 1993). Whilde (1993) listed: 15 species as rare; 8 species as endangered; 3 species as vulnerable; 3 speciesas indeterminate; 7 species as internationally important; and 6 species as extinct.

The species in each category were:

(1). Rare:

Red throated diver *Gaviastellata*
Gadwall *Anas streera*
Garganey *Anas querquedula*
Pochard *Aythya ferina*
Merlin *Falco columbarius*
Greenshank *Tringanebularia*
Ring Ouzel *Turdus torquatus*
Bearded Tit *Panurus biarmicus*
Black-necked Grebe *Podiceps nigrocollis*
Pintail *Anas acuta*
Shoveler *Anas clypeata*
Goosander *Mergus merganser*
Black-tailed Godwit *Limosa limosa*
Short-eared Owl *Asio flammeus*
Wood Warbler *Phylloscopus sibilatrix*

(2). Endangered:

Hen Harrier *Circus cyaneus*
Corncrake *Crex crex*
Roseate Tern *Sterna dougallii*
Corn bunting *Miliariacalandra*
Grey Partridge *Perdix perdix*
Red-necked Phalarope *Phalaropus lobatus*
Nightjar *Caprimulgus europaeus*

(3). Vulnerable:

Golden Plover *Pluvialisapricaria*
Dunlin *Calidris alpima*

Little Tern *Sterna albifrons*

(4). Indeterminate:

Barn Owl *Tyto alba*
Tree Sparrow *Passer montanus*
Twite *Carduelis flavirostis*

(5). Internationally Important:

Storm Petrel *Hydrobates pelagicus*
Whooper Swan *Cygnus cygnus*
Barnacle Goose *Branta leucopsis*
Chough *Pyrrhocorax pyrrhocorax*
Peregrine *Falco peregrinus*
Light-bellied Brent Goose *Branta bernicla hrota*
Greenland White-fronted Goose *Anser albifrons flavirostis*

(6). Extinct from Ireland:

Bittern *Botaurus stellaris*
White-tqiled Eagle *Haliaeetusalbicilla*
Marsh Harrier *Circus aeruginosus*
Golden Eagle *Aquila chrysaeotos*
Capercaillie *Tetrao urogallus*
Woodlark *Lullula arborea*
(The Great Auk is also a species that lived in Ireland and is now totally extinct).

A photocopy of an early draft of a review of conservation status of Irish birds, submitted by Dr John Coveney (IWC), is located in Appendix III. The review is in tabular form, followed by explanatory notes with some individual species accounts also included. From the review it is notable that:-

(A). 14 (6.5%) species are listed as (i) having suffered at least a 50% decline in the last 25 years or (ii) have suffered a historical decline, or (iii) are of global conservation concern.

(B). 88 (40.9%) species have (i) suffered a 25-49% decline in the last 25 years or (ii) are rare breeders (300 or less breeding pairs).

(C). 85 (39.5%) species have a favourable conservation status in Ireland.

(D). 8 (3.7%) species make up at least 10% of the north west European population for that species.

Class Mammalia

The present mammal fauna of Ireland is made up of animals which: (a) were here before the last glaciation; (b) arrived via a land bridge during or after the last glaciation; (c) have managed to cross the sea themselves; (d) have been introduced by man, either accidentally or deliberately. During the Pleistocene epoch, there were a number of mammals in Ireland that are now extinct. Most of the evidence for their presence is in the form of bones excavated from clay deposits beneath bogs and from caves. The list included lemmings (*Dicrostonyx gulielmi* and *Lemnus species*), reindeer

(*Rangifer tarandus*), Arctic fox (*Alopex lagopus*), lynx (*Felis lynx*), brown bear (*Ursus arctos*), spotted hyaena (*Crocuta crocuta*), grey wolf (*Canis lupus*), mammoth (*Mammuthus primigenius*) and the giant Irish deer (*Megaceros giganteus*). The giant Irish deer was widespread in the rest of Europe at that time also, but remains have been found in largest numbers in Ireland. (Fairley, 1984)

At present 55 species of feral mammal are recorded as occurring in Ireland or in Irish waters. This comprises: seven species of bat; seven species of rodent (mice, rats, and squirrels); three deer species; two seal species; two hare species; rabbit ; hedgehog; shrew; fox; otter; stoat; mink; badger; pine marten; feral goat; and twenty four species of cetaceans (whales and dolphins have been recorded in Irish waters. (Whilde, 1993.) This list does not include the domesticated animals which will be considered separately.

Of the mammals present in Ireland today, the pygmy shrew, fox, pine marten, stoat, badger, otter, red deer, Irish hare, and all the bats are usually regarded as indigenous. The Irish stoat, *Mustela erminea hibernica*, is a subspecies endemic to Ireland and the Isle of Man. The species is widely distributed in Ireland. Formerly widespread, the only native stock of red deer are those of the Killarney district. Elsewhere Irish red deer died out, probably before 1850, and the other herds are all derived from introductions. Deforestation in the seventeenth century almost certainly led, directly or indirectly, to a reduction in numbers. The brown rat, *Rattus norwegicus*, was introduced to Ireland in the early 1700's and rapidly displaced the black rat (*R. rattus*) which is now confined to ports and Lambay Island. The red squirrel, *Sciurus vulgaris*, apparently died out in the seventeenth century in Ireland only to be reintroduced in the nineteenth century. The grey squirrel, *S. carolinensis*, was introduced earlier this century and has spread throughout most of the country. A comparatively recent addition is the American mink, *Mustela vison*, which were farmed in Ireland during the 1950's and 1960's for their pelt. However, escapees from the farms have ensured an expanding population today. The third mammal species to be added to the Irish list this century is the bank vole, *Clethrionomys glareolus*, which was recorded for the first time in Ireland in 1964 in Co. Kerry. The species is thought to have been introduced in the Shannon estuary by ship, and today it is still expanding its range. The muskrat (*Ondatra zibethica*) was accidentally introduced to an area in Co. Tipperary in 1929, but were exterminated by 1935. Numbers of another rodent, the copyu from South America, which is bred for its fur also escaped in Co. Tyrone in 1944, but were quickly killed. In Britain, this species has been living in the wild since before the Second World War. A famous population of house mice, *Mus musculus*, live on North Bull Island in Dublin Bay, specimens of which are a sandy colour instead of the normal grey. (Fairley, 1984)

In Whilde (1993) three mammal species are considered to be threatened (whiskered bat, *Myotis mystacinus*; Natterer's bat, *Myotis nattereri*; ship rat, *Rattus rattus*) and ten species are considered

to be internationally important (hedgehog, *Erinaceus europaeus*; lesser horshoe bat, *Rhinolophus hipposideros*; Daubenton's bat, *Myotis daubentoni*; Leisler's bat, *Nyctalus leisleri*; pipistrelle bat, *Pistrellus pipistrellus*; brown long-eared bat, *Plecotus auritus*; Irish hare, *Lepus timidus hibernicus*; pine marten, *Martes martes*; badger, *Meles meles*; otter, *Lutra lutra*). Of the three species that were threatened in the Irish vertebrate Red Data Book (Whilde, 1993) two were considered to be of indeterminate and one of rare status.

(1) Whiskered Bat, *Myotis mystacinus* (Indeterminate): In summer this species roosts in houses, whilst in winter it roosts in hollow trees, caves, mines, cellars, and under bridges. In Ireland very few sites are known for this species, and a survey is necessary to determine the population. In the 1985 to 1988 survey the species was only recorded at 34 roosts from around the country, most of which only contained one to ten bats. In Ireland it is at the north-western edge of its range. In Britain, it is classed as vulnerable. The whiskered bat occurs throughout Europe, and is considered to be rare and vulnerable.

(2) Natterer's bat, *Myotis nattereri* (Indeterminate): This species also roosts in buildings during the summer, and spends winter in caves and tunnels. In the 1985-1988 survey, 44 roosts were located in southern Ireland and two of these held single bats while only seven held over fifty bats. Natterer's is really a woodland bat so that any loss of mature woodland will affect this species. The species is classed as vulnerable in Britain, whilst in Europe it is known to have declined in some areas and is considered vulnerable, but little is known of its status.

(3) Ship rat (or Black rat), *Rattus rattus* (Rare): The black rat is considered to be a potential public health hazard. This species was recorded from Ireland in the twelfth century, and was probably widespread in human habitation until it was rapidly replaced by the Common (or Brown) rat which was introduced in the early 1700's. In Ireland the only recent record was from Lambay Island in the 1980's, and the species probably occurs around sea ports. In Britain it is confined to London dockland and on a single island, whilst it is widespread throughout Europe.

Internationally important species in the Irish Vertebrate Red Data book are:
(1) Lesser horshoe bat, *Rhinolophus hipposideros*: this species is the smallest European horshoe bat and one of the most sensitive to disturbance. Ireland has the largest national population of Lesser horshoe bats in Europe, which was estimated at 12,000 individuals (McAney, 1994). It is confined to the west and south-west and has not been recorded in Northern Ireland. Threats include the loss of their specific summer roosting sites (large attics and lofts) and disturbance at their winter sites (caves, souterrains, cellars). The European range of this species has been shrinking in recent years, and it has diappeared from the northern part.

(2) Daubenton's bat, *Myotis daubentoni*: this species is widespread (200 roosts in southern Ireland) and probably under-recorded. It is threatened in some localities due to pressure from the concreting work done on bridges, as the males roost under bridges and thus need gaps to live in. The females need stone buildings near water such as old castles, mills and cellars of old houses and caves with active rivers. The loss of river and lakeside vegetation and water pollution will affect this bat in particular.

(3) Leisler's bat, *Nyctalus leisleri*: Ireland, at the northern edge of its range, is the major stronghold in Europe for this species. It is widespread and numerous in Ireland and has been recorded in 108 roosts to date. It is considered to be rare and possibly vulnerable elsewhere in Europe and vulnerable in a world context. Exclusion is the main threat to this species.

(4) Pipistrelle, *Pipistrellus pipistrellus*: this species is Ireland's most widespread and numerous bat and has been recorded at over 700 roosts. It is also widespread and common elsewhere in Europe but is considered vulnerable there and throughout the rest of its world range. Exclusion from roosts is the main threat to this species.

(5) Brown Long-eared bat, *Plecotus auritus*: this is the second most frequently recorded bat in Ireland, with over 300 roosts. It is also widespread and common elsewhere in Europe, but is considered to be vulnerable there as elsewhere in its world range.

(6) Hedgehog, *Erinaceus europaeus*: it was considered to be a widespread and common species in Ireland, but a more up-to-date data review of its status is required.

(7) Irish (or Mountain) hare, *Lepus timidus hibernicus*: there are two subspecies of hare in Ireland, the Irish hare and the brown hare (*Lepus capensis*) which are distinct races of the Arctic hare. The Irish hare is widespread and common in Ireland. Elsewhere in Europe the mountain hare is common in Scotland and Fenno-Scandinavia but considered to be threatened in the rest of its range in the alpine regions of Germany, Italy and France. There have been introductions of the brown hare in the 19th century. Ni Lamhna (1979) recorded brown hares in Co.s Antrim, Armagh, Donegal, Fermanagh, Londonderry and Tyrone, but states that the overall distribution picture of this species is unclear due to ease of confusion with the Irish hare.

(8) Pine Marten, *Martes martes*: this species is widespread only in the west of Ireland, and is included by Whilde (1993) in The Red Data book as an Internationally Important species. This species is considered to be the most threatened of the larger mammals in this country (pers communication Dr P. Sleeman). The Pine Marten is considered to be threatened in seven of the EU countries in which it occurs (Whilde, 1993).

(9) Badger, *Meles meles*: the badger is common and widespread in Ireland. However, it is considered that it may be vulnerable in parts of its range. In Ireland, we know of this species from the TB debate, but Sleeman (1995) shows an interesting association between badger sets and stinkhorn fungi.

(10) Otter, *Lutra lutra*: Ireland has the densest population of otters in western Europe. They occur throughout the country in freshwater and coastal habitats. Elsewhere in Europe it is thinly distributed or extinct. On a worldwide scale it is classified as vulnerable.
(From Whilde, 1993, unless otherwise stated.)

One species of mammal is considered to have become extinct in the recent past, *i.e.* the Grey Wolf, *Canis lupus*, which has been extinct in this country since the eighteenth century. After the pine marten another important species (not in The Irish Vertebrate Red Data Book) is the Irish Red deer (*Cervus elaphus*), in Killarney, which may be affected by introduced parasitic flies and hybridisation (Sleeman, 1979; pers communication P. Sleeman). Grey and red squirrels can coexist, but it remains to be seen if the grey will displace the red as they are better competitors.

Order Cetacea

This group contains the whales, dolphins and porpoises. The group as a whole have suffered major declines in numbers on a worldwide scale, so much so that many species are now considered to be endangered and some are now extinct. Cetaceans live off the Irish coast or pass through Irish waters as part of their migration. Some species of dolphin and porpoise enter harbours and estuaries, whilst most whales usually keep well out to sea. The Irish Whale and Dolphin Group operate a recording scheme for cetacean sightings and strandings, whilst an annual report of stranded cetaceans is published in the Irish Naturalists Journal. The cause of the whale stranding phenomena is largely unknown. Commercial whaling occurred off the west coast earlier this century. Today, all cetaceans, within Irish waters are protected. In 1991, the Irish Government declared Irish waters a whale and dolphin sanctuary.

The total number of species recorded in Irish waters is 24 species. This includes a number of beaked whale species, which are rarely recorded in Europe. Eleven of the species are relatively frequently recorded in Irish coastal waters. O'Riordan (1972) listed 22 species as being recorded from Irish waters and 2 other species reported by whaling activities and the possibility of a further two species as being occasional visitors to Irish waters.

Some of the more frequent species in Irish waters are:
(1) Harbour porpoise, *Phocoena phocoena*: this is probably the most common cetacean species in Irish waters. It is recorded off all coasts, but is especially abundant off the south-west. The species is known to calve off the south-west and east coasts of Ireland.

(2) Atlantic white-sided dolphin, *Lagenorhynchus albirostris*: this species is apparently common around Ireland, and is known to calve in the south-west.

(3) Common dolphin, *Delphinus delphinus*: this is also one of the most abundant species off the south and south-west coasts and is frequently seen in the Irish Sea.

(4) Bottle-nosed dolphin, *Tursiops truncatus*: this species is probably fairly common in Irish waters, where the species is known to calve. However, it is thought to have declined in recent years. There is a resident population in the Shannon estuary, which is one of a few identified in Europe. Other important areas around Ireland for this species are Galway Bay and Clew Bay.

(5) Risso's dolphin, *Grampus griseus*: this species is known to calve in Irish coastal waters, and has been recorded from the Irish Sea and the west coast.

(6) Long-finned pilot whale, *Globicephala melas*: this is the most commonly observed whale species in Irish waters. It probably enters our coastal waters in the late summer and autumn, from neighbouring deep ocean basins.

(7) Northern bottlenose whale, *Hyperoodon ampullatus*: this is mainly a deep water species with small schools probably occurring in the late summer and autumn. In the past, strandings have been mainly on the east coast which suggests that they may migrate through the Irish Sea in late summer and autumn.

(8) True's Beaked whale, *Mesoplodon mirus*: There are only a small number of specimens of this species recorded worldwide and mostly from strandings. Of the nine European strandings, six are from the west coast of Ireland.

(9) Minke whale, *Balaenopteraacutorostrata*: this is the most common rorqual in Irish waters, and is widely distributed along the Atlantic seaboard and also occurs in the Irish Sea.

(10) Sperm whale, *Physeter macrocephalus*: this deepwater species was taken by commercial whaling in the earlier part of this century.

Four main threats to cetaceans in European have been identified: (a) pollution; (b) incidental capture in fishing nets; (c) reduction in the abundance of prey species; (d) disturbance.

Domestic animals

Neolithic man were the first to introduce domestic breeds, such as goats, sheep and cattle to the country. Ireland, today, is essentially an agricultural nation and many breeds of animals are farmed or kept as exotic species. However, there is a conservation element in some of the domestic breeds, since some breeds are native to Ireland, and have become adapted to our climate and topography. Not mentioned below are goats, poultry, geese, ducks, dogs (of which there are many breeds in Ireland) or cats. The fish which are farmed have been mentioned in that section. The following is a summary of the major groups.

Sheep

The Galway Sheep is the only indigenous breed in Ireland and the Irish Genetic Resources Conservation Trust are making efforts to increase the size of the breeding stock. The Aran Islands contains a population of the Galway sheep which are endangered. Distinctive regional variations of sheep imported long ago occur, as in the Wicklow cheviot, and recently a group of sheep which seem to be a distinctive breed has been described in the Milford area of Donegal (known as the Milford sheep). It is very likely that an Irish breed of mountain sheep once existed but the importation of Scottish, English and Welsh mountain rams will have made their identification impossible. Breeds of sheep not indigenous to Ireland have been imported, many of which are rare or minority breeds. The Jacob sheep which was an endangered breed twenty years ago is now popular. It is known that there are flocks of soay, Wiltshire horn, grey faced Dartmoor, Castlemilk moorit, Lincoln longwool and banwen in Ireland. A breed of seaweed eating sheep probably similar to the north Ronaldsay was once found on the west coast. Other sheep breeds included in the Rare Breeds Directory (Anon, 1995) are Kerryhill, Welsh badger face, Dorset down, Shetland, Dartmoor greyface, Portland, Rough fell, friesland, whiteface woodland, Hampshire down, Herdwick and Wensleydale. (Jones, 1995) The Roscommon sheep and the Claddagh sheep are now extinct in Ireland. Other sheep breeds in the country are blackface, Suffolk, texel, Ile de France, rouge de l'Oest, charollais, bleu du Maine, chevoits, vendeen, Oxford down, Hampshire down, bluefaced Leicester, and belclare.

Cattle

The following breeds are listed in the Rare Breeds Directory (Anon, 1995): Kerry, Moyley (or Maol) cattle, Dexter, Gloucester, shorthorn, highland, Jersey, galloway, Shetland, white park and longhorn. The old Irish cow was a local race which became extinct before an interest in conserving livestock diversity arose. (Curran, 1995) The shorthorn (beef and dairy, *i.e.* dual purpose) was the most common stock in Ireland about 50 years ago. The Moyley breed was almost extinct but is today present in Northern Ireland because of conservation. The traditional Irish species of dexter is extinct in Ireland and the introduced form is not quite the same as the old Irish form. Traditionally the dexter was crossed with the Kerry, as one quarter of the progeny of a dexter x dexter cross were deformed (*i.e.* a pedigree dexter would be born with a flaw). The

dexter was in fact a mutation of the Kerry. Some "droimeannn" cattle, which had a white line down their back and a white tail are found at Muckross Park. This strain could be considered to be an Irish strain. Some Kerry cattle were droimeann Kerry's. Moyley and longhorn also had the same white line down the back. There may also have been a breed of Tory Island cattle, which were a mouse (grey) colour. Also, with respect to the Aran Islands, old shorthorns may be bred there. (pers comm. Dr Leo Curran) Other cattle species in the country are: limousin, Aberdeen angus, friesian, continental, simmental, hereford, charolais, Belgian blue, blonde d'aquitaine, longhorn, Shetlands, highland cattle, Ayrshire, galaways, holstein, and meuse Rhine Issel. The Dunn cow of the Ox mountains is also a local race (pers comm. Bryan Jones).

Deer

The red deer (*Cervus elaphus*) is the largest species of deer being farmed in Ireland. Within the red deer species there are a number of different lines which can be bred pure or crossed with other lines resulting in what is called a type, for example English Park type, European red type, Scottish type and Waipiti type. The English Park type are deer that originated from some of the large private parks in England. In general, the hinds and stags have been used as the basic breeding stock in many deer farms throughout the world. The majority of red deer hinds on farms in Ireland are of the English Park type. Fallow deer, which were originally introduced into Ireland during the 1400's, are farmed also, with most of the stock coming from the wild or parks in Ireland. The Sika, which was introduced into Ireland in the 1800's, is also farmed but on a very small scale. (pers comm. Dr M. Kelly.)

Pigs

The vast majority of pigs in Ireland today have been derived from two breeds, the landrace and the large white. The Irish pig (also called the Irish greyhound) is now extinct (Hogan, 1995). The following breeds are listed in the Rare Breeds Directory (Anon, 1995): Gloucestershire old spot, Berkshire, British saddleback, British lop, Tamworth and large black. The Duroc has become popular in the last ten years (the boars are black);

Horses

Five breeds are included in the Rare Breeds Directory (Anon, 1995): Irish draught, Connemara pony, Kerry bog pony, Eriskay and Exmoor. The native Irish breeds of horses are the Irish Draught horse, the Connemara pony, and the Kerry Bog pony. Of these the newly documented Kerry bog pony, which may prove to be related genetically to the Icelandic horse, is by far the most rare, and less than 20 are known. The registered Irish draught horses have under 600 breeding females which puts the breed as "vulnerable" in The Rare Breeds Survival Trust lists. The Cushendall pony is now extinct. There are also representatives in Ireland of breeds of horses which are rare or minority breeds, but of which the main population is in Britain or other countries. These include Shetland, Exmoor, Fell, Dales and Highland ponies, Icelandic horse, Welsh cobs

and ponies and Breton heavy horses. Other breeds include the coloured cobs (piebalds and skewbald) of the travelling community, which form another distinct race of horses with recognisable characteristics; the thoroughbred, Hackney pony and Clydesdale. The donkey (*Asinus asinus*) was formerly a relatively common species in Ireland, but the numbers are much reduced today. The piebald donkey is also very rare. The gennet is a sterile cross between the horse x donkey.

APPENDIX I

(A) A list of the groups and their number of species recorded (in brackets) by the BioMar survey to date (No.s 1-22), which also includes data from a small number of publications, is given below. The information was provided by the BioMar group and Dr E. Sides, National Parks and Wildlife Service, Dublin.

Phylum Porifera (118sp)	Phylum Cnidaria (114)	Phylum Platyhelminthes (1)
Phylum Nemertea (3)	Phylum Sipuncula (3)	Phylum Annelida (110)
Subclas Oligochaeta (1)	Class Pycnogonida (6)	Phylum Crustacea (112)
Class Insecta (2)	Phylum Mollusca (209)	Class Brachiopoda (2)
Phylum Bryozoa (42)	Phylum Phoronida (2)	Phylum Echinodermata (47)
Subphylum Tunicata (49)	Class Chondrichthyes (4)	Class Mammalia (2)

(B) Based on reports by the BioMar group, the following sp can be considered to have conservation interests. The general area in which these sp were recorded is also given in brackets. (The information was provided by the BioMar group and Dr E. Sides, National Parks and Wildlife Service, Dublin).

Phylum Porifera:

(West coast)	*Plakortis simples*
	Tricheurypon viride
	Axinella damicornis
	Halicnemiaverticillata
(North-west coast)	*Stelletta grubii*
(South coast)	*Oscarellarubra*
	Thymosia guernei
	Dercitus bucklandi

Phylum Coelenterata:

(West coast)	*Pachycerianthus multiplicatus*
	Halacampoides elongatus
	Scolanthus callimorphus
	Mesacmaeamitchelli
	Aurelianiaheterocera
(North west coast)	*Anthopleura ballii*

cont'd.

Phylum Echinodermata

(West coast)	*Paracentrotus lividus*

Phylum Mollusca

(North west coast)	*Haminea navicula*
	Aeolidiella alderi
	Leptochiton scabridus
	Venus verrucosa
	Venerupis senegalensis
(North coast)	*Caloria elegans*

Subphylum Urochordata

(South coast)	*Phallusia mammilata*

(C) Based on reports by the BioMar group, the following biotopes (communities) can be considered to have conservation interests. The general area in which these biotopes are recorded is also given in brackets. (The information was provided by the BioMar group and Dr E. Sides, National Parks and Wildlife Service, Dublin).

West coast:
Maerl beds
Raspailia ramosa - Corellaparallelograma (high diversity of sponges and solitary asidians.)
Axinella dissimilis - Phakellia ventilabrum (a rare sponge community.)

North west coast:
Limaria hians beds
Drachiella spectabilis
Radicilingua thysanorhizans

(Appendix I is based on the following references: Emblow et al, 1995; Sides et al, 1994; Picton et al, 1994; Emblow et al, 1994).

APPENDIX III

An early (and incomplete) draft of a review of the conservation status of Irish birds. This draft w
submitted by Dr John Coveney, IWC, and includes a list of the bird species in Ireland with the
conservation status, explanatory notes, some individual species accounts and a bibliography.

APPENDIX II

The following information was provided by Dr M. Speight, National Parks and Wildlife Service.
(1) List of threatened species for five families of the Order Diptera (true flies).

Family Syrphidae

Brachyopa insensilis
Brachypalpus laphriformis
Cheilosia pubera
Cheilosia uviformis
Cheilosia velutina
Cheilosia vicina
Chrysotoxum cautum
Didea alneti
Doros profuges
Eristalis cryptarum
Helophilus trivittatus
Melangyna compositarum
Melangyna quadrimaculata
Microdon analis
Neoascia obligua
Paragus constrictus
Parasyrphus nigritarsis
Platycheirus amplus
Platycheirus sticticus
Sphaerophoria rueppelli
Xanthandrus comtus
Xylota ambiens
Xylota florum
Xylota tarda
Melanogaster aerosa
Meligramma guttata
Platycheirus podogratus
Sphaerophoria loewi

Family Bombyliidae
Bombylius major

Family Rhagionidae
Atherix ibis
Rhagio annulata

Family Stratiomyiidae
Oxycera falleni
Vanoyia tenuicornis
Zabrachia minutissima

Family Tabanidae
Chrysops seulchralis
Tabanus bromius

Family Therevidae
Dialineura anilis

(2) The following list is of threatened beetle species in the family Carabidae (Coleoptera):

Family Carabidae

Acupalpus consputus
Agonum gracile
Agonum livens
Agonum lugens
Agonum versutum
Amara convexiuscula
Amara eurynota
Amara fulva
Amara lucida
Amara montivaga
Amara praetermissa
Asaphidion pallipes
Badister anomalus
Badister meridionalis
Badister unipustulatus
Bembidion argenteolum
Bembidion fumigatum
Bembidion geniculatum
Bembidion laterale
Bembidion lunatum
Bembidion maritimum
Calosoma inquisitor
Carabus nitens
Chlaenius tristis
Clivina collaris
Cymindis vaporariorum
Dyschirius obscurus
Dyschirius salinus
Dyschirius thoracicus
Elaphrus uliginosus

cont'd.

Harpalus rufitarsis
Lebia chlorocephala
Lebia crux-minor
Leistus montanus
Metabletus truncatellus
Nebria complanata
Notiophilus aesthuans
Panageus crux-major
Patrobus septentrionis
Perileptus areolatus
Platyderus ruficollis
Pogonus littoralis
Pterostichus aterrimus
Trechus discus
Trechus rivularis
Trechus subnotatus
Sphodurus leucophthalmus
Pterostichus oblongopunctatus

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Note that in the references: INJ = Irish Naturalists Journal; BIBS = Bulletin Irish Biogeographic Society; PRIA = Proceedings of the Royal Irish Academy.

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Draft A Review of the Conservation Status of Irish Birds

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Table 1. Conservation Status of Irish Birds

Species [1]	Population [2]	EU Status [3]	IWC Status [4]	RDB Status [5]	SPEC Status [6]	Open Season etc. [7]	Overall Status [8]
Red-throated Diver	B:5-10 [a] W:3,000 - 7,000 [b]	Annex 1	BR WI	R	3		Amber Green I
Black-throated Diver	W:50-100 [b]	Annex 1	WL		3		Amber
Great Northern Diver	W:1,000 - 1,500 [c]	Annex 1	WI		PM		Green I
Little Grebe	R:3,000-6,000 [d]		BI				Green I
Great Crested Grebe	B:2,043 [c]- 4,150i [d] W:3,000+ [c]						Green Green
Slavonian Grebe	W:150-200	Annex 1			PM		Green
Black-necked Grebe	B:1-10 [a]	Migratory	BR	R			Amber
Fulmar	B:31,300 [e]						Green
Cory's Shearwater	P:0-11,000+ [a]	Annex 1			2 PM		Amber
Great Shearwater	P:10-5,000+ [a]	Migratory					Green
Sooty Shearwater	P:345 - 15,000+ [a]	Migratory					Green
Manx Shearwater	B:30,000 - 50,000 [e]	Migratory	BI BL		2 PM		Amber
Mediteranean Shearwaters	P:50-70+	Annex 1			4		-
Storm Petrel	B:50,000 - 100,000 [e]	Annex 1	BI BL	II	2 PM		Amber
Leach's Petrel	B:200+ [e] P:21-1300+	Annex 1	BR		3 PM		Amber -
Gannet	B:24,700 [e]		BI BL		2		Amber
Cormorants	B:4,700 [e] W:10,500 [c]		BI BL WI				Green I
Shag	R:8,800 [e]		BI		4		Green I
Bittern	B:0 [a]	Annex 1		Ex	3 PM		Extinct
Little Egret	P:xx	Annex 1					-
Grey Heron	R: c.3,650 [d]						Green

	Mute Swan	R:10,000i [c]						Green
22	Bewick's Swan[S]	W:2,300 [c]	Annex 1	WI WL		3W		Amber
23	Whooper Swan	B:0-1 W:10,500 [c]	Annex 1	WI	II	4W		- Green I
24	Pink-footed Goose	W:5-60 [c]	Migratory			4		-
25	White-fronted Goose[S]	W:12,530 - 14,567	Annex 1	WI WL	II			Amber
26	Greylag Goose[S]	W:3,800 [c] F:xx	Migratory	WL				Amber Feral
27	Canada Goose	F: xx						Feral
28	Barnacle Goose	W:8,048-8,133+	Annex 1	WI WL	II	4B 2W		Amber
29	Brent Goose[S]	W:16,000 - 24,000 [c]	Migratory	WI WL	II	3		Amber
30	Shelduck	B:1,100 [d] W:10,000 - 15,000 [c]	Migratory	WL				Green Amber
	Wigeon	B:0-5 [a,d] W:100,000 [c] - 150,000 [a]	Migratory	BR[I] WI WL			1/9-31/1	- Amber
	Gadwall	B:30-50 [a] W:400-700 [c]	Migratory	BR WL	R	3	1/9-31/1	Amber Amber
	Teal[S]	B:400-1,000 [b,d] W:50,000 [c]	Migratory	BDM WI			1/9-31/1	Amber Green I
34	Mallard	B:20,000 - 23,000 [a,d] W:50,000+ [c]					1/9-31/1	Green Green
	Pintail	B:0-5 [a] W:2,000 [c]	Migratory	BR[I] WL WDM	R	3	1/9-31/1	- Amber
	Garganey	B:0-5 [a]	Migratory	BR[I]	R	3		-
	Shoveler	B:<100 [a] W:4,200 [c]	Migratory	BR WI WL WDM	R		1/9-31/1	Amber Amber
35	Pochard	B:30-50 [a,b] W: 40,000 - 50,000 [c]	Migratory	BR WI WL	R	4	1/9-31/1	Amber Amber
	Tufted Duck	B: 1,750 - 2,000 [d] W: 35,000 [c]	Migratory	WL			1/9-31/1	Green Amber
	Scaup	W:3,000 [c]	Migratory	WL		3W		Amber

Eider	B:1,000-1,500 [d] W:2,500 - 3,000 [c]		WL				Green Amber
Long-tailed Duck	W:<750 [b]	Migratory	WL				Amber
Common Scoter	B:95-110 W:8,000 - 12,000 [b,c]	Migratory	BR BDM WL	E			Amber Amber
Velvet Scoter	W:<100 [c]	Migratory			3W		-
Goldeneye	B:0-? [a] W:17,000 - 20,000 [b,c]	Migratory	BR[I] WL			1/9-31/1	- Amber
Red-breasted Merganser	B:400-500 W:4,000 - 6,000 [b,c]	Migratory	BDM				Amber Green
Goosander	B:0-2	Migratory	BR[I]	R			Amber
Ruddy Duck	F:>10						Feral
White-tailed Eagle		Annex 1		Ex	3		Extinct
Marsh Harrier		Annex 1		Ex			Extinct
Hen Harrier		Annex 1	BR BD	E	3		Red
Montagu's Harrier		Annex 1	BR[I]		4		-
Sparrowhawk							Green
Buzzard		Annex 1	BR				Amber/ Green
Golden Eagle		Annex 1		Ex	3		Extinct
Osprey		Annex 1	BR[I]		3		-
Kestrel					3		Amber
Merlin		Annex 1	BR	R			Amber
Hobby		Migratory	BR[I] ?xx				-
Peregrine		Annex 1	BI	II	3		Amber
Red Grouse [s]			BD HD			1/9-30/9	Red
Capercaillie		Annex 1		Ex	PM		Extinct
Red-legged Partridge	F:unknown				2	1/11 - 15/11	Feral
Grey Partridge			BR BD HD	E	3		Red
Quail		Migratory	BR HD		3		Red
Pheasant						1/11-31/1	Feral
Water Rail		Migratory? xx			PM		Green
Spotted Crake		Annex 1	BR[I]		4		-

Corncrake		Annex 1	BR BD HD	E	1		Red
Moorhen							Green
Coot		Migratory? xx	WL				Amber xx
Oystercatcher		Migratory	WL				Green xx
Avocet		Annex 1	BR[I]		4B 3W		-
Little Ringed Plover		Migratory	BR[I] ?xx				-
Ringed Plover			WI				Green I
Dotteral		Annex 1	BR[I]		PM		-
Golden Plover		Annex 1	BD BR HD WI WL	V	4	Airport 1/9-31/1	Red Green xx
Grey Plover		Migratory	WL		PM		Amber
Lapwing		Migratory	BD WI		PM	Airport	Red Green
Knot		Migratory	WL		3W		Amber
Sanderling		Migratory	WL				Amber
Little Stint		Migratory			PM		-
Pectoral Sandpiper	P:xx	Migratory					-
Curlew Sandpiper	P:xx	Migratory					-
Purple Sandpiper		Migratory			4 PM		Green
Dunlin		Migratory	BR WL	V	3W		Amber Amber
Ruff	P:xx	Annex 1			4 PM		-
Jack Snipe		Migratory			3W PM	1/9-31/1	Amber
Snipe		Migratory	BD		PM	1/9-31/1	Amber xx
Woodcock		Migratory			3W	1/11-31/1	Amber
Black-tailed Godwits		Migratory	BR WI WL	R	2		Amber Amber
Bar-tailed Godwit		Annex 1	WI WL		3W		Amber
Whimbrel		Migratory			4 PM		Green

	Curlew		Migratory	BI WI		3W	1/11 - 30/11	Amber Amber
95.	Spotted Redshank	P:xx	Migratory					-
	Redshank		Migratory	SC WI		2		Amber Green
	Greenshank	P:xx W:xx	Migratory	BR[I]	R			-
93	Green Sandpiper	P:xx	Migratory			PM		xx
	Wood Sandpiper	P:xx	Annex 1			3		-
	Common Sandpiper		Migratory					Green
	Turnstone		Migratory	WI				Green
	Red-necked Phalarope		Annex 1	BR[I]	E	PM		Amber
	Grey Phalarope	P:xx	Migratory			PM		Green
	Pomerine Skua	P:xx	Migratory			PM		Green
	Arctic Skua	P:xx	Migratory			PM		Green
	Great Skua	P:xx	Migratory			4		Green
	Mediteranean Gull		Annex 1	BR[I]		4		-
	Little Gull	P:xx	Migratory			3		Amber
	Sabine's Gull	P:xx	Migratory					Green
	Black-headed Gull		Migratory				Airport	Green
	Ring-billed Gull	P:xx		BR[I] ?xx				Green
	Common Gull		Migratory			2	Airport	Amber
	Lesser Black-backed Gull[S]		Migratory xx ?			4	Airport	Green
	Herring Gull[S]			BI BD			Airport	Amber
	Iceland Gull	P:xx	Migratory			PM		Green
	Glaucous Gull	P:xx	Migratory					Green
	Great Black-backed Gull					4	Airport	Green
	Kittiwake							Green
	Sandwich Tern		Annex 1	BL		2		Amber

	Roseate Tern		Annex 1	BI BD BL	E	3		Red
	Common Tern		Annex 1	BD BL				Amber
	Arctic tern		Annex 1	BL				Amber
	Little Tern		Annex 1	BR BL	V	3		Red
	Black Tern	P:xx	Annex 1	BR[I]		3		-
	Guillemot			BL				Amber
	Razorbill			BL		4		Amber
	Great Auk							Extinct (globally)
	Black Guillemot					2		Amber
	Puffin		Migratory ?? x	BL		2		Amber
	Rock Dove/Feral Pigeon						Control & Airport	Green
	Stock Dove			BD		4	Control & Airport	Amber
	Woodpigeon					4	1/6-31/1 Control & Airport	Green
	Collared Dove					PM	Control & Airport	Green
	Turtle Dove	P:xx	Migratory	BR[I]		3	Control & Airport	- -
	Cuckoo		Migratory	BD				Amber
	Barn Owl			BD	I	3		Red
	Long-eared Owl							Green
	Short-eared Owl	P:xx	Annex 1	BR[I]	R	3 PM		Amber
	Swift		Migratory					Green
	Nightjar		Annex 1	BR HD	E	2 PM		Red
	Kingfisher		Annex 1			3		Amber
	Hoopoe	P:xx	Migratory					-
	Woodlark	B:0[a]	Annex 1		Ex	2		Extinct
	Skylark		Migratory? xx			3		Amber
	Sand Martin		Migratory	BD		3		Amber
	Swallow		Migratory			3		Amber
	House Martin		Migratory					Green
	Tree Pipit	P:xx	Migratory	BR[I]				-
	Meadow Pipit			BI		4		Green

Rock Pipit							Green
Yellow Wagtail[P]	P:xx	Migratory	BR[I]				- -
Grey Wagtail			BI		PM		Green
Pied Wagtail[S]	P:xx (White wag)						Green -
Waxwing	P:xx				PM		-
Dipper[S]			BI BD		PM		Amber
Wren			BI				Green
Dunnock			BI		4		Green
Robin			BI		4		Green
Black Redstart	P:xx	Migratory					-
Redstart	P:xx	Migratory	BR		2		Amber -
Whinchat		Migratory	BD		4		Amber
Stonechat			BD		3 PM		Amber
Wheatear		Migratory					Green
Ring Ouzel		Migratory	BR HD	R	4		Red
Blackbird		M? xx			4		Green
Fieldfare		Migratory			4W		Green
Song Thrush		M? xx			4		Green
Redwing		Migratory			4W		Green
Mistle Thrush					4		Green
Grasshopper Warbler		Migratory			4		Green
Savi's Warbler		Migratory	BR[I]		4 PM		-
Sedge Warbler		Migratory	BI		4		Green
Reed Warbler	P:xx	Migratory	BR		4		Amber -
Lesser Whitethroat	P:xx	Migratory	BR[I]				- -
Whitethroat		Migratory	BD		4		Amber
Garden Warbler	P:xx	Migratory	BR		4		Amber -

	Blackcap		Migratory			4		Green
	Wood Warbler		Migratory	BR	R	4 PM		Amber
	Chiffchaff		Migratory			PM		Green
	Willow Warbler		Migratory					Green
	Goldcrest					4 PM		Green
	Firecrest	P:xx	M? xx			4		-
	Spotted Flycatcher		Migratory			3		Amber
	Pied Flycatcher	P:xx	Migratory	BR[1]		4		- -
	Bearded Tit			BR[1]	R	PM		-
	Long-tailed Tit							Green
	Coal Tit[S]							Green
	Blue Tit					4		Green
	Great Tit							Green
	Treecreeper							Green
	Jay[S]					PM		Green
	Magpie						Control & Airport	Green
	Chough		Annex 1	BI	II	3		Amber
	Jackdaw			BI		4 PM	Control & Airport	Green
	Rook			BI			Control & Airport	Green
	Hooded Crow[S]						Control & Airport	Green
	Raven					PM		Green
	Starling		Migratory				Airport	Green
	House Sparrow							Green
	Tree Sparrow			BL	I			Amber
	Chaffinch		Migratory			4		Green
	Brambling		Migratory					Green
	Greenfinch					4		Green
	Goldfinch					PM		Green
	Siskin					4		Green
	Linnet		M? xx			4		Green
	Twite			BD HD	I			Red
	Repoll[S]			BL		PM		Green

2.9	Crossbill			BR[1]				Green
2.10	Bullfinch							Green
2.11	Lapland Bunting	P:xx	Migratory			PM		-
2.12	Snow Bunting	P:xx	Migratory			PM		-
2.13	Yellowhammer			BD		4 PM		Amber
2.14	Reed Bunting							Green
2.15	Corn Bunting			BR BD HD	E	4 PM		Red

[1] Species names and order are as in Hutchinson (1989). Unless otherwise stated, rarities as defined by Mullarney (1989) and Fitzharris and Smiddy (1995) are not included. [s] indicates a distinctive subspecies (identifiable in the field) in a European context. As distintive subspecies as a group are not sharply defined, arbitary decisions were necessary in some cases as to which subspecies should be classified as such. However, all distinctive subspecies of conservation importance are included.

[2] Population figures are given for breeding (B), passage (P), wintering (W) and feral (F) populations, as appropriate. Breeding and feral populations are in pairs except where indicated by an i, which indicates individuals. Wintering and passage populations are always in individuals. Standard references for population sources are as follows: [a] Birds in Ireland (Hutchinson 1989); [b] A Conservation Strategy for Birds in Ireland (Coveney et al 1993); [c] Ireland's Wetland Wealth (Sheppard, 1993); [d] The New Atlas of Breeding Birds in Britain and Ireland 1988-1991 (Gibbons et al 1993); [e] The Status of Seabirds in Britain and ireland (Lloyd et al 1991); [f] The Atlas of Wintering Birds in Britain and Ireland (Lack, 1986); . Details of other sources are given in the species notes. xx check SPEC submissions

[3] Species listed in Annex 1 of the EU Birds Directive (79/409/EEC) require special conservation measures (Article 4.1). Regularly occuming migratory species require similar measures to those taken for Annex 1 species (Article 4.2). Note that only non Annex 1 species which are migratory are listed as such. xx definition of migratory - as BWP? in terms of the relative seasonal proportions in Ireland.

[4] Categories in this column were defined as follows in the IWC Conservation Strategy :- **B(W)I:** Breeds (winters) in internationally significant numbers i.e. greater than 10% of the north-west European population; **BR:** Rare breeder i.e. the lower end of the range of the breeding population estimate is less than 300 pairs - **BR[I]** indicates that the species may not breed at all in some years; **B(W)D:** Declining breeder (winterer) i.e. greater than 50% over the past twenty years or so -**M** indicates the decline was 25 to 49%; **B(W)L: Localised** breeding (wintering) species with more than 50% of the population in top 10 sites (Coveney et al., 1993). **HD** indicates a very large qualitative decline since 1800 of a breeding population of a species which still breeds in Ireland. It was determined by comparison of the Historical Atlas oBreeding Birds in Britain and Ireland 1875-1900 with the two modern breeding atlases (Gibbons et al 1993; Sharrock 1976). The M modification of declining species and the HD category were not included in the IWC Conservation Strategy (Coveney et al 1993), which also did not cover species extinct in Ireland.

[5] **Sp**ecies of European Conservation Concern are defined as follows:- **SPEC 1:** Species of global conservation concern; **SPEC 2:** Species whose global populations are concentrated in Europe (i.e. more than 50% of their global population or range in Europe) and which have an unfavourable conservation status in Europe; **SPEC 3:** Species whose global populations are not concentrated in Europe, but which have an unfavourable conservation status in Europe; **SPEC 4:** Species whose global populations are concentrated in Europe (i.e. more than 50% of their global population or range in Europe) but which have a favourable conservation status in Europe; **W:** This indicates that it the wintering population that is of conservation concern; otherwise the categorisation refers to the breeding population; **PM:** This indicates that the species is poorly monitored in that either the population size or trend are poorly known (Tucker

& Heath, 1994). Note that in Appendix 2 of Tucker and Heath (1994), which lists SPECs by country, there are several omission in the Irish list and, therefore, this coloumn was compiled from the main species accounts.

6 Categories in this column are asdefined in the Irish Vertebrate Red Data Book:- **R:** Rare; **Ex:** Extinct; **E:** Endangered; **II:** Internationally important; **V:** Vulnerable; **I:** Indeterminate (Whilde, 1993). Note that some entries in this column differ from the entries under this heading in Table 1 of the IWC Conservation Strategy. Entries for the IWC Conservation Strategy were taken from a draft of the Irish Vertebrate Red Data Book which was modified before publication.

7 In the most recent hunting seasons order for 1995/1996 (SI 249 of 1995), the indicated species may be hunted between the dates listed (inclusive) except in designated wildfowl sanctuaries. These are often referred to as "no shooting areas" but control species (see below) and foxes and rabbits can be shot in these areas. Control in a species entry indicates that these species can be controlled by landowners and their agents for causing damage to crops, livestock, fauna or where they represent a threat to public health. Normally this is by shooting but traps, decoys and poison may be used for Hooded Crow and Magpie. Pigeons and doves may also poisoned by specific permit (SI 254 of 1986). Airport in a species entry indicate that the species can be controlled by airport authorities and their nominees where such species represent a threat to air safety. In this case the NPWS must be informed if poison is used (SI 254 of 1986).

8 Five categories are used, Red, Amber, Green, Extinct and Feral. Red indicates species which have suffered at least a 50% decline in the last 25 years, or a historical decline (define in terms of the Historical Atlas) or are of global conservationconcern xx some Red species i.e. most threatened in IWC Con Strat do not fit these categories. Amber is for species which have suffered a decline of 25-49% in the last 25 years, are rare breeders (300 or fewer breeding species), are localised (at least50% of the population in 10 or fewer sites) or are in SPEC categories 2 or 3. Green indicates a species which has a favourable conservation status in Ireland and Green I indicates that this species in internationally numbers (at least10% of the north west European population). For breeding species, north west Europe is defined as all European countries bordering on the Atlantic or the North Sea (Coveney et al 1993), while the flyway definitions of Sheppard (1993) are followed for waterfowl. Extinct means a species that formerly bred regularly in Ireland. Feral indicates an introduced species which is, or is likely to be self supporting in Ireland. Species which only occur in small numbers as passage migrants or which have only bred less than xx times are not categorised.

Species Notes

Red-throated Diver *Gavia stellata*

The species does not justify Red status for the breeding population, because, in so far as it is known, it appears to be stable. It is also insignificant in European terms (Tucker and Heath, 1994). In estimating the population at 3,000 - 7,000, Coveney et al (1993) took account of the estimate of 12.000 to 15.000 by Lack (1986) and the widespread and dispersed nature of the species' coastal distribution. This represents 6 to 14% of the NW European population and is an order of magnitude higher than Whilde's (1993) estimate. Although wintering in internationally important numbers, it does not qualify for amber status because of its dispersed population, which is not subject to any significant threats (Coveney et al 1993).

Black-throated Diver *Gavia arctica*

The population estimate from Coveney et al (1993) seems reasonable in view of the increasing reports of this species especially from Galway Bay and Strangford Lough (xx refer to IBR).

Great Northern Diver *Gavia immer*

Although wintering in internationally important numbers which comprise about 26% of the NW European population, it does not qualify for amber status because of its dispersed population, which is not subject to any significant threats (Coveney et al 1993). It is likely that muchof this population comes from North America.

Little Grebe *Tachybatus ruficollis*

Although breeding in internationally important numbers (13-16% of the NW European population), it does not qualify for amber status because of its dispersed population, which is not subject to any significant threats (Coveney et al 1993).

Great Crested Grebe *Podiceps cristatus*

The higher breeding population figure is an extrapolation made by Gibbons et al (1993) but may be too high in view of winter population estimate. In some winters, numbers are higher due to influxes from the Continent during periods of cold weather (Sheppard 1993). xx Is there enough movement of the Irish population to coastal areas to classify this species as migratory?

Slavonian Grebe *Podiceps auritus*

Population estimate from Coveney et al (1993). xx check recent IBRs. Although identified as poorly monitored species by Birds in Europe, it does not seem reasonable to classify this as an amber species in Ireland due to its dispersed nature and the lack of any major threats (Coveney et al 1993) xx recent large counts in the L. Foyle.

Black-necked Grebe *Podiceps auritus*

It could be argued that this species should have have Red status in Ireland. However, as

a. its peak of about 300 pairs in Lough Funshinagh in 1932 was ephemeral (Hutchinson 1989);

b. it was unknown as a breeder in Ireland prior to 1929 (Hutchinson 1989);

c. Ireland is peripheral to a very extensive global range (Cramp and Simmons, 1977); and

d. it is not threatened in Europe (Tucker & Heath, 1994);

the re-direction of conservation resources that Red status would imply is not justified. Instead its continued presence should be viewed as a bonus of measures to conserve its mainly turlough breeding sites - a priority habitat under the EU Habitats Directive. Although, the whereabouts of the Irish breeding birds are unknown in winter (they are pretty unknown in the summer as well! xx), the species is classified as migratorybecause virtually the entire breeding population leaves the breeding grounds in winter (Cramp and Simmon 1977).

Fulmar *Fulmarus glacialus*

This species has increased dramatically since it colonised Ireland in 1991. Although the breeding areas may be entirely deserted in late autumn and some birds may disperse considerable distances and some birds may moveconsiderable distances (Hutchinson 1989), this is pobably not sufficient for the Irish population to classified as migratory.

Cory'Shearwater *Calonectris diomedea*

Although a rarity (Mullarney 1989), large numbers occassionally occur off south western Ireland e.g. 10,900 off Cape Clear on 16 August 1980 (Hutchinson 1989), which could be as much as 4% of the European population or 3% of the world population, which is concentrated in the Mediteranean, the Azores, Maderia, the Canaries (Tucker and Heath, 1994).

Great Shearwater *Puffinus gravis*

The entire breeding population of some 5,000,000 pairs is confined to three sites in the Tristan de Cunha group and Gough Island in the south Atlantic with small numbers on the Falklands and is not globally threatened (del Hoyo, 1992). Therefore, the numbers occurring in Irish waters are not very significant.

Sooty Shearwater *Puffinus griseus*

Several million birds breed in sub-antarctic waters(del Hoyo et al 1992) so the Irish numbers are not very significant.

Manx Shearwater *Puffinus puffinus*

Excluding similar non Palearctic forms which were recently classified as separate species (del Hoyo et al 1992), 99% of the population breeds in Europe and 11-15% breeds in Ireland. The extent to which non Irish breeders use Irish waters is not known. Most of the European population winters off eastern South America although there are occassional winter records (Cramp and Simmons 1977).

Mediteranean Shearwater *Puffinus yelkouan*

This species was listed in Hutchinson 1989 as the west Mediteranean race of Manx Shearwater, *P.p. mauretanicus*. It has been recognised as a separate species in the IrishBird Report since 1991 (O'Sullivan and Smiddy 1992). The subspecies concerned is the west Mediteranean race *P.y. mauretanicus*. The passage figures are derived from Smiddy and O'Sullivan (1993, 1994 and 1995). The Irish numbers are insignificant given that the European population (both races) is in the range 18,000 to 57,000 pairs.

Storm Petrel *Hydrobates pelagicus*

As a breeding species, the Storm Petrel is virtually endemic to Europe and is concentrated in Ireland (13-18% of the population), Iceland, the Faroe Island and Britain. It migrates to western and southern African waters (Tucker and Heath 1994).

Leach's Petrel *Oceandroma leucorhoa*

The Irish breeding population is insignificant given the global population of 7-9 million pairs and is also very small given the European population of 91,000 to 250,000 (Lloyd et al 1991, Tucker & Heath. 1994) so Red status is not justified. The passage figures are derived from Smiddy and O'Sullivan (1993, 1994 and 1995). The species migrates to the tropics

Gannet *Sula bassana*

Although the species has increased dramatically since about 1880 after the elimination of persecution (Hutchinson 1989), the occurrence of 91% of the breeding population at Little Skellig in Co. Kerry justifies its continued amber status. Between 10 and 11% of the NW European population, itself being about 75% of the world population, breeds in Ireland. Most of the young birds migrate south along the Atlantic but most of the adults do not (Lack 1986) thus it is not clear if this species can be classified as migratory in terms of the EU Birds Directive.

Cormorant *Phalacrocorax carbo*

The subspecies concerned is *P. c. carbo*. Although occuring in internationally important breeding numbers (about 11 of the NW European population) and being localised, it does not qualify for amber status because of its increasing population, because in addition to the major colonies there are many small widely dispersed colonies and because it is not subject to any major threats (Coveney et al 1993). Although there are considerable movements from breeding areas along the coast by adults and juveniles, most Cormorants wintering in Ireland are native (Lack 1986) and therefore cannot be classed as migratory.

Shag *Phalacrocorax aristotelis*

Although occuring in internationally important numbers (10-11% of the NW European population), it does not qualify for amber status because of its increasing and widely dispersed population and because it is not subject to any major threats (Coveney et al 1993). This species is a near European endemic, in which 75% of it range occurs. Most Shags wintering in Ireland are native (Lack 1986) and therefore cannot be classed as migratory.

Bittern *Botaurus stellaris*

Early in the lastcentury the Bittern was recorded as breeding in 14 counties and was "very common" in Donegal. However, by 1840 to the early 1850s it was considered extinct. This has been attributed to shooting pressure and drainage of swampy habitats (Whilde, 1993) although Holloway (1996) has suggested the cold climatic period up to the 1840s may also have played a role. It still occurs as a vagrant and booming in suitable habitat is occassionally heard. This had led to speculation that it may recolonise naturally if suitable habitat was available and it was protected from shooting (Whilde, 1993). However the ongoing decline in Europe and its precarious status in Britain (Tucker and Heath) militates against this.

Little Egret *Egretta garzetta*

to be completed. Potential colonist?

Grey Heron *Ardea cinera*

Irish Grey Herons are sedentary and the few foreign ringed birds that have been recovered here are insufficeint to justify a migratory status (Hutchinson 1989). The breeding population estimate of Gibbons et al (1993) accords well with Sheppard's (1993) estimate of 10,500 individuals in winter.

Mute Swan *Cygnus olor*

Irish Grey Herons are rather sedentary and the few foreign ringed birds that have been recovered here are insufficeint to justify a migratory status (Hutchinson 1989).

Bewick's Swan *Cygnus columbianus*

The subspecies concerned is *C.c. bewickii*. The Irish population represents about 11% of the localised but slowly increasing NW European population.

Whooper Swan *Cygnus cygnus*

Although wintering in internationally important numbers, it does not justify Amber status because it is increasing and widely dispersed and because it is not subject to any major threats (Coveney et al 1993). About 60% of the world population of about 100,000 birds winters in Europe (del Hoyo et al 1992). Breeding was first proven in Ireland in 1992 in Donegal (Murphy, 1992).

Pink-footed Goose *Anser bracyrhynchus*

The Irish wintering birds are insignificant given a world population of 48,000 to 60,000, which winters exclusively in countries surrounding the southern North Sea.

White-fronted Goose *Anse albifrons*

The subspecies concerned is *A. a. flavirostris* The population estimate is from Fox et al (1994) for 1994. This species could be hunted until 1981/1982 but there has been a national moratorium on hunting since then except for the winter of 1985/1986 and 1989/1990, when limited hunting took place in Wexford (Fox et al 1994). This subspecies is very vulnerable because it is by far the rarestsubspecies and because 67-69% (figures) of the world population is concentrated almost equally on the Wexford slobs and on Islay in Scotland. However, a near doubling in the world population since 1983 preclude Red status.

Greylag Goose *Anser anser*

The subspecies concerned is *A. a. anser.* Check JO'H's paper for feral population and notes.

Canada Goose *Branta canadensis*

Check JO'H's paper for feral population and notes. A few wild birds occur as vagrants (Hutchinson 1989).

Barnacle Goose *Branta leucopsis*

The population estimate is from Merne & Walsh (1994) for 1993 and 1994. The Irish wintering population has increased from 2,771 birds in 1959/1960 but justifies its continued Amber status because of the concentration of about half of the population on the Inishkea Islands in Mayo and Lissadell in Sligo. The birds wintering in Ireland comprise some 21% of the isolated Greenland breeding population. The remainder of these birds winter in Scotland. Three other isolated populations breed in Svalbard (Norway, 13,000 birds), Novaya Zemlya and Vaigach Island (Russia, 120,000-130,000 birds) and in the mid Baltic (1,000 birds) and all winter locally in countries around the southern North Sea.

Brent Goose *Branta bernicla*

The subspecies concerned is the pale bellied race *B. b. hrota.* In excess of 99% of the Greenland/North American birds of this race that winter in Europe, do so in Ireland but another 55,000 or so winter in North America. A third small population of *hrota*. 4,000 to 5,000 breeds in Svalbard (Norway) and Franz Josef Land (Russia) and winters in Denmarland England (del Hoyo et al 1992, Tucker and Heath 1994). Although fluctuating due to varying productivity, numbers of this subspecies in Ireland have increased from about 6,000 in 1950 (Hutchinson 1989). However, the continued Amber status is justified because disease of its main food plant *Zostera marina* caused severe declines in the past (Lack 1986)) and because of its localised status - particularlythe heavy dependence on Strangford Lough early in the season (Speppard 1993). The other two races are much more numerous (del Hoyo et al 1992).

Shelduck *Tadorna tadorna*

The migratory status refers to the moult migration of breeding birds to the Waddenzee and perhaps Britain (Hutchinson 1989) as well as an apparent influx of wintering birds. The Amber status is justified for the wintering population, despite its increase, because over 50% of it is concentrated in five sites (Sheppard, 1993).

Wigeon *Anas penelope*

About 13% of the NW European wintering population of this species occurs in Ireland. Classifying the wintering population of such a numerous and widespread species as Amber may seem strange but in the mid 1980s over 50% occur at five sites, Lough Foyle, Little Brosna Callows, Shannon Callows, Rahasane Turlough and on the North Slob (Sheppard 1993). Numbers reach the high end of the range in hard winters (Coveney et al 1993). Although the species has only been proved to breed twice in Ireland (Hutchinson 1989), it is occuring in increased numbers in summer and breeding may take place in some years, unnoticed (Gibbons et al 1993).

Gadwall *Anas strepera*

This species is declining in Europe, mainly as a result of the decline in the large Russian population, which, at 55,000 to 85,000, represents about 70% of the European population. The wintering population is of Icelandic origin (Lack, 1986).

Teal *Anas crecca*

The subspecies concerned is *A.c. crecca* The decline in range between the periods of the two breeding atlases was 51.5% for Ireland and 16.6% in Britain (Gibbons et al 1993). Given the secretive nature of the species and the relatively poor coverage in Ireland in the second atlas, Coveney et al (1993) estimated the decline at simply greater than 25%. The wintering population represents about 13% of the NW European population. The breeding population is belived to be sedentary but the much larger wintering population migrates from a broad section of nothern Europe and Siberia (Lack, 1986)

Mallard *Anas platyrhynchos*

The Irish population is largely sedentary and there is little immigration (Lack 1986).

Pintail *Anas acuta*

The current wintering population of 2,000 (Sheppard, 1993) compares with a range of 3,000 to 7,000 in the early 1970's (Hutchinson, 1979). This represents a decline of 33 to 71% but as little evidence was presented to justify the higher figure, the decline is probably in the lower part of the range. The reasons for the decline are unclear but may be linked to the large decline that has taken place in eastern Europe (Tucker and Heath, 1994). Gibbons et al 1993) report it as only a sporadic breeder but Whilde (1993) notes that it may be more regular in the Shannon catchment but is overlooked. In any case the Irish population is insignificant given that the European population of 170,000 to 340,000 pairs (Tucker and Heath 1994).

Garganey *Anas querquedula*

Records of our only summer visiting duck have increased noticeably in recent yearsand there have been records of proved or probable breeding (Smiddy & O'Sullivan 1993, 1994 and 1995) . It is likely that small numbers now breed inmost years in more than one county. This arrival as a rare breeder, however, has occurred aginst the trend of a large decline in Europe, although the population is still estimated to be 640,000 to 1,100,000 (Tucker and Heath, 1994),

Shoveler *Anas clypeata*

The Irish wintering population represents about 10% of the NW European population. However, it is down on the early 1970's estimate by 35 to 48% (Sheppard 1993) although the decline is likely to be nearer the lower end of the range. Gibbons et al (1993) report a decline in NW Europe by Tucker and Heath (1994) do not. The breeding population appears to have been more widespread in the early part of the century (Whilde 1993).

Pochard *Aythya fenna*

Pochard is a rare but increasing breeder (Whilde, 1993). Ireland holds at least 11% of the NW European wintering population and most of that is concentrated in Loughs Neagh and Corrib for at least the late summer early autumn period.

Tufted Duck *Aythya fuligula*

This species is increasing as a breeder in Ireland since it colonised in 1877 (Hutchinson 1989) fluctuating in winter. The size of wintering population fluctuates around the fortunes of Lough Neagh flock which ranges from 11,000 to 30,000 (Sheppard 1993).

Sacup *Aythya manila*

The wintering Scaup population appears to be rising in recent years after a long period of stability since the early 1970's. A population crash occurred on the east coast in the 1960's (just outside the 25 year frame of reference) which then held about 6,000 birds. The Irish population is a

relatively small component of the localised European population of about 130,000 birds (Tucker and Heath, 1994).

Eider *Somateria mollissima*

This species continues to increase as a breeding species since it colonised at Inistrahull in 1912 (Gibbons et al 1993, Hutchinson 1989).

Long-tailed Duck *Clangula hymalis*

The small Irish population of this species is increasing but Sheppard's (1993) estimate is believed to have been too low as it would have missed birds out of sight of land.

Common Scoter *Melanitta nigra*

Whilde (1993) classified Common Scoter as endangered mainly because of the loss of the population on Lower Lough Erne, where it grew from initial colonisation in 1904/1905 to a peak of 152 pairs in 1967. By 1993 only a few non-breeding males remained. The decline in Lower Lough Erne, however, has been offset by the the finding of or colonisation by birds at Lough Corrib, Lough Conn/Cullin and Lough Ree as reported by surveys in 1985/1986 (Ruttledge 1987) and in 1995 (Gittings and Delany in prep). (xx check all this with S Delany. In May 1996, 9 birds (5 males and 4 females) were observed on Lough Arrow in Co. Sligo (pers. obs.) where no breeding has occurred in the past. This indicates that there may be other undiscovered sites. Common Scoter was classified as "most threatened" by Coveney et al (1993) on the basis of medium or high level threats from pollution and natural ecological change. Given the recent survey results and the fact that the Irish population in tiny by comparison with the minimum European breeding population of 100,000 pairs (Tucker & Heath, 1994), the transformation of "most threatened" into Red status would be difficult to justify. The Common Scoter, should however remain as one of the higher priority Amber breeding species, especially as the Irish population is unique in its choice of large lowland lakes compared with small upland lakes in the rest of its range. In winter the species occurs in flocks in the larger bays and although the population crashed in the 1960s, it had recovered by 1983 (Sheppard 1993).

Velvet Scoter *Melanitta fusca*

The Irish wintering population is insignificant given that the NW European wintering population is about 1,000,000 birds, mostly concentrated in five Baltic sites (Tucker and Heath 1994).

Goldeneye *Bucephala clangula*

Lough Neagh is by far the single most important site with over 12,000 birds in the early 1990's (Sheppard 1993). Increasing numbers of summering birds are observed (xx check IBRs) and with British population expanding (Gibbons et al 1993), it may breed

Red-breasted Merganser *Mergus serrator*

The breeding population declined in range by about 33% between the two breeding atlases (Gibbons et al. 1993). As this reversed an earlier expansion (Hutchinson 1989), it is belived not to be an artefact of poor coverage. The winter population estimate of Sheppard (1993) was increased by Coveney et al (1993) to take account of non-estuarine birds.

Goosander *Mergus merganser*

There was a series of single breeding records in Donegal between 1970 and the 1988 to 1991 period (Gibbons et al 1993, Hutchinson 1989). More recently, breeding has been observed, perhaps by more than 1 pair, in Wicklow on the Avonmore river catchment in 1994 and 1995 and probably in 1993 (Coombs, 1994). Breeding was again proved in 1996 (J Haine pers comm). With the colonisation and increase in wales (Gibbons et al 1993), breeding may become regular in Wicklow. In winter the species is still a rarity.

Ruddy Duck *Oxyura jamaicensis*

The breeding population of this species is estimated at a minimum of 10 pairs with a wintering population of about 80 birds, which is believed to have colonised from the accidently introduced

British population (Wells and Smiddy 1995). The similar colonisation of Europe may wipe out the closely related White-headed Duck (*Oxyura leucocephala*), which is now restricted to Spain, Russia, Turkey and western Asia with a total population of 14,000 pairs of which there are only 250 in Europe (del Hoyo et al 1992, Tucker and Heath, 1994). This species is globally threatened and Ruddy Duck appears to be dominant where they come into contact.

Next species *Species latinus*

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