



Mesotrophic Standing waters

Mesotrophic lakes are perhaps the most biologically diverse lake type found in Britain. Not only are they potentially very species-rich, but as a group, they support a higher proportion of nationally scarce and rare aquatic plants than any other lake type.

Current status

Lakes and tarns can be classified according to their nutrient status, especially phosphorus concentrations. Mesotrophic lakes and tarns have a naturally high concentration of nutrients. These water bodies support a much greater diversity of aquatic plants than more nutrient poor (oligotrophic) lakes and tarns. Every lake is unique in terms of its chemical and biological characteristics and, in Cumbria, some lakes show characteristics of both oligotrophic and mesotrophic conditions.

For the purposes of this plan, the mesotrophic lake habitat includes the wetlands associated with the transition from open water to terrestrial vegetation, the 'hydrosere'. This is an integral part of the nature conservation interest of lakes.

Mesotrophic lakes are relatively infrequent in the UK and are largely confined to the margins of upland areas in the north and west. Much of the UK resource of this habitat is located in Cumbria. Examples of lakes that are covered by this plan include: Bassenthwaite Lake, Elterwater, Loweswater,

Talkin Tarn, Brotherswater, Grasmere, Derwent Water, Haweswater, Thurstonfield Lough, Ullswater and Windermere. Many of these lakes are affected by adverse impacts, notably nutrient pollution and eutrophication. Indeed, the trophic status of a lake may move, depending upon inputs; Esthwaite Water, in the past classified as a mesotrophic lake, is currently eutrophic due to nutrient pollution.

There are 12 mesotrophic standing waters designated as Sites of Special Scientific Interest in Cumbria. Of these, two are candidate Special Areas of Conservation, one is a Wetland of International Importance under the Ramsar Convention and one a National Nature Reserve. Mesotrophic standing waters belong to the *oligotrophic to mesotrophic standing waters of plains to subalpine levels of the Continental and Alpine Region and mountain areas of other regions, with vegetation belonging to Littorelletea uniflorae and/or Isoeto-Nanojuncetea* habitat type listed in Annex 1 of the EC Habitats Directive. In addition, Bassenthwaite Lake and Windermere are both designated as sensitive areas under the EC Urban Waste Water Treatment Directive.

Characteristic wildlife

Mesotrophic lakes potentially have the highest macrophyte diversity of any lake type and a higher proportion of nationally scarce and rare aquatic plants. Within mesotrophic lakes there can be a number of different aquatic plant communities, depending on substrate, depth and exposure to wind-induced turbulence. Stony and exposed shorelines have shoreweed, water lobelia and quillwort. In sheltered bays with a more stable water column there can be, in addition, Nuttal's pondweed or Canadian pondweed, water-milfoil and a variety of broadleaved and fineleaved pondweed species. Areas of fine sediments around outflows and inflows can be dominated by stoneworts.

Macro-invertebrates (especially dragonflies, water beetles, stoneflies and mayflies) are well represented in mesotrophic lakes. These lakes can support both coarse fish such as pike or perch and salmonid fish species such as brown trout or Atlantic salmon, as well as being a feeding ground for lampreys and eels. Some mesotrophic lakes in Cumbria also support populations of Arctic charr and other rare fish such as vendace and schelly. Mesotrophic lakes are also important for breeding and wintering waterfowl, including mallard, wigeon, tufted duck, goldeneye and coot.

Key species

The following rare or threatened species are associated with mesotrophic standing waters in Cumbria. Species were selected on the basis that they are UK BAP Priority Species (marked P) or species of County importance in Cumbria. Where species of County importance are also UK BAP Species of Conservation Concern, they are marked C.

water vole	<i>Arvicola terrestris</i>	P
European otter	<i>Lutra lutra</i>	P
Daubenton's bat	<i>Myotis daubentonii</i>	C
reed bunting	<i>Emberiza schoeniclus</i>	P
natterjack toad	<i>Bufo calamita</i>	P
great crested newt	<i>Triturus cristatus</i>	P
vendace	<i>Coregonus albula</i>	P
schelly	<i>Coregonus lavaretus</i>	C
Arctic charr	<i>Salvelinus alpinus</i>	C
a reed beetle	<i>Donacia aquatica</i>	P
a water beetle	<i>Donacia impressa</i>	
a water beetle	<i>Macrolea appendiculata</i>	

a water beetle	<i>Notaris aethiops</i>	
variable damselfly	<i>Coenagrion pulchellum</i>	
downy emerald dragonfly	<i>Cordulia aenea</i>	
a mayfly	<i>Ameletus inopinatus</i>	
a mayfly	<i>Siphonurus lacustris</i>	
a caddisfly	<i>Cyrnus insolutus</i>	
a caddisfly	<i>Erotesis baltica</i>	
a caddisfly	<i>Setodes argentipuncellus</i>	
glutinous snail	<i>Myxas glutinosa</i>	P
Lilljeborg's whorl snail	<i>Vertigo lilljeborgi</i>	C
a stonefly	<i>Capnia bifrons</i>	
medicinal leech	<i>Hirudo medicinalis</i>	P
a moss	<i>Bryum cyclophyllum</i>	
lesser bearded stonewort	<i>Chara curta</i>	P
floating water-plantain	<i>Luronium natans</i>	P
slender naiad	<i>Najas flexilis</i>	P
pillwort	<i>Pilularia globulifera</i>	P
creeping spearwort	<i>Ranunculus reptans</i>	

Current issues

○ **Nutrient enrichment.** Mesotrophic lakes are particularly vulnerable to increases in nutrient levels (eutrophication), which may lead to changes in the abundance and species composition of algae and other plants, and a loss of the conservation value of the lake.

Eutrophication is the most important issue affecting mesotrophic lakes in Cumbria. Severe eutrophication may also result in the deeper waters becoming depleted of oxygen, a condition which is detrimental to salmonid fish and vendace. Sources of excessive nutrient inputs can include sewage effluent, nutrient rich water running off adjacent agricultural or forested land, accidental spillages (for example, slurry), and fish farms. It is extremely difficult to reverse eutrophication in lakes, especially when phosphorus has built up in lake sediments, acting as a long-term nutrient 'reservoir' enriching the lake, particularly shallow lakes. Environment Agency is presently developing a strategy to address eutrophication problems.

○ **Pollution from road run-off,** particularly after road-salting in winter, is a widespread threat, potentially affecting many Cumbrian mesotrophic lakes.

○ **Pollution from industrial and other sources.** Derwent Water is potentially threatened by re-mobilisation of heavy metals from the sediments, if the lake becomes more eutrophic. These metals are a legacy of historical mining in the area.

- **Groundwater contamination.** Contamination or nutrient enrichment of groundwater may affect some mesotrophic lakes, although more work is needed to investigate this.
- **Water abstraction.** Excessively low water levels can affect the ecology of the lake, either directly (for example by threatening plants on the lake margins), or indirectly (for example by causing low flows in rivers feeding lakes and increasing the time taken to flush polluted water out of the lake).
- **Changes in adjacent land use** (for example, ploughing of land, land drainage, intense grazing, afforestation). Such changes can increase the risk of soil erosion, with a consequent increase in waterborne sediments which may affect nutrient status. The increased turbidity caused by these sediments may also reduce the amount of light available to aquatic plants.
- **Fishery management.** Introductions of fish to lakes can alter the natural integrity of mesotrophic lakes in a variety of ways. They can affect populations of native species through competition and can alter the structure of food webs within the lake, this in turn affecting other plants and animals.
- **Accidental or deliberate introduction of alien plant species.** Introductions can impact on the native flora, particularly with invasive species such as New Zealand pigmyweed/Australian swamp stonecrop that are able to grow in a wide range of habitats and conditions. There are four Cumbrian records of this species, including Bassenthwaite Lake and Derwent Water.
- **Recreation.** Water-borne traffic can suppress growth of aquatic plant communities (either by direct physical damage to the plants or by causing increased turbidity), and may favour increased growth of algae through mobilisation of nutrients in lakebed sediments. Recreation can also disturb wintering and breeding bird populations.
- **Damage to marginal vegetation.** Natural lake hydrosere are often substantially modified or eliminated by agriculture and lakeside developments.

Current action

- **Regulatory framework.** In carrying out their functions, the Environment Agency, water companies, Internal Drainage Bodies and local authorities have certain statutory duties to

further nature conservation. These are set out in the Land Drainage Act 1991 and the Environment Act 1995. The Environment Agency also has statutory responsibilities for pollution control.

- **Management.** Individual management plans exist for several of the larger lakes, for example Bassenthwaite Lake and Windermere. Specific issues on individual lakes are also highlighted in the appropriate Local Environment Agency Plan (LEAP). The Environment Agency is currently preparing a business plan to provide a strategic overview of still waters within Cumbria, including mesotrophic lakes. Nationally, the Environment Agency has published a proposed management strategy for the control of eutrophication in England and Wales. The newly-established Still Waters Partnership, comprising EA, LDNPA, EN, NT, NWW, FBA and CEH, aims to protect or enhance the Lake District's internationally important resource of still waters by promoting sustainable management and use of these waters and their catchments.
- **Current knowledge of the sites.** There is a large body of survey data and other research for most Cumbrian mesotrophic lakes, and in some cases data extend back for many years. This includes data from surveys of water chemistry, algae and macrophytes.
- **Ongoing and planned investigations.** A wide range of monitoring and other studies is in place or planned by EN, EA, LDNPA, NWW and CEH. EA is currently developing classification schemes for lakes, based on chemical, biological and hydrological parameters. Several of the Cumbrian mesotrophic lakes have been included in the development of these schemes.
- **Nutrient control.** In Cumbria, phosphorus reduction measures are in place at some sewage treatment works discharging into the catchments of Bassenthwaite Lake, Esthwaite Water and Windermere. Investigations into the nutrient dynamics of Esthwaite Water and Bassenthwaite Lake are continuing to assess the relative input of nutrients from different sources and to determine the significance of internal recycling in these relatively shallow lakes.
- **Publicity.** The UK Steering Group for mesotrophic lakes is preparing an interim report, which will include reference to the 'flagship' sites within the UK, which include Bassenthwaite Lake.

Context in relation to other plans:

UK Habitat Action Plans

There is a UK Biodiversity Action Plan for mesotrophic lakes in *Biodiversity: the UK Steering Group Report* (1995), to which the UK Steering Group for mesotrophic lakes has proposed minor modifications. The modified plan sets out the following national objectives and targets:

- * Maintain the characteristic ecology of mesotrophic lakes.
- * Identify and implement effective remedial action to address impacts which damage, or threaten to damage, current mesotrophic lakes.
- * Identify and implement effective action, where appropriate, to restore the characteristic ecology of former mesotrophic lakes.

National Lead Agency

The national lead agency for mesotrophic lakes is the Scottish Environment Protection Agency, whose nominated officers is based at SEPA East Region in Edinburgh.

Local contacts

Allan Stewart represents English Nature (01539 792800) on the UK Steering Group for mesotrophic lakes.

Associated plans in the Cumbria BAP

The following Cumbria species/habitat action plans are of relevance to mesotrophic standing waters:

Phase I

- vendace
- water vole
- rivers and streams
- reedbed
- wet woodland

Phase II

- schelly
- Atlantic salmon
- medicinal leech
- pillwort
- oligotrophic standing waters
- standing waters on marl

References

Palmer M. (1989) A botanical classification of standing waters in Great Britain and a method for the use of macrophyte flora in assessing changes in water quality. *Research & Survey in Nature Conservation* **19**. Nature Conservancy Council, Peterborough.

Objectives, targets and proposed actions for mesotrophic standing waters in Cumbria

Broad Objective A	Maintain the characteristic ecology of mesotrophic lakes in Cumbria			
Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
I Confirm current status and extent of resource	1 Complete inventory of mesotrophic lakes in Cumbria by end of 2000.	LDSWP, CWT	S	RM
	2 Identify the lakes where more information is required to confirm current status, and agree a plan to gather this information by end of 2000.	LDSWP, CWT	S	RM

Broad Objective A		Maintain the characteristic ecology of mesotrophic lakes in Cumbria		
Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
2 Maintain favourable condition of mesotrophic lake SSSIs and cSACs	1 Complete conservation objectives for mesotrophic lake SSSIs by 2001.	EN	S	PL
	2 Ensure that all SSSI mesotrophic lakes have a site management plan implemented by 2005, taking full account of all impacts.	LDSWP	M	PL/SS
	3 Continue to offer long-term management agreements to protect mesotrophic lake SSSIs where appropriate.	EN	O	SS
	4 Review existing consents affecting the mesotrophic lake candidate SACs by 2002.	EA, EN	M	SS
3 Ensure planning and environmental legislative mechanisms protect the existing status of mesotrophic lakes	1 Establish water quality objectives and associated nutrient standards appropriate for mesotrophic lakes in Cumbria by 2005 and aim to meet targets by 2010.	LDSWP, DCs	M/L	PL/SS
	2 Ensure new abstractions and discharges do not cause further deterioration of mesotrophic lakes.	EA, NWW	O	SS
	3 Incorporate policies in Development Plans which seek to ensure that developments and land drainage operations do not result in further deterioration of mesotrophic lakes.	LAs, EA, EN	O	SS
	4 Where relevant for mesotrophic lakes, all new forest design plans and woodland grant schemes to include provisions to prevent adverse impacts on mesotrophic lakes in the catchment.	FC, FE	O	SS
	5 Identify as Wildlife Sites the most important areas for wildlife in the County outside of statutory sites, including mesotrophic standing waters, by 2006.	CWT, LAs	L	SS
	6 Promote the use of best practice management techniques for mesotrophic lakes and their catchments.	LDSWP, CWT, LAs, MAFF, ECCP	O	CP/A

Broad Objective B Identify and implement effective remedial action to address impacts on current mesotrophic lakes in Cumbria and to restore, where appropriate, former mesotrophic lakes

Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
1 Identify current threats and agree plan of action for rehabilitation of impacted mesotrophic lakes	1 Identify current threats and agree a priority list of mesotrophic lakes requiring restoration measures. By 2004.	LDSWP, CWT	M	RM/PL
	2 Identify the lakes requiring further investigation by 2004.	LDSWP, CWT	M	RM
	3 Implement restoration measures for above lakes by 2005.	LDSWP, CWT, Eden Rivers Trust	M/L	SS
2 Reduce the threat posed by alien plant species	1 Consider options for control of <i>Crassula helmsii</i> by 2002.	LDSWP	M	SP
3 Reduce the threat of damage by fisheries activities	1 Review appropriate fisheries management policy for those SSSI lakes affected by fisheries related impacts, and implement species management plans to prevent the further spread of problem species by 2005.	EA, EN, NT	M	RM/SP

Broad Objective C Increase awareness and understanding of the conservation of lakes and their wildlife value

Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
1 Disseminate information on mesotrophic lakes	1 Circulate UK BAP Steering Group leaflet on mesotrophic lakes.	EN, EA	S/O	CP
	2 Prepare and publish the story of the improvement of the aquatic environment of Windermere, by 2001.	LDSWP	S	CP

Key to Tables

Suggested organisational involvement: Key Deliverers in bold type; Partners in plain type.

CEH = Centre for Ecology and Hydrology; CWT = Cumbria Wildlife Trust; DCs=District Councils; EA = Environment Agency; ECCP=East Cumbria Countryside Project; EN = English Nature; FE = Forest Enterprise; LDNPA = Lake District National Park Authority; LAs = Local Authorities; LDSWP=Lake District Still Waters Partnership; NT = National Trust; NWW = North West Water Limited.

Timescale: O=ongoing; S=short term (2000-2001); M=medium (2002-2005); L=long (2006-2010).

Type: Type of action; PL=Policy & Legislation; SS=Site Safeguard & Management; SP=Species Management and Protection (species plans only); A=Advisory; RM=Research & Monitoring; CP=Communications and Publicity.