



JNCC Report

No. 317

**An estimate of the extent of dystrophic,
oligotrophic, mesotrophic and eutrophic
standing fresh water in Great Britain**

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April 2001

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ISSN 0963 – 8091

This report should be cited as:

Palmer, MA & Roy, DB (2001) An estimate of the extent of dystrophic, oligotrophic, mesotrophic and eutrophic standing fresh water in Great Britain. *JNCC Report, No. 317*

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Acknowledgements

The statutory conservation agency site typing system and the TRS system are based on an enormous amount of fieldwork, carried out over more than two decades by staff of these agencies. Foremost among these surveyors were Chris Newbold, Liz Charter, Sue Bell, Ian Butterfield, Olivia Lassi re and staff of the former Nature Conservancy Council England and Wales Field Units.

Phil Boon (Scottish Natural Heritage), Catherine Duigan (Countryside Council for Wales), Ian Fozzard (Scottish Environment Protection Agency), Richard Howell (Environment Agency) Jeff Kirby and Andrew Stott (Department of Environment, Transport and the Regions) have provided comments on draft reports.

Data in electronic form from surveys of over 3,000 Scottish lochs were made available by Scottish Natural Heritage; Catherine Duigan supplied information on Welsh lakes; and Liz Charter provided data on Lake District tarns from her MSc Thesis.

Peter Rothery (Centre for Ecology and Hydrology) provided statistical advice. Susan Davies and Debbie Jackson (JNCC) were the nominated officers for this contract; Debbie Jackson and Colin McLeod prepared the final report for publication.

Figures 3 to 12 were produced using DMAP, written by Alan Morton.

Summary

The UK Biodiversity Action Plan and the EC [Habitats Directive](#) aim to conserve specific types of habitat by means of action plans and site protection measures. In order to set natural resources in context, to enable planning to be effective and to facilitate the costing of proposals for action, it is necessary to know the extent of each habitat type. The total surface area of standing fresh water in Great Britain is estimated at 2400 km². The aim of the investigation described here is to estimate the extent of the different types of standing freshwater habitat that make up this total.

Freshwater habitat classification systems used in Britain and the European Union incorporate the concept of trophic levels. The current British system, based on the results of a nationwide botanical survey of standing waters, groups ten standing water site types under the broad habitat categories dystrophic, oligotrophic, mesotrophic, eutrophic and brackish. Data collected by the statutory nature conservation agencies on site type (and therefore habitat type) and surface area are available for 3500 water bodies, mostly in Scotland. In England and Wales, survey has been much more selective and patchy than in Scotland. Therefore, it was not considered possible to estimate the areas of habitat types in England and Wales (or in Britain as a whole) simply by direct extrapolation from the survey sample to the total resource of standing water.

Computerised national datasets available to the [Centre for Ecology and Hydrology \(CEH\)](#) include [Ordnance Survey \(OS\)](#) statistics on the area of standing water in each kilometre square in Great Britain and records of the occurrence of aquatic plant species in the [Biological Records Centre \(BRC\)](#) database. A system of Trophic Ranking Scores (TRS) has been developed for aquatic plant species. Using BRC data, a mean TRS for each 10x10 km square in Britain was produced and the country was divided into TRS bands. For each of these bands the percentage by surveyed area of each freshwater habitat type (dystrophic, oligotrophic, mesotrophic and eutrophic) was calculated. These percentages were applied to the total area of standing water in each TRS band and the extent of these habitats in Britain as a whole could then be calculated.

The estimated extent (with an approximation of error) and percentage of each freshwater habitat type is:

	Dystrophic	Oligotrophic	Mesotrophic	Eutrophic
	Area (km²)			
England	1 ± 0.1	93 ± 9	62 ± 6	518 ± 52
Scotland	10 ± 1	1294 ± 65	180 ± 18	121 ± 6
Wales	0.4 ± 0.04	59 ± 6	25 ± 3	40 ± 4
Great Britain	11 ± 1	1445 ± 80	267 ± 27	679 ± 62
	Area (%)			
England	0.2	14	9	77
Scotland	0.6	80	12	7
Wales	0.4	47	20	32
Great Britain	0.5	60	11	28

Preface

Although estimates for the total area of freshwater in Great Britain are available, it is not possible with present data sources to directly estimate the extent of standing water in the trophic status categories (namely dystrophic, oligotrophic, mesotrophic and eutrophic) commonly used by the conservation agencies to classify water bodies.

This report presents a methodology for estimating the extent of standing water in each of the trophic status categories using Trophic Ranking Scores. This is a system that assigns aquatic plant species a score according to the nutrient status of the waters in which they are found. This publication is a revision of an earlier contract report¹ produced for JNCC and it includes additional data from Scotland and an additional validation of the estimates.

The purpose of publishing this report is to stimulate discussion and further work rather than provide an authoritative reference document on the extent of standing water in each of the trophic status categories. Although the methodology used is considered to be statistically sound, it is difficult to judge the scale of the possible errors due to some unavoidable assumptions about the data and the quality of the available information.

The work presented here could be improved by further validation, particularly for the English and Welsh data as the results presented here are heavily influenced by and validated with the data from Scotland. In addition, data that should become available from the results of the Countryside Survey 2000 programme (Haines-Young *et al.* 2000) and the Plant Atlas 2000 project (Pearman & Preston 1996) may mean that these analyses could be significantly improved upon.

Given the above caveats, we believe that this report and the methodology presented within it will provide a useful reference document for those involved with implementing conservation policy for freshwaters in Great Britain.

The views expressed in this report are those of the authors and not necessarily those of the Joint Nature Conservation Committee or of the Centre for Ecology and Hydrology.

¹ Palmer, MA & Roy, DB (1997) *An estimate of the extent of dystrophic, oligotrophic, mesotrophic and eutrophic standing water in Great Britain*. (Contractors: MA Palmer and Institute of Terrestrial Ecology) Unpublished report to the Joint Nature Conservation Committee, Peterborough.

1 Introduction

The UK Biodiversity Action Plan (Department of the Environment 1994) and the European Community (EC) *Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora* (the ‘Habitats Directive’) aim to conserve specific types of habitat by means of action plans and site protection measures. In order to set natural resources in context, to enable planning to be effective and to facilitate the costing of proposals for action, it is necessary to know the extent of each habitat type.

The total area of standing fresh water in Great Britain has been estimated using a number of methods. However, a breakdown of this total into different types of standing water had not been attempted until 1997, when a preliminary assessment was produced (Palmer & Roy 1997) for the UK habitat action plan for eutrophic standing waters (UK Biodiversity Group 1998). The work described here is a revision of Palmer & Roy (1997), employing the same approach, but using a larger dataset that incorporates a large quantity of recently collated survey information from Scotland.

Standing waters are commonly classified according to their nutrient status, although any such classification is a subjective division of a continuum from nutrient-poor to nutrient-rich conditions. The terms dystrophic, oligotrophic, mesotrophic and eutrophic represent recognisable levels in the fertility series. They have been defined in terms of nitrogen and phosphorus concentrations by the [Organisation for Economic Co-operation and Development](#) (1982).

The classification systems used in Britain (Nature Conservancy Council 1989) and the European Union (Devillers *et al.* 1991) for the purpose of selecting freshwater Sites of Special Scientific Interest and Special Areas of Conservation incorporate the concept of trophic levels. The current British system, based on the results of a nationwide botanical survey of standing waters, recognises ten Site Types which may be grouped under the categories dystrophic, oligotrophic, ‘mixed’, mesotrophic, eutrophic and brackish (Palmer 1992). This site classification is used as a basis for this investigation.

2 Objectives

The objectives of this investigation were to:

- estimate the proportions of the dystrophic, oligotrophic, mesotrophic and eutrophic components of the standing freshwater resource of Great Britain, using national datasets available to the [Centre for Ecology and Hydrology](#) (CEH) and data derived from botanical surveys of standing waters carried out by the statutory conservation agencies; and
- produce an estimate of the total area of dystrophic, oligotrophic, mesotrophic and eutrophic standing fresh water in England, Scotland, Wales and Great Britain.

3 Data sources

3.1 Statistics on the total standing water resource of Great Britain

There are three computerised national datasets that give estimates of the total resource of inland waters in Great Britain. These are:

- the Countryside Survey 1990 (Barr *et al.* 1993);
- the Institute of Terrestrial Ecology (ITE) Land Cover Map (Fuller *et al.* 1994); and
- Ordnance Survey statistics.

All these data are available in computerised form via the Countryside Information System (CIS) (Howard & Bunce 1994). CIS is a geographic database application that provides land cover and land use data at 1 km spatial resolution. It combines information obtained from satellite imagery with detailed field survey of species and landscape features in a stratified random sample of 508 1 km squares, gathered during the Countryside Survey 1990 (Barr *et al.* 1993).

The main drawback of the Countryside Survey data for use in the present investigation is the large standard error of estimates of the area of standing water. The total area is estimated as 1000 km² of standing water in England (SE 600 km²), 1000 km² in Scotland (SE 300 km²) and 100 km² in Wales (SE <50 km²).

The ITE Land Cover Map is derived from satellite imagery of the whole of Great Britain, based on a pixel size of 25x25 m. Computerised information within CIS is summarised at the 1 km square level. This dataset has the disadvantage of not distinguishing between standing and running water, so data on the area of standing water could not be derived from this source.

Ordnance Survey (OS) statistics include total areas summarised to 1 km² level for features shown on the 1:25,000 OS maps. This dataset distinguishes between standing and running water, but ignores standing water totals within 1 km squares where they are less than 1 ha. The total areas of standing water given in OS summary statistics were 45,861 ha for England, 152,088 ha for Scotland and 8612 ha for Wales. The total for Great Britain is therefore 206,561 ha.

Smith & Lyle (1979) made a detailed analysis of OS maps in order to calculate the total area of standing water in Britain. Their estimates were 67,500 ha in England, 160,400 ha in Scotland and 12,500 ha in Wales. The total for Great Britain is therefore 240,400 ha. Estimates by Smith & Lyle do not ignore totals less than 1 ha per 1 km square, which probably accounts for much of the discrepancy between these figures and those of the OS summary data.

3.2 National plant distribution data

The Biological Records Centre (BRC), housed at CEH Monks Wood, contains computerised records of the occurrence throughout Great Britain of all vascular plants, charophytes and bryophytes. The main dataset relevant to this investigation is the one used to produce the atlas of aquatic plants (Preston & Croft 1996). This comprises records of freshwater vascular plants from over 2700 of the 2800 10x10 km squares in Britain that contain land. Plant records have been passed to BRC from a number of sources. Statutory nature conservation agency data accounts for a small proportion, but the majority of the information has been supplied by volunteer botanists, mainly members of the Botanical Society of the British Isles (BSBI). The BSBI is currently collecting data for a revised atlas of the vascular plant flora of the British Isles (Pearman & Preston 1995), an exercise that has resulted in the input of over 4 million new records to BRC. Unfortunately, these new data were not available for use in this investigation.

3.3 Conservation agency lake survey data

The statutory conservation agencies have carried out a long-term botanical survey of standing waters throughout Great Britain. The aim of the survey was to produce a comprehensive account of the freshwater resource, as a basis for nature conservation assessment. A standard methodology was used, which entailed producing a full plant species list for each water body, with information on relative abundance. Survey has been most systematic in Scotland (Lassière 1995), where over 3200 lochs have been covered since 1983. Here, a modification of the stratified random sampling approach was used to choose sites for survey. A selection of the lochs appearing on 1:50,000 OS maps was made, based on surface area, altitude and geology, then priority sites were identified within this selection using a number of criteria such as situation within designated areas or known occurrence of rare species.

In England and Wales, survey has been intensive for a few areas such as the Lake District (Charter 1984), the West Midlands (Wigginton 1980, 1989) and Anglesey. Elsewhere it has been limited largely to a broad selection of sites thought to be of potential nature conservation interest, so there are large areas of England and Wales for which no data are available (Palmer *et al.* 1992).

3.4 Site types

Analysis by TWINSPAN (Hill 1979) of data collected between 1975 and 1988 from over 1000 sites in England, Scotland and Wales resulted in a botanical classification of standing waters in Great Britain (Palmer 1992; Palmer *et al.* 1992). The approximate numbers of sites per country included in this analysis were 330 in England, 30 in Wales and 700 in Scotland. The great majority of Scottish and Welsh sites in this dataset were natural lakes, whereas many of the English sites were artificial waters such as gravel pits, reservoirs and canal sections.

Ten main standing water vegetation types and two sub-groups were recognised from the TWINSPAN analysis and related to data on pH, conductivity and alkalinity, which are indicative of nutrient status. Unfortunately, little information was available on nitrogen and phosphorus concentrations in the water bodies surveyed, but the site types were linked with trophic states as follows:

Type 1	Dystrophic (nitrogen-poor and highly acidic)
Type 2	Oligotrophic (nutrient-poor), typically peaty
Type 3	Oligotrophic, typically mineral substrate
Type 4	Sites with a mix of oligotrophic and eutrophic characteristics, regarded here as mesotrophic (moderately nutrient-rich)
Type 5A	Mesotrophic
Type 5B	Mesotrophic, species-poor
Type 6	Brackish sites in Scotland
Type 7	Eutrophic (nutrient-rich), mainly northern
Type 8	Eutrophic, typically rich in emergent vegetation
Type 9	Predominantly eutrophic, water lilies dominant
Type 10A	Eutrophic, <i>Elodea canadensis</i> sub-group
Type 10B	Eutrophic, <i>Chara</i> sub-group.

Table 1 lists the 207 typed English sites used in the present investigation. The list treats groups of gravel pits as single sites and omits canals. The site typing system has recently been re-applied by the Countryside Council for Wales to 38 lakes (Table 2) and by Scottish Natural Heritage (SNH) to 3212 lochs, many of them surveyed since 1988. The Scottish data have been used to produce a computerised lochs database, which was made available by SNH for the present investigation. A further 39 Scottish sites not included in the SNH database but surveyed by staff (Chris Newbold and Margaret Palmer) of the former Nature Conservancy Council have been typed (Table 3).

Because few of the largest Scottish lochs were covered by conservation agency survey, additional lochs over 200 ha in extent described in *A Nature Conservation Review* (Ratcliffe 1977) were added to the dataset. The largest, at 7100 ha, is Loch Lomond, which is described as oligotrophic at the northern end and mesotrophic at the southern end. The others are Loch Morar, Loch Sionascaig and Loch Laidon, all identified by Ratcliffe as oligotrophic. Descriptions in *A Nature Conservation Review* (Ratcliffe 1977) were also used to Type 11 of the sites in England (Table 1).

In all, information on site typing was available for this investigation for 3500 standing waters throughout Britain.

3.5 Surface area of water bodies surveyed

Surface area estimates are given for all the water bodies listed in Tables 1 – 3 and in the SNH lochs database. Area data were provided by the [Countryside Council for Wales](#) (Catherine Duigan pers. comm.) for most of the Welsh lakes in Table 2. Information on the area of tarns surveyed in the Lake District was obtained from Charter (1984) and data on the size of meres in the West Midlands was extracted from Wigginton (1980, 1987). Information was taken from *A Nature Conservation Review* (Ratcliffe 1977) for relevant sites in Tables 1 and 3. Area estimates were made from [Ordnance Survey](#) maps for the rest of the standing waters listed in Tables 1 and 3. Appendix 1 comprises data abstracted from the SNH database, adjusted to take account of the fact that some lochs overlap 10x10 km grid squares. For these sites, the approximate area of open water in each grid square is entered.

Estimates of the areas of oligotrophic and mesotrophic habitat types in Loch Lomond are given in Table 3. Murphy *et al.* (1994) described plant communities in Loch Lomond that are associated with oligotrophic and mesotrophic conditions. However, Best & Traill (1994) were of the opinion that the water chemistry indicates that the whole of Loch Lomond is oligotrophic, though the southern end verges towards mesotrophy. For the purpose of this exercise, the 20% of the loch lying south of the Highland Boundary Fault (MacDonald 1994) is regarded as mesotrophic and the rest as oligotrophic.

3.6 Trophic Ranking Scores for plant taxa

Palmer (1992) developed a system of ‘DOME codes’ and ‘Trophic Ranking Scores’ (TRS) for the aquatic macrophyte taxa recorded frequently in the national survey of standing waters. The DOME codes reflect the occurrence of plants in the various site types and give a measure of the strength of the association. Code ‘dOm’, for instance, indicates that a plant is strongly associated with oligotrophic waters and also occurs less frequently in both dystrophic and mesotrophic conditions, whereas code ‘E’ means that a plant is generally confined to eutrophic waters.

Trophic Ranking Scores are numerical expressions of the DOME codes. Macrophytes confined to nutrient-poor (Types 1, 2 and 3) waters have low scores (3.0 – 4.0), those confined to eutrophic (Types 7, 8, 9 and 10) waters have high scores (8.5 – 10.0), whilst plants characteristic of mesotrophic conditions (Type 5) or with a wide tolerance of trophic states have intermediate scores. A list of DOME codes and TRSs for the 96 plant taxa used in this investigation is given as Table 4. The mean TRS for the full complement of open water and emergent species commonly occurring in each habitat type is shown below.

Habitat type	Mean TRS (submerged, floating, and emergent species)
Dystrophic waters (Site Type 1)	4.30
Oligotrophic waters (Site Types 2 & 3)	5.57
Mesotrophic waters (Site Type 5)	7.10
Eutrophic waters (Site Types 7, 8, 9 & 10)	8.63

A mean TRS can be calculated for an individual water body or area, taking account of all the scoring species recorded in the site or area. The mean TRS of an individual site gives a good indication of the nutrient status of the water. For areas of land (e.g. 10x10 km squares) holding a number of water bodies, values in the middle portion of the scale usually indicate a mixture of water types rather than purely mesotrophic conditions.

4 Methods

4.1 Calculating the area of the standing water resource

Ordnance Survey data were more appropriate than either Countryside Survey or ITE Land Cover data for use in this investigation, for the reasons given in Section 3.1. However, because totals of standing water less than 1 ha within any 1 km square are ignored in the OS summary statistics, the figures given are short of the true total and a number of 10x10 km squares are unrealistically depicted as devoid of standing water. Of the 240,020 1 km squares in Britain, no fewer than 226,381 are given in the OS summary statistics as having no standing water. If these 'dry' squares contain on average only 0.15 ha of standing water, an extra 34,000 ha would be added to the national total, bringing it to 240,561 ha.

It was decided that the Smith & Lyle (1979) national total of 240,400 ha is probably the most accurate estimate available and that the OS statistics should be adjusted to allow for the discrepancy between the two totals. Therefore, the shortfall of 21,639 ha for England, 8312 ha for Scotland and 3888 ha for Wales (33,839 ha for Great Britain) in the OS summary data was distributed equally between all the 'dry' 1 km squares in each country. In this way, an adjusted figure was produced for the total area of standing water for each 10x10 km square (Appendix 2).

4.2 Demonstrating the range of mean Trophic Ranking Scores

Post-1949 records of the 96 aquatic plant taxa allotted a TRS value and considered suitable for this investigation were abstracted from the BRC database. Using presence/absence data for these species, mean TRS values were calculated for each of the 2732 10x10 km squares in Great Britain in which the plants had been recorded (Appendix 2). A map was produced to display the results, using five mean TRS bands (3 – 5; 5+ – 6; 6+ – 7; 7+ – 8; 8+ – 10).

4.3 Mapping site types

A spreadsheet was created containing the 10x10 km square grid reference and site type for all the water bodies in Tables 1 – 3 and Appendix 1. Site types were mapped (Figures 3 – 12) to enable comparisons to be made between the national distribution of site types and the map of TRS values throughout Britain.

4.4 Estimating the area of different standing water habitat types

The spreadsheet also incorporated information on surface area and habitat type for each site as follows:

- dystrophic = Site Type 1;
- oligotrophic = Site Types 2 and 3;
- mesotrophic = Site Types 4, 5A and 5B;
- eutrophic = Site Types 7, 8, 9, 10A and 10B; brackish = Site Type 6.

A simple and obvious method of estimating the extent of different standing water habitat types in Britain would be to take the proportions of each habitat type identified during the survey and to extrapolate directly to the total area of standing water in Great Britain. The great drawback to this procedure is that the conservation agencies have not collected survey data on lakes for a large majority of 10x10 km squares in England and Wales. As most of these squares are in the highest TRS band, the proportion of eutrophic water will be underestimated.

It is believed that mean TRS, in tandem with habitat type data and area statistics, can be used to predict the proportions of the different habitat types present in unsurveyed areas. This predictive

method can therefore produce a much more accurate estimate of the extent of habitat types in England and Wales. The following procedure was followed:

- Step a. The total area of standing water in each of the five mean TRS bands in England, Scotland, Wales and Britain was calculated by summing the adjusted OS areas for the 10x10 km squares within each band (see Appendix 2).
- Step b. The total area for surveyed sites in each of the standing freshwater habitat types dystrophic, oligotrophic, mesotrophic (including 'mixed) and eutrophic within each mean TRS band in Britain was calculated, using site area and habitat type data in Appendix 1 and Tables 1 – 3 and TRS values in Appendix 2.
- Step c. For each TRS band in Britain, the percentage by surveyed area of each habitat type (oligotrophic, dystrophic, mesotrophic and eutrophic) was calculated.
- Step d. By applying these percentage figures to the adjusted OS data for the total area of standing water in each band in each country (given by Step a), the probable total area of each of these four freshwater habitat types in each mean TRS band was calculated for England, Scotland and Wales.
- Step e. The overall totals for the four habitat types in England, Scotland, Wales and Great Britain were obtained by summing the totals in each of the five TRS bands. The percentage of each type within the four countries was then calculated.

Brackish (Type 6) waters were ignored in the analysis for the following reasons. They are rare and their occurrence is not related to TRS. Also, coastal water bodies that have an obvious connection to the sea appear not to have been included in the OS summary statistics for standing water. This group includes large lochs such as the Loch of Stenness on Orkney, which, at 500 ha, makes up half the area of Type 6 waters identified in the statutory agency survey programme.

4.5 Estimating error

In order to give some indication of possible error inherent in the estimates produced by the method described in Section 4.4, a check was made using data from Scotland alone. For Scotland, where nearly half of the standing water has been surveyed (see Section 5.1) and survey was based on stratified random sampling, it is acceptable to make a direct extrapolation from survey data to the total freshwater resource. The total area of each freshwater habitat type in Scotland was estimated by applying the percentages of these in the survey sample to the total area of standing water in the country. Error estimates for Scotland were obtained by comparing the figures obtained by this method and the one using TRS bands described in Section 4.4. Because there are several sources of possible error (see Section 6), a somewhat larger error estimate was applied to the results as a whole (see Section 5.5).

5 Results

5.1 The distribution of the standing water resource and the extent of survey

Figure 1 represents the distribution of the standing water resource in Britain, produced from the adjusted Ordnance Survey figures for the area of standing water in each 10x10 km square (Appendix 2).

The proportion of the total fresh water resource surveyed in England, Scotland and Wales is as follows:

	Area surveyed (excluding brackish) (ha)	% of total freshwater resource surveyed
England	8578	13
Scotland	77,823	49
Wales	1145	9
Great Britain	87,546	36

5.2 Trophic Ranking Scores for each 10x10 km square

Figure 2 is a map indicating five mean TRS bands, based on data for all the 10x10 km squares in Great Britain in which scoring plant taxa have been recorded (see Appendix 2). A total of 129 coastal squares had no freshwater plant records, so could not be given a mean TRS value. However, most of these squares have very little land within them.

Figure 2 shows that the lowest two mean TRS bands (3-5 and 5-6) are confined to the Scottish highlands and a small area of central Wales. TRS band 6-7 occupies much of northern Scotland apart from the core mountain areas, the highest parts of northern England, much of the mountainous area of north and central Wales, Dartmoor and Bodmin Moor. TRS band 7-8 includes lowland Scotland, the uplands of northern England apart from the highest areas, lowland Wales except the south coast, most of Devon and Cornwall, the New Forest and some heathland areas in southern England. Squares on the south coast of Wales and in most of lowland England apart from the south west, have a mean TRS exceeding 8.

5.3 The distribution of standing water habitat types in Great Britain – survey data

Figures 3 to 12 show the distribution of dystrophic, oligotrophic, mesotrophic, eutrophic and brackish waters in Great Britain, based on the sample of sites surveyed by the statutory nature conservation agencies since 1975.

The proportion of sites in the survey sample within each habitat type was analysed in relation to TRS band for England, Scotland and Wales (Figure 13). Where a site had areas of different trophic status or it overlapped 10x10 km squares, the constituent parts were treated as separate sites. It is obvious from Figure 13 that there is a strong similarity in the distribution patterns for all three countries, despite the unevenness in sampling effort. Oligotrophic sites (Types 2 and 3) dominate TRS bands below 7; band 7 to 8 holds a much more even mixture of oligotrophic, mesotrophic (Types 4 and 5) and eutrophic sites; TRS band >8 contains mainly eutrophic sites (Types 7, 8, 9 and 10).

The main inconsistency occurs in the distribution of dystrophic (Type 1) sites. In Scotland, the percentage of dystrophic sites decreases in line with increasing TRS. Most of these waters are lochans situated in extensive blanket bog systems. In England, where the total extent of

dystrophic water in the survey sample is only about 30 ha, the largest percentage of dystrophic sites occurs in the areas of highest mean TRS. This is probably because these waters are mainly pools in small lowland raised bogs that lie in relatively nutrient-rich surroundings. In Wales no dystrophic waters have been definitely identified in the lake survey. Upland bog pools in England and Wales appear to have been largely ignored in the survey, so there could well be more dystrophic water south of the border than the survey sample indicates.

For brackish waters (Type 6), recorded only from Scotland, the total area surveyed is 949 ha. Similar sites may occur in England (e.g. in the Norfolk Broads area) and Wales, but if so they are rare.

5.4 An estimate of the extent of the different habitat types

Table 5 gives the figures representing each step in the method outlined in Section 4.4.

- Step a. Total area of standing water in England, Scotland, Wales and Britain (adjusted OS data) within mean TRS bands.
- Step b. Area of dystrophic, oligotrophic, mesotrophic and eutrophic water identified from the sample surveyed in Britain, within mean TRS bands.
- Step c. % of dystrophic, oligotrophic, mesotrophic and eutrophic water in the survey sample in Britain, within mean TRS bands.
- Step d. Predicted area of dystrophic, oligotrophic, mesotrophic and eutrophic water in England, Scotland and Wales, within mean TRS bands.
- Step e. Total areas and percentages (across all mean TRS bands) for each habitat type in each country.

5.5 Error estimates

As pointed out in Sections 4.4 and 5.1, survey has been scanty and biased in England and Wales, compared with that in Scotland. Therefore, calculating the total area of habitat types in England, Wales and Great Britain by direct extrapolation (applying the proportions of the four habitat types in the survey sample to the total standing water resource) would give a skewed result. The following are the proportions of the four habitat types in the survey sample (see Table 5, Step b).

Habitat type	Total area surveyed in GB (ha)	% of survey sample
Dystrophic	484	0.55
Oligotrophic	66,224	76
Mesotrophic	10,534	12
Eutrophic	10,304	12
Total	87,546	

These figures greatly under-estimate the amount of eutrophic water and over-estimate the quantity of oligotrophic water, according to the TRS banding method (see Section 5.6).

However, because of the intensity and systematic nature of the survey in Scotland, direct estimates for the extent of the various freshwater habitat types can legitimately be made for that country by simple extrapolation. These results can be compared with totals for Scotland obtained using the TRS banding method (Section 4.4), as follows:

Habitat type	Area in Scottish survey sample (ha)	% of sample
Dystrophic	454	0.58
Oligotrophic	63,067	81.04
Mesotrophic	8352	10.73
Eutrophic	5950	7.65
Total	77,823	100

Total area of standing fresh water in Scotland (adjusted statistics): **160,415 ha**

Predicted total areas of habitat types in Scotland, using two methods:

Habitat type	Direct extrapolation from survey (ha)	TRS banding method (ha) (see Table 5)	% difference
Dystrophic	0.58% of 160,415= 930	1000	7.53
Oligotrophic	81.04% of 160,415= 130,000	128,709	-0.99
Mesotrophic	10.73% of 160,415= 17,213	18,752	8.94
Eutrophic	7.65% of 160,415= 12,272	11,953	-2.60
Total		160,419	

The Scottish results for the two methods are very close for oligotrophic and eutrophic water and for the other two habitat types the difference is less than 10%. This gives confidence to the use of TRS banding for estimating the proportion of the different habitat types. As there are several sources of possible error (see Section 6), it seems reasonable to suppose that the figures given in Table 5 for the extent of dystrophic, oligotrophic, mesotrophic and eutrophic water in England and Wales are accurate to within $\pm 10\%$. For dystrophic and mesotrophic water in Scotland, a figure of $\pm 10\%$ is applied to the mean of the results using the two methods of assessment, but for oligotrophic and eutrophic water in Scotland the error estimate is set at $\pm 5\%$.

5.6 Summarised results

The estimated extent (with probable error indicated) and approximate percentage of the four freshwater habitats are:

	Dystrophic	Oligotrophic	Mesotrophic	Eutrophic
	Area (ha)/%			
England	115 \pm 12 0.2%	9281 \pm 928 14%	6211 \pm 621 9%	51,751 \pm 5175 77%
Scotland	965 \pm 97 0.6%	129,355 \pm 6468 80%	17,983 \pm 1798 12%	12,113 \pm 606 7%
Wales	44 \pm 4 0.4%	5853 \pm 585 47%	2533 \pm 253 20%	4013 \pm 401 32%
Great Britain	1124 \pm 112 0.5%	144,489 \pm 7981 60%	26,727 \pm 2672 11%	67,877 \pm 6182 28%

6 Discussion

6.1 Definitions of trophic states

There are a number of definitions of the terms dystrophic, oligotrophic, mesotrophic and eutrophic, using a variety of variables to define these states. Ratcliffe (1977) gives the following as the characteristics of the different types of fresh water:

	Alkalinity (mg l⁻¹ CaCO₃)	pH
Dystrophic	0 – 2	<6
Oligotrophic	0 – 10	6 – 7
Mesotrophic	10 – 30	around 7
Eutrophic	>30	>7

The Organisation for Economic Co-operation and Development (1982) uses the following definitions, based on annual average geometric means:

	Total phosphorus (mg l⁻¹)	Chlorophyll (mg l⁻¹)
Ultra-oligotrophic	≤ 0.004	≤ 0.001
Oligotrophic	≤ 0.01	≤ 0.0025
Mesotrophic	0.01 – 0.035	0.0025 – 0.008
Eutrophic	0.035 – 0.1	0.008 – 0.025
Hyper-eutrophic	≥ 0.1	≥ 0.025

Estimates of the extent of the different habitat types produced by this investigation are dependent on definitions that rely on biota rather than physical or chemical characteristics, although the latter will be reflected in the biota. The habitat definitions are based on plant assemblages forming a series related to conductivity, pH and alkalinity. However, these definitions also rely on personal knowledge of a range of the sites surveyed and a subjective but informed assessment of which TWINSpan end-groups should form definitive site types.

The site series is a continuum, ranging from Type 1 at the nutrient-poor end to Type 10 at the rich end of the spectrum. Site Type 5 is regarded as mesotrophic, meaning that water bodies with this particular assemblage of vegetation are most characteristic of the mid point in the series, usually with a pH around 7 and alkalinity in the range 0.2 – 0.6 mg l⁻¹. For the purposes of this investigation, Type 4 sites, which often have a mixed substrate and elements of both oligotrophic and eutrophic vegetation represented, are also classed as mesotrophic. There is overlap between site types in terms both of their physical and chemical variables and their vegetation. Typical examples of sites are clearly recognisable, but the borderline between trophic states is blurred and there are numerous examples where it is difficult to distinguish relatively nutrient-rich oligotrophic sites from mesotrophic sites or relatively nutrient-poor eutrophic sites from mesotrophic sites.

Most of the sites in the dataset used in this investigation were classified using the TWINSpan key to site types (Palmer 1992). Misclassification of some sites in relation to their trophic status is obviously a potential source of error. This is especially true for large water bodies such as Loch Lomond. To check this particular example, the area calculations were reworked without Loch Lomond being included in the dataset and the results were compared with those shown in Section 5.6. Almost identical percentages were obtained for the four habitat types in Great Britain.

The Scottish Environment Protection Agency (SEPA) and the Macaulay Land Use Research Institute (MLURI), Aberdeen, are refining a quality classification of standing waters (Fozzard *et al.* 1997), which takes account not only of current phosphorus concentrations and acid

neutralising capacity but also of ‘hindcasted’ values. The Environment Agency is also investigating methods of monitoring change, based on a similar approach (Moss *et al.* 1996). These initiatives acknowledge the fact that water bodies change over time, partly as a result of human impact. The statutory conservation agency classification scheme (Palmer *et al.* 1992), on the other hand, takes no account of past characteristics of sites, but classifies them solely according to current condition.

6.2 Trophic Ranking Scores

Palmer *et al.* (1992) listed 116 plant taxa that have been allotted Trophic Ranking Scores. Twenty of these taxa, most of them emergent plants, were not used in this investigation because they are not exclusively aquatic and records from the BRC database would have included occurrences in such habitats as wet grassland and marshland. The rejected taxa include *Sphagnum* species, *Juncus bulbosus* and *Agrostis stolonifera*.

The usefulness of the TRS system suggested in Palmer *et al.* (1992) for monitoring standing waters was reviewed by Williams *et al.* (1996). A modification of TRS was incorporated by Moss *et al.* (1996) in their scheme for classifying and monitoring standing waters. Figure 2 shows a striking resemblance to maps showing the critical load of sulphur for fresh waters (Critical Loads Advisory Group 1995). This further supports the authenticity of the TRS bands.

The absence of aquatic plant records in the BRC dataset from 4.5% of 10x10 km squares, with the consequent lack of a TRS value for these squares, means that about 85 ha of surveyed water could not be allocated to a TRS band. This must cause a small amount of inaccuracy in the area calculations.

The TRS system applies only to plants of still water, as it has been developed from standing water survey data. However, most of the plant taxa that have been given TRS values occur in both standing and flowing water. The question arises as to whether plants have the same trophic requirements when growing in rivers and streams as when growing in standing water. It is impossible to separate records from standing and flowing waters in the BRC database, so the mean TRS calculated for each 10x10 km square include records from all types of water.

The Environment Agency is at present working on a method of assessing water quality in rivers, for the purpose of complying with the EU Urban Waste Water Treatment Directive (Environment Agency 1999). This methodology uses records of river macrophytes, about 130 of which have been allotted a Species Trophic Rank (STR) reflecting their tolerance of different trophic conditions. This work closely parallels the work by Palmer *et al.* (1992) on standing water macrophytes. In order to compare TRS and STR for the 60 submerged, floating and emergent plant taxa common to both systems (Table 4), a regression analysis was carried out. A correlation was found (Figure 14), which indicates that inability to separate standing and flowing water records in the BRC database does not distort the TRS values for 10x10 km squares.

It was assumed that the plant records in the BRC database, gathered since 1950, represent the situation as it was during the site survey period, which began over two decades after the first BRC records. If species have been lost from 10x10 km squares, for instance as a result of eutrophication or acidification, the mean TRS may be different from that used as a basis for this investigation. It is unfortunate that the large volume of recent data collected by the BSBI for the revised atlas of the British Isles was unavailable for this study.

6.3 An assessment of the accuracy of the area estimates

The total number of standing waters in Britain is unknown. The lower limit for inclusion of waters on the 1:250,000 Ordnance Survey maps is approximately 4 ha, and at this scale Smith & Lyle (1979) counted 3788 lochs in Scotland. The most extensive are Loch Lomond, Loch Ness, Loch Awe and Loch Shin, which together cover nearly 200 km² and contain about 12 km³ of water, one-third of the total volume for Scotland (Lyle & Smith 1994). On larger-scale maps far

more waters are shown. From sample counts of maps at 1:63,360 scale Smith & Lyle estimated that there are over 30,000 lochs in Scotland.

The Countryside Council for Wales estimates that there are more than 2000 lakes in Wales over 0.25 ha in extent (C. Duigan pers. com.). Recent estimates give the number of ponds and lakes in England and Wales as around 157,000, of which over 95% are between 0.0025 and 1 ha in extent (Barr *et al.* 1994; Biggs *et al.* 1996). Many of these would not feature in OS maps and statistics because the Ordnance Survey does not measure the area of any parcel of land or water smaller than 0.04 ha (Harley 1975). On the blanket bogs of Scotland there are large numbers of dystrophic pools that would also be too small to appear on OS maps. It therefore appears that the total area of standing water (Smith & Lyle 1979) used in this investigation may be an underestimate, and that the area of habitat types at both ends of the nutrient spectrum (eutrophic ponds and dystrophic pools) may also be underestimates.

Altogether, about 36% of the standing water resource in Britain has been typed (Section 5.1) according to the classification adopted by the conservation agencies (Palmer *et al.* 1992). However, because large Scottish lochs make up much of this area, only a small percentage of the total number of standing waters is included in the typed sample.

The assessment of error incurred by using TRS bands (explained in Section 5.5) indicates that this method should be accurate to within about 10%. This estimate includes an allowance for the other sources of possible error mentioned in this section. The figures for Great Britain produced previously by Palmer & Roy (1997), using the same methodology, suggest that there is more eutrophic water and less oligotrophic water than in the present estimate. The latter should be more accurate because the survey sample is bigger.

% British freshwater resource

	1997 estimate	Present estimate
Dystrophic	0.5%	0.5%
Oligotrophic	52%	60%
Mesotrophic	12%	11%
Eutrophic	36%	28%

As discussed in Section 5.5, area estimates obtained through the TRS banding method should be much more accurate than estimates made by direct extrapolation from the proportions of the different habitat types in the survey sample in England and Wales. The following is a comparison of the percentages of the four habitat types in the survey sample with the percentages estimated to occur using the TRS banding method.

	% in survey sample	% predicted by TRS method	% of resource surveyed
England			13
Dystrophic	0.4	0.2	
Oligotrophic	27	14	
Mesotrophic	25	9	
Eutrophic	48	77	
Scotland			49
Dystrophic	0.6	0.6	
Oligotrophic	81	80	
Mesotrophic	11	12	
Eutrophic	8	7	
Wales			9
Dystrophic	0	0.4	
Oligotrophic	71	47	
Mesotrophic	5	20	
Eutrophic	23	32	

6.4 Suggestions for further work and applications of the results of the study

A validation exercise for this study is desirable. This might involve selecting a number of 10x10 km squares lying in different trophic bands in widely separated areas in Britain, predicting the proportions of different types of water from the mean TRS and surveying and typing all the water bodies lying within them.

One of the assumptions on which the methodology in this investigation is based is that areas with similar mean TRS contain similar proportions of habitat types, no matter where they are in Britain. More survey work in England and Wales may indicate regional differences that would undermine this assumption. This investigation predicts that 20% of the total freshwater resource in Wales is mesotrophic, whereas the sample surveyed contains only 5%. This large discrepancy could be due to bias in the Welsh survey, but may result from a greater degree of artificial enrichment having occurred in Wales than in the more remote areas of Scotland, where the bulk of the national sample is situated. This implies that the natural state of many of the eutrophic lakes in Wales is mesotrophy. Hindcasting (Fozzard *et al.* 1997; Moss *et al.* 1996), the use of palaeolimnological techniques or the application of integrated classification systems (Monteith 1996), may bear this out. Unexpectedly, the results are reversed for England, where there is a greater proportion of mesotrophic water in the survey sample than is predicted to occur. This may be due to sampling bias, as the largest natural water body in England, Lake Windermere, is mesotrophic and is included in the survey sample.

The statutory nature conservation agencies are about to embark on a re-analysis of the botanical and environmental data from all the freshwater sites surveyed in Britain. The dataset will be far larger than that for the 1000 or so sites included in the original analysis (Palmer *et al.* 1992), but will be even more heavily biased towards Scotland. This new analysis should shed further light on the relationship between aquatic macrophyte assemblages and trophic status.

The conclusions of this report could be used to further nature conservation in a number of ways. Knowledge of the distribution and extent of different freshwater habitat types is needed to set conservation measures in context and is therefore particularly relevant to the implementation of the Habitats Directive and to Habitat Action Plans for mesotrophic lakes (UK Biodiversity Steering Group 1995) and eutrophic standing waters (UK Biodiversity Group 1998).

6.5 Conclusion

The methodology described in this report combines the use of botanical survey data, mean Trophic Ranking Scores for aquatic plants and Ordnance Survey statistics to predict the distribution and extent of four standing freshwater habitat types in Great Britain. Estimates of the extent and percentage of each habitat type are shown below.

	Dystrophic	Oligotrophic	Mesotrophic	Eutrophic
	Area (ha)			
England	115 ± 12	9281 ± 928	6211 ± 621	51,751 ± 5175
Scotland	965 ± 97	129,355 ± 6468	17,983 ± 1798	12,113 ± 606
Wales	44 ± 4	5853 ± 585	2533 ± 253	4013 ± 401
Great Britain	1124 ± 112	144,489 ± 7981	26,727 ± 2672	67,877 ± 6182
	Approximate area (km²)			
England	1 ± 0.1	93 ± 9	62 ± 6	518 ± 52
Scotland	10 ± 1	1294 ± 65	180 ± 18	121 ± 6
Wales	0.4 ± 0.04	59 ± 6	25 ± 3	40 ± 4
Great Britain	11 ± 1	1445 ± 80	267 ± 27	679 ± 62
	%			
England	0.2%	14%	9%	77%
Scotland	0.6%	80%	12%	7%
Wales	0.4%	47%	20%	32%
Great Britain	0.5%	60%	11%	28%

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Tables

Table 1: Location, type and area of English sites used in the analysis

Locality	Site name	10 km square	Site type	Area (ha)	Habitat type	
Lake District	Airy Hill Pond	NY53	3	0.5	Oligotrophic	
	Allcock Tarn	NY30	3	1	Oligotrophic	
	Allan Tarn, Coniston	SD28	3	1	Oligotrophic	
	Angle Tarn, Bow Fell	NY20	3	3	Oligotrophic	
	Angle Tarn, High Street	NY41	3	6	Oligotrophic	
	Barfield Tarn	SD18	3	3.2	Oligotrophic	
	Barnegates Tarn	NY30	10B	0.5	Eutrophic	
	Barrow Plantation Tarn	SD49	5A	1	Mesotrophic	
	Bassenthwaite Lake	NY22	5A	400	Mesotrophic	
	Bassenthwaite Lake	NY23	5A	300	Mesotrophic	
	Baysbrown Tarn	NY30	2	2	Oligotrophic	
	Beacon Tarn	SD29	2	4.6	Oligotrophic	
	Birk's House Tarn	NY01	8	1	Eutrophic	
	Blea Tarn, Eskdale	NY10	3	4	Oligotrophic	
	Blea Tarn, Armboth	NY21	2	8.6	Oligotrophic	
	Blea Water	NY41	3	13	Oligotrophic	
	Blelham Fish Pond	NY30	2	0.5	Oligotrophic	
	Blelham Tarn	NY30	5A	10	Mesotrophic	
	Bolton's Tarn	SD49	2	3	Oligotrophic	
	Boretree Tarn	SD38	3	4.3	Oligotrophic	
	Borwickfold Tarn	SD49	5B	1	Mesotrophic	
	Bowscale Tarn	NY33	3	2.8	Oligotrophic	
	Burnmoor Tarn	NY10	3	24	Oligotrophic	
	Buttermere	NY11	3	95	Oligotrophic	NCR
	Cleabarrow Tarn	SD49	10A	0.5	Eutrophic	
	Coniston Lake	SD29	3	150	Oligotrophic	
	Consiton Lake	SD39	3	150	Oligotrophic	
	Crook Tarn	SD49	5A	0.7	Mesotrophic	
	Crummock Water	NY11	3	260	Oligotrophic	
	Crummock Water	NY12	3	40	Oligotrophic	
	Cunswick Tarn	SD49	9	8.4	Eutrophic	
	Derwent Water	NY21	2	200	Oligotrophic	
	Derwent Water	NY22	2	400	Oligotrophic	
	Devoke Water	SD19	3	28	Oligotrophic	
	Dock Tarn	NY21	2	1.9	Oligotrophic	
	Eel Tarn	NY10	2	2	Oligotrophic	
	Elterwater	NY30	5A	25	Mesotrophic	
	Ennerdale Water	NY01	3	100	Oligotrophic	
	Ennerdale Water	NY11	3	200	Oligotrophic	
	Eskdale Green Tarn	NY10	2	3	Oligotrophic	
	Esthwaite Water	SD39	5A	195	Mesotrophic	NCR
	Flass Tarn W	NY10	2	0.5	Oligotrophic	
	Flass Tarn E	NY10	3	0.5	Oligotrophic	
	Ghyll Head Reservoir	SD39	5A	3.1	Mesotrophic	
	Grasmere	NY30	3	100	Oligotrophic	
	Greendale Tarn	NY10	3	2	Oligotrophic	
	Grisedale Tarn	NY31	3	12	Oligotrophic	
	Hagg Pond	SD39	2	0.5	Oligotrophic	
	Harnsey Tarn	NX90	8	0.25	Eutrophic	
	Harrop Tarn	NY31	2	2	Oligotrophic	
Hayeswater	NY41	3	15	Oligotrophic		

Locality	Site name	10 km square	Site type	Area (ha)	Habitat type	
	Helton Tarn	SD48	10A	4.5	Eutrophic	
	High Arnside Tarn	NY30	5A	1	Mesotrophic	
	High Crag Tarn	NY30	5A	1	Mesotrophic	
	High House Tarn	SD39	3	0.5	Oligotrophic	
	Hodson's Tarn	SD39	3	1	Oligotrophic	
	Kemp Tarn	SD49	3	0.1	Oligotrophic	
	Lambhowe Tarn	SD49	5A	1	Mesotrophic	
	Lily Pond	SD39	2	0.5	Oligotrophic	
	Lingmoor Tarn	NY30	2	0.5	Oligotrophic	
	Little Langdale Tarn	NY30	3	8.5	Oligotrophic	
	Longlands Pond	NY01	10A	3	Eutrophic	
	Loughrigg Tarn	NY30	5A	8.6	Mesotrophic	
	Mere Tarn	SD27	9	1.7	Eutrophic	
	Middle Fairbank Reservoir	SD49	5A	4.2	Mesotrophic	
	Moss Eccles Tarn	SD39	3	2	Oligotrophic	
	Overwater	NY23	5A	20	Mesotrophic	
	Priest Pot	SD39	3	1	Oligotrophic	
	Podnet Tarn	SD49	2	0.25	Oligotrophic	
	Rather Heath Tarn	SD49	5A	2.1	Mesotrophic	
	Red Tarn	NY31	3	9.8	Oligotrophic	
	Red Tarn, Wrynose	NY20	3	1.5	Oligotrophic	
	Robinson's Tarn	SD39	2	0.5	Oligotrophic	
	Rydal Water	NY30	3	50	Oligotrophic	
	Scale Tarn	SD39	2	0.6	Oligotrophic	
	School Knot Tarn	SD49	3	0.4	Oligotrophic	
	Siddick Pond	NY03	10A	10	Eutrophic	
	Skegges Water	NY40	3	4.7	Oligotrophic	
	Skelsmergh Tarn	SD59	9	0.8	Eutrophic	
	Small Water	NY40	3	3	Oligotrophic	
	Small Water	NY41	3	2	Oligotrophic	
	Sprinkling Tarn	NY20	3	2.5	Oligotrophic	
	Stickle Tarn	NY20	3	9.1	Oligotrophic	
	Styhead Tarn	NY20	3	2.2	Oligotrophic	
	Sunbiggin Tarn	NY60	10A	6	Eutrophic	NCR
	Talkin Tarn	NY55	5A	20	Mesotrophic	
	Tarn Hows	NY30	3	6	Oligotrophic	
	Tarn Hows	SD39	3	8	Oligotrophic	
	Three Dubs Tarn	SD39	3	2.5	Oligotrophic	
	Tindale Tarn	NY65	7	20	Eutrophic	
	Urnswick Tarn	SD27	10A	4.8	Eutrophic	
	Wastwater	NY10	3	290	Oligotrophic	NCR
	Whinfell Tarn	SD59	9	5.5	Eutrophic	
	Whin's Pond, Penrith	NY53	9	15	Eutrophic	
	Wise Een Tarn	SD39	3	6	Oligotrophic	
	Windermere	NY30	5A	160	Mesotrophic	
	Windermere	SD38	5A	150	Mesotrophic	
	Windermere	SD39	5A	600	Mesotrophic	
	Witherslack Fish Pond	SD48	10B	1.8	Eutrophic	
	Woodhowe Tarn	NY10	5A	1.5	Mesotrophic	
	Wraymires Tarn	SD39	5A	1.8	Mesotrophic	
Northumberland	Broomlee Lough	NY76	5A	50	Mesotrophic	
	Crag Lough	NY76	7	20	Eutrophic	
	Greenlee Lough	NY76	5A	60	Mesotrophic	
Lancashire	Hawes Water (Silverdale)	SD47	9	6	Eutrophic	NCR
Yorkshire	Hell Kettles	NZ21	10B	0.2	Eutrophic	
	Hornsea Mere	TA14	10A	230	Eutrophic	NCR
	Malham Tarn	SD86	10B	62	Eutrophic	NCR
	Ripon Pond	SE37	10A	1	Eutrophic	

Locality	Site name	10 km square	Site type	Area (ha)	Habitat type	
West Midlands Meres and Mosses	Semer Water	SD98	10A	80	Eutrophic	NCR
	Abbotts Moss	SJ56	1	2	Dystrophic	NCR
	Alkmond Park Pool	SJ41	8	4.4	Eutrophic	
	Aqualate Mere	SJ72	8	73	Eutrophic	
	Baddiley Mere East	SJ54	8	6.7	Eutrophic	
	Bar Mere	SJ54	8	9.7	Eutrophic	
	Berrington Mere	SJ50	8	2.5	Eutrophic	
	Berth Pool	SJ42	8	2.9	Eutrophic	
	Betton Pool	SJ50	9	6.4	Eutrophic	
	Birchgrove Pool	SJ42	8	1.7	Eutrophic	
	Blake Mere	SJ43	8	8.4	Eutrophic	
	Bomere	SJ40	8	6	Eutrophic	
	Bomere	SJ50	8	4	Eutrophic	
	Booth's Mere	SJ77	8	6.4	Eutrophic	
	Budworth Mere	SJ67	8	39	Eutrophic	
	Chapel Mere	SJ55	8	6.5	Eutrophic	
	Chartley Moss	SK02	1	1	Dystrophic	NCR
	Clarepool Moss	SJ43	1	0.4	Dystrophic	NCR
	Cole Mere	SJ43	8	28	Eutrophic	
	Cop Mere	SJ82	8	17	Eutrophic	
	Cröse Mere	SJ43	8	15.4	Eutrophic	NCR
	Deer Park Mere	SJ55	8	9.4	Eutrophic	
	Doddington Mere	SJ74	8	19	Eutrophic	
	Ellesmere	SJ43	8	46	Eutrophic	
	Fenemere	SJ42	8	9.4	Eutrophic	
	Hatch Mere	SJ57	8	4.7	Eutrophic	
	Hencott Pool	SJ41	8	3.5	Eutrophic	
	Kettle Mere	SJ43	8	1.7	Eutrophic	
	Maer Pool	SJ73	8	5.5	Eutrophic	
	Marbury Big Mere	SJ54	8	11	Eutrophic	
	Marbury Little Mere	SJ54	8	1.3	Eutrophic	
	Marton Pool (Baschurch)	SJ42	8	6.8	Eutrophic	
	Marton Pool (Chirbury)	SJ20	10A	14	Eutrophic	
	Melchett Mere	SJ78	10A	7	Eutrophic	
	Mere Mere	SJ78	8	16	Eutrophic	
	Newton Mere	SJ43	8	8.3	Eutrophic	
Norbury Big Mere	SJ54	8	1.6	Eutrophic		
Norbury Little Mere	SJ54	8	1.5	Eutrophic		
Oak Mere	SJ56	3	45	Oligotrophic	NCR	
Oss Mere	SJ54	8	9.5	Eutrophic		
Peckforton Mere	SJ55	8	1	Eutrophic		
Petty Pool	SJ66	8	4	Eutrophic		
Petty Pool	SJ67	8	8	Eutrophic		
Pick Mere	SJ67	8	18	Eutrophic		
Quoisley Big Mere	SJ54	8	4	Eutrophic		
Quoisley Little Mere	SJ54	8	2.2	Eutrophic		
Rostherne Mere	SJ78	8	153	Eutrophic	NCR	
Shomere	SJ50	9	1.3	Eutrophic		
Sweat Mere	SJ43	8	0.5	Eutrophic		
Tabley Mere	SJ77	8	19	Eutrophic		
Tatton Mere	SJ77	10A	16	Eutrophic		
Tatton Mere	SJ78	10A	16	Eutrophic		
White Mere	SJ43	8	26	Eutrophic		
Worcestershire	Westwood Great Pool	SO86	10A	20	Eutrophic	
	Berry Mound Sand Pit	SP07	10A	1	Eutrophic	
	Upper Bittel Reservoir	SP07	10A	40	Eutrophic	
Nottinghamshire	Pirton Pool	SO84	10A	10	Eutrophic	
	Clumber Park Lake	SK67	8	40	Eutrophic	

Locality	Site name	10 km square	Site type	Area (ha)	Habitat type	
	Newstead Abbey Park Lakes	SK55	8	5	Eutrophic	
	Newstead Abbey Park Lakes	SK55	10A&B	10	Eutrophic	
	Rainworth Lake	SK55	10A	15	Eutrophic	
Leicestershire	Blackbrook Reservoir	SK41	4	40	Mesotrophic	
Northamptonshire	Yardley Chase Ponds	SP85	10B	0.5	Eutrophic	
Lincolnshire	Deeping Gravel Pit 2	TF10	9	0.5	Eutrophic	
	Deeping Gravel Pit 1	TF10	10B	15	Eutrophic	
	Langtoft Gravel Pits	TF11	10A&B	30	Eutrophic	
	Sea Bank Clay Pits	TF57	10A	6	Eutrophic	
	Sea Bank Clay Pits	TF58	10A	1	Eutrophic	
	Swanholme Pits 7 and 8	SK96	1	0.1	Dystrophic	
	Swanholme Pits 6, 11, 12	SK96	3	4.5	Oligotrophic	
	Swanholme Pits 1, 2, 3, 5, 10	SK96	5A	7.5	Mesotrophic	
	Swanholme Pit 4	SK96	4	1.5	Mesotrophic	
	Swanholme Pit 14	SK96	9	1.5	Eutrophic	
	Swanholme Pit 9	SK96	10A	1.5	Eutrophic	
Cambridgeshire	Castor Hanglands NNR Pond	TF10	10A	0.05	Eutrophic	
	Gordon's Mere, Woodwalton Fen	TL28	10A	2	Eutrophic	
	Stibbington Gravel Pits 3 & 7	TL09	9	2	Eutrophic	
	Stibbington Gravel Pits (5 pits)	TL09	10A&B	18	Eutrophic	
Norfolk Broads	Calthorpe Broad	TG42	9	2	Eutrophic	NCR
	Hickling Broad	TG42	10	120	Eutrophic	NCR
	Horse Mere	TG42	10	32	Eutrophic	NCR
	Upton Broad	TG31	9	5	Eutrophic	NCR
Norfolk Breckland	Bagmore Pit	TL89	7	1.5	Eutrophic	
	Fowl Mere	TL88	10B	12	Eutrophic	NCR
	Home Mere	TL88	7	1	Eutrophic	
	Smokershole	TL89	7	0.5	Eutrophic	
	Thompson Water	TL99	7	10	Eutrophic	
	Warren Marsh	TL89	10A	1.3	Eutrophic	
	West Mere	TL89	7	1	Eutrophic	
	West Tofts Mere	TL89	10B	3	Eutrophic	
Kent	Stodmarsh Lakes	TR15	10B	20	Eutrophic	
	Stodmarsh Lakes	TR16	10B	50	Eutrophic	
	Stodmarsh Lakes	TR26	10B	50	Eutrophic	
Hertfordshire	Tring Reservoirs	SP91	10A	110	Eutrophic	NCR
Essex	Abberton Reservoir	TL91	10	1200	Eutrophic	NCR
Berkshire	Sandhurst Ponds	SU86	3	14	Oligotrophic	
	Wasing Wood Pond	SU56	1	0.5	Dystrophic	
	Windsor Great Meadow Pond	SU97	8	20	Eutrophic	
Oxfordshire	Wychwood Ponds	SP31	10	1.2	Eutrophic	NCR
Glos/Wiltshire	Cotswold Water Park (56 pits)	SU09	10A&B	300	Eutrophic	
	Cotswold WP (Pits 9A, 9B, 16E)	SU19	10B	3	Eutrophic	
	Cotswold Water Park (Pit 1W)	SU09	9	1	Eutrophic	
Hampshire	Aldershot Lakes	SU85	3	3	Oligotrophic	
	Fleet Pond	SU85	8	40	Eutrophic	
	Hatchet Pond	SU30	5A	15	Mesotrophic	NCR
	Old Arlesford Pond	SU53	9	10	Eutrophic	
	Warren Heath Ponds (2)	SU75	1	0.5	Dystrophic	
	Warren Heath Pond	SU75	2	0.3	Oligotrophic	
	Woolmer Ponds	SU73	1	25	Dystrophic	
Somerset	Blagdon Reservoir	ST55	10	275	Eutrophic	NCR
	Blagdon Reservoir	ST56	10	100	Eutrophic	NCR
	Chew Valley Reservoir	ST55	10	125	Eutrophic	NCR
	Chew Valley Reservoir	ST56	10	110	Eutrophic	NCR
	Priddy Pool 1	ST55	1	1	Dystrophic	
	Priddy Pool 2	ST55	10A	1	Eutrophic	
Dorset	Little Sea Mere	SZ08	5A	20	Mesotrophic	NCR

Locality	Site name	10 km square	Site type	Area (ha)	Habitat type	
Devon	Slapton Ley	SX84	9	75	Eutrophic	NCR
	Stover Lake	SX87	2	8	Oligotrophic	
Cornwall	Croft Pascoe Pool	SW71	2	1.5	Oligotrophic	
	Dozmary Pool	SX17	4	20	Mesotrophic	
	Hayle Kimbro Pool	SW61	2	4	Oligotrophic	
	Ruan Pool	SW71	2	2	Oligotrophic	

NCR = information on area and/or site type taken from *A Nature Conservation Review* (Ratcliffe 1977)

Table 2: Location, type and area of Welsh sites used in the analysis

Locality	Site name	10 km square	Site type	Area (ha)	Habitat type
North Wales	Gloyw Lyn	SH62	3	3	Oligotrophic
	Hanmer Mere	SJ43	9	17	Eutrophic
	Llyn Alwen	SH85	3	18	Oligotrophic
	Llyn Alwen	SH95	3	8	Oligotrophic
	Llyn Bedydd	SJ43	8	0.8	Eutrophic
	Llyn Conwy	SH74	2	38	Oligotrophic
	Llyn Cwellyn	SH55	3	85	Oligotrophic
	Llyn Glasfryn	SH44	9	6	Eutrophic
	Llyn Idwal	SH65	3	14	Oligotrophic
	Llyn Llagi	SH64	3	63	Oligotrophic
	Llyn Mymbyr	SH65	3	35	Oligotrophic
	Llyn Ogwen	SH66	3	37	Oligotrophic
	Llyn Tegid	SH83	3	104	Oligotrophic
	Llyn Tegid	SH93	3	310	Oligotrophic
	Llyn Coron, Anglesey	SH36	5A	6	Mesotrophic
	Llyn Coron, Anglesey	SH37	5A	20	Mesotrophic
	Llyn Dinam, Anglesey	SH37	10B	9	Eutrophic
	Llyn Llygeiran, Anglesey	SH38	5A	5	Mesotrophic
	Llyn Llygeiran, Anglesey	SH39	5A	6	Mesotrophic
	Llyn Penrhyn, Anglesey	SH37	10A	19	Eutrophic
	Llyn Rhos-Ddu, Anglesey	SH46	8	2	Eutrophic
	Llyn Traffwll, Anglesey	SH37	9	36	Eutrophic
	Llyn yr Wyth Eidion, Anglesey	SH48	9	1.2	Eutrophic
Mid Wales	Llyn Bugeilyn	SN89	2	9	Oligotrophic
	Llyn Cau	SH71	3	14	Oligotrophic
	Llyn Eiddwen	SN66	2	10	Oligotrophic
	Llyn Fanod	SN66	3	5	Oligotrophic
	Llyn Glanmerin	SN79	3	3	Oligotrophic
	Llyn Gynon	SN76	3	13	Oligotrophic
	Llyn Gynon	SN86	3	12	Oligotrophic
	Llyn Hir	SN76	3	5	Oligotrophic
	Llyn West Ieuan	SN78	3	4	Oligotrophic
	Maes-Llyn	SN66	4	3	Mesotrophic
South Wales	Bosherston Lake	SR99	10A	23	Eutrophic
	Bosherston Lake	SR99	10B	10	Eutrophic
	Broad Pool	SS59	3	1	Oligotrophic
	Kenfig Pool	SS78	10A	23	Eutrophic
	Llanbwchllyn	SO14	5A	10	Mesotrophic
	Llyn Fach	SN93	2	3	Oligotrophic
	Llyn y Fan Fawr	SN82	3	17	Oligotrophic
	Llyn Llech Owain	SN51	2	6	Oligotrophic
	Llyn Syfaddan (Llangorse Lake)	SO12	10A	120	Eutrophic
	Lower Talley Lake	SN63	5A	10	Mesotrophic
	Upper Talley Lake	SN63	9	5	Eutrophic

Table 3: Location, type and area of Scottish sites used in the analysis, in addition to sites in the Scottish Natural Heritage lochs database

Site name	10 km square	Site type	Area (ha) (approx)	Habitat type	Source of information
Loch Druidibeg, S. Uist	NF73	2	260	Oligotrophic	NCC/NCR
Loch Druidibeg, S. Uist	NF83	2	60	Oligotrophic	NCC/NCR
Loch nam Bam, Argyll	NM81	2	2	Oligotrophic	NCC
Loch an Losgairn Mor, Argyll	NM81	2	10	Oligotrophic	NCC
Loch a Clachain, Argyll	NM81	2	2	Oligotrophic	NCC
Loch an Daihm, Argyll	NM81	2	10	Oligotrophic	NCC
Loch Chon, Trossachs	NN40	2	150	Oligotrophic	NCC
Loch Dhu, Trossachs	NN40	2	10	Oligotrophic	NCC
Loch Lairig Cheile, Trossachs	NN52	2	15	Oligotrophic	NCC
Loch Leathann, Islay	NR46	2	10	Oligotrophic	NCC
Loch Skerrow, Kirkcudbrightshire	NX66	2	40	Oligotrophic	NCC
Loch Laidon, Perthshire/Argyll	NN35	2	350	Oligotrophic	NCR
Loch Laidon, Perthshire/Argyll	NN45	2	110	Oligotrophic	NCR
Loch Sionascaig, Ross	NC11	3	620	Oligotrophic	NCR
Loch Morar, Inverness	NM69	3	350	Oligotrophic	NCR
Loch Morar, Inverness	NM78	3	350	Oligotrophic	NCR
Loch Morar, Inverness	NM79	3	1750	Oligotrophic	NCR
Loch Morar, Inverness	NM88	3	200	Oligotrophic	NCR
Loch Morar, Inverness	NM89	3	700	Oligotrophic	NCR
Loch Ard, Trossachs	NN40	3	175	Oligotrophic	NCC
Loch Doine, Trossachs	NN41	3	70	Oligotrophic	NCC
Loch Dochart, Trossachs	NN42	3	30	Oligotrophic	NCC
Loch Iubhair, Trossachs	NN42	3	100	Oligotrophic	NCC
Loch Voil, Trossachs	NN41	3	110	Oligotrophic	NCC
Loch Voil, Trossachs	NN51	3	25	Oligotrophic	NCC
Loch Voil, Trossachs	NN52	3	100	Oligotrophic	NCC
Loch Ellrig, Stirling	NS87	3	10	Oligotrophic	NCC
Loch Lomond	NN30	3	1350	Oligotrophic	NCR
Loch Lomond	NN31	3	450	Oligotrophic	NCR
Loch Lomond	NS38	3	900	Oligotrophic	NCR
Loch Lomond	NS39	3	2700	Oligotrophic	NCR
Loch Lomond	NS49	3	250	Oligotrophic	NCR
Loch Ochiltree, Wigtownshire	NX37	3	50	Oligotrophic	NCC
Loch of Lowes, Perthshire	NO04	4	55	Mesotrophic	NCC
Crooked Loch, Dumfries	NT31	4	10	Mesotrophic	NCC
Loch Mahaik, Trossachs	NN70	5A	10	Mesotrophic	NCC
Loch Butterstone, Perthshire	NO04	5A	40	Mesotrophic	NCC
Loch Lomond	NS38	5A	900	Mesotrophic	NCR
Loch Lomond	NS49	5A	100	Mesotrophic	NCR
Loch Lomond	NS48	5A	450	Mesotrophic	NCR
Shaws Upper Loch, Dumfries	NT31	5A	5	Mesotrophic	NCC
Mill Loch, Dumfries	NY08	5A	12	Mesotrophic	NCC/NCR
Loch Obisary, N. Uist	NF85	6	10	Brackish	NCC
Loch Obisary, N. Uist	NF86	6	120	Brackish	NCC
Loch Obisary, N. Uist	NF96	6	60	Brackish	NCC
Loch an Duin, N. Uist	NF87	6	245	Brackish	NCC/NCR
Loch of Stenness, Orkney	HY21	6	420	Brackish	NCC/NCR
Loch of Stenness, Orkney	HY31	6	80	Brackish	NCC/NCR
Loch Kilcheron, Lismore, Argyll	NM83	7	15	Eutrophic	NCC
Loch of Harray, Orkney	HY21	7	475	Eutrophic	NCC/NCR
Loch of Harray, Orkney	HY31	7	125	Eutrophic	NCC/NCR
Rescobie Loch, Angus	NO55	8	165	Eutrophic	NCC/NCR
White Loch of Myrton, Wigtownshire	NX34	8	15	Eutrophic	NCC
White Loch, Wigtownshire	NX16	8	60	Eutrophic	NCC/NCR

Site name	10 km square	Site type	Area (ha) (approx)	Habitat type	Source of information
Glentoo Loch, Kirkcubrightshire	NX76	9	20	Eutrophic	NCC
Erncrogo Loch, Kirkcubrightshire	NX76	9	20	Eutrophic	NCC
Upper Loch, Dumphries	NY08	9	2	Eutrophic	NCC
Lindores Loch, Fife	NO21	10A	40	Eutrophic	NCC
Shaws Under Loch, Dumfries	NT31	10A	20	Eutrophic	NCC
Whitmuir Loch, Dumfries	NT42	10A	2	Eutrophic	NCC
Whitmuir Loch, Dumfries	NT52	10A	1	Eutrophic	NCC
Kirk Loch, Dumphries	NY08	10A	10	Eutrophic	NCC
Loch Balgavies, Angus	NO55	10B	50	Eutrophic	NCC/NCR

Sources of information:

NCC = Nature Conservancy Council data

NCR = *A Nature Conservation Review* (Ratcliffe 1977)

Table 4: DOME codes, Trophic Ranking Scores (TRS) and Species Trophic Rank (STR) for plant taxa used in this analysis

Species	DOME code	TRS	STR
Submerged and floating plants			
<i>Potamogeton polygonifolius</i>	dO	3.0	10
<i>Sparganium angustifolium</i>	dO	3.0	-
<i>Subularia aquatica</i>	O	4.0	-
<i>Utricularia minor</i> agg.	O	4.0	-
<i>Eleogitons fluitans</i>	dOm	4.0	10
<i>Utricularia intermedia</i>	DOM	4.0	-
<i>Callitriche hamulata</i>	Om	5.0	9
<i>Isoetes lacustris</i>	Om	5.0	-
<i>Lobelia dortmanna</i>	Om	5.0	-
<i>Myriophyllum alterniflorum</i>	OM	5.5	8
<i>Nitella</i> spp.	OM	5.5	-
<i>Potamogeton alpinus</i>	OM	5.5	7
<i>Sparganium natans</i>	OM	5.5	-
<i>Utricularia vulgaris</i> agg.	OM	5.5	-
<i>Elatine hexandra</i>	oM	6.0	-
<i>Nuphar pumila</i>	oM	6.0	-
<i>Fontinalis antipyretica</i>	Ome	6.3	5
<i>Glyceria fluitans</i>	Ome	6.3	-
<i>Littorella uniflora</i>	OMe	6.7	8
<i>Nymphaea alba</i>	OMe	6.7	6
<i>Potamogeton natans</i>	OMe	6.7	5
<i>Apium inundatum</i>	OME	7.0	9
<i>Potamogeton berchtoldii</i>	oME	7.3	4
<i>Potamogeton gramineus</i>	oME	7.3	7
<i>Potamogeton obtusifolius</i>	oME	7.3	5
<i>Potamogeton perfoliatus</i>	oME	7.3	4
<i>Potamogeton praelongus</i>	oME	7.3	6
<i>Callitriche stagnalis</i>	omE	7.7	-
<i>Hippuris vulgaris</i>	omE	7.7	4
<i>Callitriche hermaphroditica</i>	ME	8.5	-
<i>Callitriche obtusangula</i>	ME	8.5	5
<i>Chara</i> spp.	ME	8.5	-
<i>Eleocharis acicularis</i>	ME	8.5	-
<i>Elodea canadensis</i>	ME	8.5	5
<i>Nuphar lutea</i>	ME	8.5	3
<i>Potamogeton crispus</i>	ME	8.5	3
<i>Potamogeton pusillus</i>	ME	8.5	4
<i>Ranunculus aquatilis</i>	ME	8.5	5
<i>Ranunculus hederaceus</i>	ME	8.5	6
<i>Ranunculus peltatus</i>	ME	8.5	4
<i>Ranunculus trichophyllus</i>	ME	8.5	6
<i>Lemna minor</i>	mE	9.0	4
<i>Persicaria amphibia</i>	mE	9.0	4
<i>Ceratophyllum demersum</i>	E	10.0	2
<i>Elodea nuttallii</i>	E	10.0	3
<i>Lemna trisulca</i>	E	10.0	4
<i>Myriophyllum spicatum</i>	E	10.0	3
<i>Oenanthe aquatica</i>	E	10.0	-
<i>Potamogeton filiformis</i>	E	10.0	-
<i>Potamogeton friesii</i>	E	10.0	3
<i>Potamogeton lucens</i>	E	10.0	3
<i>Potamogeton pectinatus</i>	E	10.0	1
<i>Potamogeton trichoides</i>	E	10.0	2

Species	DOME code	TRS	STR
<i>Ranunculus baudotii</i>	E	10.0	-
<i>Ranunculus circinatus</i>	E	10.0	4
<i>Sparganium emersum</i>	E	10.0	3
<i>Zannicellia palustris</i>	E	10.0	2
Emergent plants			
<i>Baldellia ranunculoides</i>	O	4.0	-
<i>Carex limosa</i>	O	4.0	-
<i>Lythrum portula</i>	O	4.0	-
<i>Carex rostrata</i>	dOM	4.3	7
<i>Menyanthes trifoliata</i>	DOMe	5.3	9
<i>Ranunculus flammula</i>	dOMe	5.3	7
<i>Potentilla palustris</i>	dOMe	5.5	-
<i>Carex aquatilis</i>	OM	5.5	-
<i>Carex lasiocarpa</i>	OM	5.5	-
<i>Equisetum fluviatile</i>	OME	7.0	5
<i>Carex vesicaria</i>	oME	7.3	6
<i>Eleocharis palustris</i>	oME	7.3	6
<i>Phragmites australis</i>	oME	7.3	4
<i>Schoenoplectus lacustris</i>	oME	7.3	3
<i>Oenanthe crocata</i>	o(?m)E	7.5	7
<i>Alisma plantago-aquatica</i>	ME	8.5	3
<i>Carex elata</i>	ME	8.5	-
<i>Cicuta virosa</i>	ME	8.5	-
<i>Cladium mariscus</i>	ME	8.5	-
<i>Phalaris arundinacea</i>	ME	8.5	-
<i>Sparganium erectum</i>	ME	8.5	3
<i>Typha latifolia</i>	ME	8.5	2
<i>Iris pseudacorus</i>	mE	9.0	5
<i>Myosotis scorpioides</i>	mE	9.0	-
<i>Apium nodiflorum</i>	E	10.0	4
<i>Berula erecta</i>	E	10.0	5
<i>Butomus umbellatus</i>	E	10.0	5
<i>Carex acuta</i>	E	10.0	5
<i>Carex acutiformis</i>	E	10.0	3
<i>Carex paniculata</i>	E	10.0	-
<i>Carex pseudocyperus</i>	E	10.0	-
<i>Carex riparia</i>	E	10.0	4
<i>Glyceria maxima</i>	E	10.0	3
<i>Rorippa nasturium agg</i>	E	10.0	-
<i>Rumex hydrolapathum</i>	E	10.0	3
<i>Schoenoplectus tabernaemontani</i>	E	10.0	-
<i>Typha angustifolia</i>	E	10.0	2
<i>Veronica anagallis-aquatica</i>	E	10.0	4
<i>Veronica beccabunga</i>	E	10.0	-

Table 5: Calculation of the area of standing freshwater habitats in England, Scotland, Wales and Great Britain

Step a

Total area (to the nearest ha) of standing water – adjusted OS figures within TRS bands

	TRS band					No TRS data	Total
	3-5	5-6	6-7	7-8	8+		
England	0	0	3442	14,771	49,113	31	67,357
Scotland	3173	58,215	66,149	29,108	1931	1839	160,415
Wales	0	443	3443	6234	2310	13	12,443
Great Britain	3173	58,658	73,034	50,113	53,354	1883	240,215

Step b

Area (ha) of dystrophic, oligotrophic, mesotrophic and eutrophic water identified from the survey sample, within TRS bands in Britain

	TRS band					No TRS data	Total
	3-5	5-6	6-7	7-8	8+		
Dystrophic	1	191	243	42	6	1	484
Oligotrophic	613	22,294	36,952	6256	72	37	66,224
Mesotrophic	170	1048	3173	6074	68	<1	10,534
Eutrophic	1	430	492	4727	4650	4	10,304
Total	785	23,963	40,860	17,099	4796	43	87,546

Step c

Percentage areas in Britain of the freshwater habitat types in the survey data, within TRS bands

	TRS band					No TRS data
	3-5	5-6	6-7	7-8	8+	
Dystrophic	0.14%	0.80%	0.60%	0.25%	0.11%	3.38%
Oligotrophic	78.05%	93.04%	90.43%	36.59%	1.50%	85.43%
Mesotrophic	21.65%	4.37%	7.77%	35.52%	1.42%	0.93%
Eutrophic	0.17%	1.80%	1.20%	27.64%	96.96%	10.26%

Step d

Predicted area (to the nearest ha) of habitat types in England, Scotland and Wales, within TRS bands

	TRS band					No TRS data
	3-5	5-6	6-7	7-8	8+	
England						
Dystrophic	0	0	21	37	56	1
Oligotrophic	0	0	3113	5405	736	27
Mesotrophic	0	0	267	5247	697	<1
Eutrophic	0	0	41	4083	47,624	3
Scotland						
Dystrophic	4	465	394	73	2	62
Oligotrophic	2476	54,160	59,822	10,651	29	1571
Mesotrophic	687	2545	5137	10,339	27	17
Eutrophic	5	1045	797	8045	1872	189
Wales						
Dystrophic	0	4	21	16	3	<1
Oligotrophic	0	412	3114	2281	35	11
Mesotrophic	0	19	267	2214	33	<1
Eutrophic	0	8	41	1723	2240	1

Step e

Estimated total area and percentage of each freshwater habitat type in England, Scotland, Wales and Great Britain

	Dystrophic		Oligotrophic		Eutrophic		Mesotrophic	
	ha	%	ha	%	ha	%	ha	%
England	115	0.2	9281	14	6211	9	51,751	77
Scotland	1000	0.6	128,709	80	18,752	12	11,953	7
Wales	44	0.4	5853	47	2533	20	4013	32
Great Britain	1159	0.5	143,843	60	27,496	11	67,717	28