Chapter 6 Summary of fish impacts with particular reference to central England and management recommendations

General

Table 6 summarises features of the fish discussed in Chapter 5 in terms of their origin, breeding, feeding, potential for bottom and macrophyte disturbance and likelihood of association with intrusive angling practices (heavy ground-baiting, intensive approaches likely to lead to local habitat disturbance). The features are scored in a manner which accords high scores to features likely to lead to maintenance of clear water, high macrophyte diversity and biomass and low phytoplankton biomass, particiularly in shallow lakes. Summing of the scores thus gives a ranking of desirability of a particular fish species in this respect.

The ranking, from least to most desirable, is: Common carp, bream, tench, roach, crucian carp, rudd, perch, dace, pike, eel, (rainbow trout), and brown trout.
In general management terms, introduction of those with the most negative scores should be avoided and common carp, the introduced fish at this end of the ranking, should be removed if possible or allowed to die out without further introductions in SSSI sites. Bream, tench and roach should not be introduced if they are not already present. They are native fish and usually coexist with macrophytes unless switching factors have caused the replacement of macrophyte-dominated communities with phytoplankton at moderate nutrient levels. On the other hand they are also, particularly in the case of bream and roach, fish that are readily able to take advantage of the switch and help stabilise the dominance of phytoplankton. At the other end of the league, predators such as eel, brown trout and pike should never be removed from SSSI sites. They are crucial for the control of zooplanktivores and, in the case of pike, if it has been removed already, should be restocked. Eels will naturally recolonise a site from which they have been removed and can probably sustain a moderate commercial fishery as a result. The case of rainbow trout is difficult as it is not a native British fish. However it does not usually breed and appears to do little damage.

Such a league table is of potential use in the management of SSSI sites as it provides a general rule of thumb. It is, however, a potentially problematic tool for it runs almost diametrically counter to the perception of need by anglers and of the philosophy of fisheries management in general. Elements of this philosophy inform the National Rivers Authority Fisheries Strategy (1993).

Table 6. Summary of the characteristics of the most common fish species in the West Midland meres in respect of their compatibility with conservation objectives in SSSI sites, particularly shallow ones designated for the richness of their macrophyte communities. Br, Bream; Cp, Common carp; Cr, Crucian carp; Dc, dace; El, Eel; Rc, Roach; Rd, Rudd; Pc, Perch; Pk, Pike; Tn, Tench; Bt, Brown trout; Rt, Rainbow trout.

	Br	Cp	Cr	Dc	El	Rc	Rd	Pc	Pk	Tn	Bt	Rt
Native/Introduced	N	I	(N)[1]	(N)[1]	N	N	N	N	N	N	N	I
Breeds prolifically	+	-	±	+	++	++	++	++	++	+	+	-
Disturbs bottom	++	++	+	-	-	-	-	-	-	++	-	-
Pelagial zoopl'vre[3]	++	+	±	-	-	++	+	++	-	-	-	-
Weed-bed zoopl'vre[3]	-	-	-	+	-	-	-	+	+	-	-	-
Piscivorous[3]	-	-	-	-	+	-	-	+	++	-	+	+
Intrusive angling	++	++	-	-	-	-	-	-	-	+	-	-
Usually abundant	+	++	±	±	++	++	+	++	++	+	±	±
Destroys plants	-	++	±	-	-	?+	-	-	-	?+[2]	-	-
Total score*	-7	-23	-2	+20	+28	-3	+1	+5	+25	-4	+33	+28

1. Introduced from southern England 2. Because of predation on epiphyte eating snails
3. Post-larval

* Scoring system: N = 5, (N) = 0, I = -5; for breeding, - = 5, ± = 3, + = 0, ++ = -5; for bottom disturbance, ++ = -5, + = 0, - = 5; for zooplanktivory, - = 5, ± = -1, + = -3, ++ = -5; for piscivory, ++ = 5, + = 3, - = -5; for angling intrusion, - = 5, + = -3, ++ = -5; for abundance, ± = 0, + = -3, ++ = -5; for plant destruction, - = 5, ± = -1,+ = -3, ++ = -5.

The requirements of anglers are usually for lots of large, hungry fish, which preferably resist capture by fighting. The first three requirements are mutually incompatible but their provision is the underlying theme of traditional fisheries management, which is essentially an 'agricultural' activity. The fourth requirement is expressed in the recent widespread interest in carp fishing in the lowlands as a parallel to the perhaps unattainably expensive salmonid fishing of the uplands. It may also reflect wider sociological trends. Fisheries managers operate on the assumption that maximum production and high biomass densities of fish must be a good thing and on the assumption that bottom -up processes control the status of aquatic systems.

The concept that top-down processes are important is not widely understood, perhaps because the traditional conditioning given by an emphasis on salmonid fisheries and on large deep lakes and rivers rightly emphasises bottom-up control in such habitats. Thus, reflecting these traditions, the National Rivers Authority Fisheries Strategy takes its cue from its duty under the 1991 Water Resources Act to maintain, improve and develop salmon, trout, freshwater fish and eel fisheries under its jurisdiction. The strategy contains implicit assumptions of bottom up control in a tacit support for restocking programmes for mitigation, restoration and enhancement and in policies for the deployment of development funds. ' Market research into the expectations of potential users will also be considered'. The NRA is encouraged by government policies to see the angling community as its customers and is rightly anxious to meet their needs as far as it can. The long list of stockings (Table 5), albeit many of these are not officially recorded in writing but were probably verbally approved, is evidence of this. For all of these stockings were made in the absence of information on the habitats or existing fish stocks and communities - the NRA files are singularly lacking in fish surveys from the meres.

At present, where fish are concerned, the NRA may not see the conservation movement as an equivalent but separate customer, there being perhaps another tacit assumption that the more fish there are, the greater the quality of the habitat so that both angling and conservation needs are served by the same strategy. Where shallow lakes are concerned, this is not necessarily true and it is such habitats in which the greatest angling pressure is concentrated in England.

All of this is not a matter of particular castigation but a statement of the historic development of freshwater science in twin fundamental and fisheries directions. It is a situation paralleled by the similar bifurcation between conservation management and fundamental ecology on the one hand and agricultural management of the land on the other. There are positive indicators in annealing this rift, however. The NRA Fisheries Strategy indeed hints at a marrying of the two directions for, despite the emphases imposed by the Water Resources Act, there are indications in it of considerable caution about the efficacies of restocking and the need to monitor their effects, and about the introduction of non-native species or strains of fish - albeit with an emphasis on threats to native fish populations rather than habitats. (There is, however, no explicit recognition of common carp as an introduced species). There is also considerable concern for habitat restoration and no indication of support for the removal of predators such as pike, which has been a popular demand of angling clubs in the past. What is perhaps simply needed is for better liason between English Nature and the NRA so as to agree a common policy of fisheries management in SSSI sites vis a vis those managed primarily for anglers.

In evolving such an agreed policy it must be admitted that the data available are yet largely inadequate and frequently anecdotal. What, for instance is a biomass of carp that is compatible with aquatic plant communities? Carp are native members of mainland European fish communities where such coexistence is sustained. To what extent are the effects of common carp made worse by the presence of bream - or roach plus bream? Do tench complicate the issue and at what biomass? The uncertainties are endless and unlikely to be resolved without large scale experimentation on a properly replicated pond scale. The lack of simple population and biomass data for the meres in the files of the statutory bodies also partly reflects the difficuties of obtaining such data. Fish populations are notoriously difficult to sample on any absolute basis. There is also the problem that because of the influence of weather, reflected in water temperature, on recruitment, stocks of coarse fish naturally vary greatly from time to time. Lack of understanding of this underlies many of the demands made by angling clubs for restocking. However, at present, it is not easy to specify what the natural range of biomass of a given species in a given lake would be. The disturbances due to past restocking and introductions also complicate the issue. It is indeed not yet possible to specify precisely what the 'natural' fish community of any lowland lake in England was and, unless the techniques of molecular biology can be used on fossil DNA preserved in the sediments, it may never be possible to be sure.

Specific management of the Meres

Anglers' perceptions are that most of the meres have low fish densities, & irregular recruitment but with some fish (largely bream, carp and tench) reaching near record-breaking size. Four meres are believed to have a moderate overall fish density (Aqualate, Betley, Bomere, and Marton Pool SSSI), whilst one mere has a high density (Fenemere). The meres have been stocked, but on an irregular basis and with relatively small numbers of fish. It is likely that only the introduction of carp has altered the fish community to any extent. There is information about the stocking of six meres with carp (Aqualate, Betley, Fenemere, Hatchmere, Berth Pool and Marton Pool nr Baschurch). Only three of the meres (Copmere, Shomere and Ellesmere), for which information is available, do not contain carp. As these fish are not indigenous to the area, this suggests widespread undocumented stocking. Carp are thought not to be able to breed successfully to recruitment in this country and so stock density will be determined by number of introductions and mortality. Carp are thought to occur in high numbers in only two meres (Betley and Fenemere) and with time, if no supplementary introductions take place, these will die out. The limited extent of stocking of other fish species probably means that the fish communities are reasonably similar to those that would be present in the absence of any human influence. We suggest that it would be prudent, however, to discourage any further stocking of any fish in SSSI sites until English Nature in collaboration with the NRA have developed guidelines in the conservation interest.

Cultural eutrophication has occurred for some of the meres and poses a threat to macrophyte diversity. For Betley Mere and Fenemere, the alleged presence of a large number of carp has probably exacerbated the situation though the substantial macrophyte coverage of Betley Mere may suggest that carp are not so abundant as perceived. No further carp should be allowed into these (or any other) meres. In some circumstances, a low number of large carp probably poses little threat to macrophyte diversity and may even help suppress the most vigorous growing plant species. The problem at present is in specifying these circumstances. For many shallow, meres, the magnitude of zooplanktivory may be high and its effects exacerbated by the presence of carp. Due to enrichment of the meres by changes in land-use, the impact of even a normal level of zooplanktivory now may be crucial in determining the outcome of competition between phytoplankton and zooplankton.

Meres that are important for macrophytes may nonetheless be utilised as fisheries. Problems arise when anglers fish the meres and find a low biomass of fish. Whether this is natural or not, anglers tend to think that if they introduce some fish, they will be able to catch more and hence, often vigorously (and maybe illegally) pursue the art of 'improving' their fishery. Education is the key to this dilemma and should be furthered perhaps by

English Nature personnel addressing meetings of angling clubs, in tandem with NRA fishery officers.

Proposed stockings of the fish community to improve its angling value should be viewed with caution, and only allowed where massive fish death has occurred due to an acute incident such as a pollution induced fish kill. Introductions to increase stock size, and hence angler success, should not be allowed on the basis that introductions may pose a threat to nature conservation value and in any case will give only temporary effects. In some cases, English Nature might consider obtaining a management agreement with the landowner not to allow fishing. Removal of fish is recommended only for carp, though this may not be feasible due to the large person-power needed. With time, and no further introductions, the carp populations should die out.

If it is desired to restore the macrophyte community to meres which have lost it (e.g. Petty Pool, Fenemere) biomanipulation, (including temporary complete fish removal), perhaps with the provision of zooplankton refuges, will be necessary, though the techniques are not yet completely developed and would benefit from more research. There is clearly an urgent need to collect reliable quantitative data on the fish communities, biomass and recruitment in the meres. Chapter 7 suggests a strategy for this.

In summary, the urgent needs of English Nature in management of the SSSI meres with respect to fish are:

(i) Development of a joint understanding and policy with the NRA fishery sections with respect to habitat conservation in shallow meres;

(ii) Proactive education of angling clubs;

(iii) Establishment of quantitative absolute data on the fish communities of the meres.

Chapter 7 A Strategy for Establishment of the Biomass and Population Structure of Fish Communities in the Meres

This report has had to be based on subjective fish community data which make the formulation of specific guidelines difficult. Quantification of fish community composition and density would vastly increase the usefulness of already obtained data on water chemistry, phytoplankton, zooplankton and macrophytes. It is recommended that for those meres for which supplementary information is already held, (English Nature Research Contract F72-06-14), the amount and type of fish present should be identified fully as this would enable better evaluation of fish effects and would represent a large step towards the generation of guidelines for managing fish communities and angling practices in lakes that possess SSSI status.

Sampling of large and deep waterbodies and also shallow and weedy ones poses inherent problems for fishery scientists. The larger the waterbody, the more effort required and as depth increases, different techniques may have to be employed. However,even this assumes a homogenous distribution of fish with regard to depth and distance from the shore. This is usually not the case as roach, perch, tench and pike generally inhabit the littoral (Gliwicz and Warsaw 1992; Hammer 1985; Bohl 1980; Gee 1978 and Guma'a 1978) though they may make diurnal and seasonal movements between different parts of a lake.

To sample these fish, primarily the littoral zone needs to be netted. However, some fish occur in the pelagial (Persson 1983b, 1987b and Johansson, 1987) and these would have to be estimated by seine netting the open water over two days, with fish being marked on day one and an estimate made from the proportion of caught fish that were marked in the second day's catches. When fish are caught, they may take several days to recover and during this period, they are not as catchable. To allow catchability of fish to return to normal, the two nettings would need to be about one week apart. It is assumed that in summer in the deep meres which stratify few fish would be present in the sub-littoral zone. The use of gillnets or fyke nets (these passively trap the fish and, unlike gill netting, incur no extra mortality on fish) would test this assumption. Mesh sizes would be in the range of 3 to 12mm. The small number of fish that are entrapped in the gill nets would be used fully and information on age and growth as well as gut contents would be obtained. All sampling would need to be on a standard basis to give biomass per unit area.

An appreciation of fish movement between the littoral and pelagial would be useful in determining habitat utilisation. To gain an idea of migration between the littoral and pelagic habitats, fish caught by seine netting in the littoral would be marked in a different way to those caught in the pelagic. Overnight, gill nets would be laid in each area. The distribution of marked fish caught in subsequent nettings would allow useful interpretation of fish movements to be made. A comparison of number and types of captured fish between the intensively fished littoral and the lightly fished pelagic would enable an estimation for the whole lake to be made. Large meres would have to be sub sampled and the results from small areas extrapolated to estimate total fish stock density. To estimate the larger, more valuable, fish such as large bream, carp and tench, angler catches would have to be assessed.

It is envisaged that 24 meres be surveyed, which, at two to three days per mere would require twelve weeks. Prior to this, netting licences would need to be obtained from the NRA, as well as permission from landowners and English Nature. The relevant fishing clubs should be consulted, because although they technically could not prohibit netting, it would be useful to have their cooperation. This preparatory stage would take 4 weeks. After 12 weeks of field work, the production of a final report would require a further 6 weeks. The total time needed would be 5 months. Total manpower would be one full-time person for 5 months and up to three people to aid in the field work on a casual basis for a period of 12 weeks. Costs would probably be in the region of £10000 to £15000.

Netting efficiency is hindered by large amounts of macrophytes and the best time to carry out a fish survey would be just prior to the main period of plant growth. Unfortunately, this coincides with spawning times for many fish and netting would not only exacerbate post-spawning mortality, but also affect survival of underyearling fish. Sampling fish populations in the winter months is notoriously difficult as fish tend to aggregate in deep inaccessible areas, that are often difficult to locate. As a compromise, the optimum sampling time would be late July to September or early October. The starting date for this project should be early June.

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