STRATFORD-ON-AVON LOCAL PLAN INQUIRY

THE HIGHER AVON
(UPPER AVON PHASE II)
(AVON EXTENSION)

PROOF OF EVIDENCE OF
DR D N F HALL

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ACRONYMS

BTO	British Trust for Ornithology
BW/BWB	British Waterways/British Waterways Board
HMOCS	Her Majesty's Overseas Civil Service
IUCN	International Union for the Conservation of Nature and Natural Resources
LANT	Lower Avon Navigation Trust
NCC	Nature Conservancy Council
NRA	National Rivers Authority
ODA	The Overseas Development Administration of the Foreign and Commonwealth Office
SSSI	Site of Special Scientific Interest
STWA	Severn-Trent Water Authority
UANT	Upper Avon Navigation Trust
WARNACT	Warwickshire Nature Conservation Trust
WDC	Warwick District Council

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THE HIGHER AVON
(UPPER AVON PHASE II)

PROOF OF EVIDENCE OF:

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Qualifications B.Sc. D.Sc. D.Univ. C.Biol. F.I.Biol.

1943-44 Bradford Technical College: Engineering Cadetship Diploma.
1947-51 Nottingham University: B.Sc (2/i) Honours in Zoology.
1964 Nottingham University: Awarded D.Sc for marine studies.
1974 Elected Fellow of the Institute of Biology (F.I.Biol).
1983 Awarded Honorary Doctorate (D.Univ) of the University of Stirling "in recognition of services to science and assistance to the University in the establishment of the Institute of Aquaculture".
1983 Awarded Honorary Fellowship of Humberside College of Higher Education (now University of Humberside) "in recognition of his distinguished contribution to the work of the College and to international developments in the field of fisheries management and technology".

Military Service 1944-47 Royal Engineers. Service in India. Demobilised with the rank of Captain (OC 319 Well Boring Platoon RPE).

HMOCS 1951-53 Post graduate studies at British marine laboratories.
1953 Barbados. Research on the flying-fish fishery (*Hirundichthys affinis*).
1953-57 Scientific Officer with the Singapore Regional Fisheries Research Station, studying the Penaeidae (shrimps/prawns) of the region and participating in a survey of the marine fisheries potential of Malayasia.
1957-59 Working up penaeid material at the MBA Laboratory, Plymouth.
1959-64 Director, East African Marine Fisheries Research Organization, Zanzibar.
1963 Appointed Subject Leader for the Fisheries Aspects of the International Indian Ocean Expedition. Visited most of the countries surrounding the Indian Ocean in order that those nations and others fishing in the Indian Ocean might obtain the greatest possible benefit from the Expedition.
Left Zanzibar at the end of 1964 following the revolution there earlier that year.

Civil Service 1965-83 Fisheries Adviser and from 1972 Principal Fisheries Adviser, Overseas Development Administration (ODA), London, providing technical and professional advice to the British Government on all matters pertaining to the operation of the British Aid Programme in the field of fisheries including representing the United Kingdom at international and other meetings. This work, the object of which was to utilise the renewable aquatic resources of developing countries to provide the greatest social and economic benefits to their populations, required extensive travel worldwide.
Left ODA on retirement, 25 November l983.

Post-ODA Consultancy appointments on behalf of the Falkland Islands Government (in UK) and ODA (in Bangladesh and Sri Lanka), and on behalf of the Upper Avon Navigation Trust.

On a personal note, since 1984 I have lived in a cottage beside the Upper Avon. I have served on the Council of the Upper Avon Navigation Trust (UANT) and I am currently the Chairman of the Lower Avon Navigation Trust (LANT).

SUMMARY

The Navigable Avon

a. The River Avon was first made navigable, from Tewkesbury to within about four miles of Warwick, in the mid-17th Century but the profits from commercial use failed to meet maintenance costs. The navigation was split into Lower (Tewkesbury to Evesham) and Upper sections in 1717 but this did not provide a solution. The Upper Avon navigation fell into decay after about 1856: the Lower Avon navigation became unnavigable above Pershore during the Second World War. Both navigations were rescued by Charitable Trusts set up for the purpose. The Lower Avon Navigation Trust (LANT) restored navigation to the lower section between 1950 and 1962: navigation on the upper section, from Evesham to and beyond Stratford-upon-Avon, was restored by the Upper Avon Navigation Trust (UANT) between 1969 and 1974, but for reasons beyond the control of UANT the weir levels had to be set mostly well below the original levels. The navigable Avon now provides 46 miles of environmentally beautiful, highly popular recreational waterway from its confluence with the River Severn to Alveston weir (about three miles upstream of Stratford). Both Trusts depend on recreational boating for the major part of their incomes, from boats based on the Avon and from those entering from adjacent waterways.

b. The busiest lock on the continuously navigable river is at Strensham on the Lower Avon. During the busiest recent season (1990) Strensham lock recorded 9,638 boat movements during 2,030 hours, an average of one boat movement every $12^{1}/_{2}$ minutes. These boat movements comprised boats making through passages together with a much larger number of local boats on short excursions. On the Upper Avon it is assumed that there may be up to 7,000 boat movements/year. Research on the effect of boat movements on canal wildlife indicates that this level of activity would be beneficial if the Avon were a canal having a relatively static body of water. However, the Avon is a self-scouring river on which the wildlife is subjected naturally and continually to conditions more demanding than those of a canal, such as the water flow and silt-laden floods. In consequence, it is recognised that it is not possible to predict the effect of boating activity in a river environment from research undertaken on canals.

c. Every accusation of environmental harm alleged to have been caused by navigation on the River Avon (bank erosion, the destruction of marginal aquatic vegetation, the swamping of birds' nests and bank-side breeding holes, pollution through the emission of oil, petrol, dirty cooling water, exhaust gases and waste water, stirring up silt, basic disturbance to the wildlife, the need for extensive reinforced river banks, indiscriminate mooring, locks and weirs which spoil the environment) is examined and is shown to be fundamentally without foundation. The continuously navigated Avon has water of very high quality, a wide variety of ecological habitats, varied and extensive aquatic and bank-side vegetation, a delightful bird fauna, and very substantial stocks of fish making it highly popular with anglers (the World Fishing Championships were held on the Upper Avon in 1981 at the height of the boating season).

The Higher Avon

d. The Higher Avon scheme (Upper Avon Phase II) is a simple scheme which extends well beyond the Stratford local planning area. It is aimed at linking the currently continuously navigable Lower and Upper Avon navigations and the intermittently navigable Higher Avon with the Grand Union canal. 83% of the distance from Alveston weir to the confluence of the Avon with the River Leam, that is 9.99 miles of the 12.04 miles, are already fully navigable, consisting of wide, deep reaches retained behind four man-made weirs. All that is needed to enable through navigation of this length are four locks built into artificial lock cuts, off the main line of the river, to by-pass the four weirs. Most of the remaining 17%, the environmentally sensitive Barford loop, would be by-passed by one long canal including two locks, while navigable depth over other sections may be assured by maintaining the summer-time levels behind two weirs nearer to the winter-time levels.

e. The anticipated pressure on the Higher Avon environment and the wildlife from the forecast level of boating is less than that on the continuously navigated Avon, so that, by the example of the navigated Avon, the alleged harm to the environment from boats and boaters can be discounted. WARNACT objections, which repeated the alleged harm from navigation along with other comments, are also shown to be groundless.

f. None of the proposed lock cuts crosses environmentally sensitive ground. On the contrary, there would be environmental benefits from the proposed works, particularly in the form of increased fishing waters and the buffer provided between Barford village and the proposed Barford by-pass by a new canal with screening waterside trees.

g. The quality of the water of the Higher Avon was so bad 20 years ago, as a result of poor quality sewage effluent constituting up to 80% of the flow, that, in 1976, tests with caged fish had to be undertaken to see if the river was capable of supporting fish life. Further improvements at sewage treatment plants since then have resulted in further improvements in the quality of the

water and thereby to the aquatic wildlife it supports. Fish stocks have improved considerably but they are still not as good as those of the continuously navigated Avon: the Higher Avon is still not rated as a cyprinid (carp) fishery, whereas all the navigated Avon from Stratford to Tewkesbury has that rating.

h. Ecologically, the Higher Avon supports <u>far</u> fewer highly ranked aquatic sites and Sites of Special Scientific Interest than the continuously navigated Avon, while the quality of the bankside and aquatic vegetation, the bird-life and the other wildlife the river supports is in no way superior to that of the Upper Avon, of which it is simply a continuation.

<u>Conclusion</u>

i. The continuously navigated Avon has water of a higher quality than the Higher Avon; it has banks and water margins that exhibit a very wide range of forms and habitats; marginal vegetation equally as extensive, rich and diverse as the Higher Avon; a variety of fish equally as good as the Higher Avon and stocks considerably greater; and a quality and quantity of bird-life equally as high as, if not better than, the Higher Avon, all proving that navigation as practised and controlled on the Avon causes neither environmental harm nor general disturbance to the wildlife. These are matters which can be demonstrated at any time to anyone who cares sufficiently about the river to enquire. It is shown that navigation, the river environment and the Avon wildlife can co-exist in harmony and that there is nothing exceptional about the Higher Avon or its wildlife. In consequence it is concluded that the wildlife of the Higher Avon is in no danger from the extension of navigation through to Warwick.

NAVIGATION ON THE WARWICKSHIRE AVON

1. Stratford-on-Avon District Council, which has planning jurisdiction over 3 miles of the River Avon upstream of Alveston weir, seeks to resist the extension of navigation on the River Avon upstream to Warwick on conservation grounds. This is in contrast with the attitude taken by the Warwick District Council, which has planning jurisdiction over the further 9 miles of that distance. This account aims to show, therefore, that the wildlife of the continuously navigable Avon is not only rich and abundant but that it is equally as good if not better than that of the Higher Avon (the river between Alveston weir and the confluence of the Avon with the River Leam) and that there is no justification on conservation grounds for resisting the extension of navigation further upstream, eventually to link the navigable Avon with the Grand Union canal. The layout, therefore, is to look firstly at the continuously navigable Avon and the supposed effects of navigation on its wildlife, and then to consider the intermittently navigable Higher Avon (explained in paragraph 42), but because of the nature of the subject these two aspects tend to overlap.

THE CONTINUOUSLY NAVIGABLE AVON

Introduction and Early History

2. The River Avon, 111 miles long (179km NRA 1994), is navigable continuously from its confluence with the River Severn for a distance of about 46 miles, through 17 locks, to the foot of Alveston weir some three miles upstream of Stratford-upon-Avon. The river provides a highly popular recreational amenity and is enjoyed by a wide range of the public including those who walk or simply sit on the banks to appreciate the beauty of the countryside and the riverside wildlife, and those who venture on to the river in a wide range of craft including rafts, rowing boats, punts, dinghies, canoes, sailing craft, trip boats, hire craft and private craft. Anyone can enjoy this part of the Avon at any time (except, of course, at times of flood). The great popularity of the Avon is due very largely to it being an impounded river that is navigable by means of weirs and locks. Without the impoundments the Avon would be a minor river of little recreational interest. From Tewkesbury to Evesham, 26 miles (8 locks), navigation is controlled by the Lower Avon Navigation Trust (LANT): from Evesham to Alveston, about 20 miles (9 locks), navigation is controlled by the Upper Avon Navigation Trust (UANT).

3. The Avon was not always navigable. During the reign of Henry VI (1422-1461) the Earl of Warwick planned to make the Avon navigable from the Severn at Tewkesbury to Warwick for the carriage of various commodities from Bristol but no craft of any great size used the Avon until William Sandys made the river navigable some 200 years later (Hutchings & Higgins 1974). In 1635, Letters Patent were granted by Charles I to William Sandys of Fladbury to make the Avon navigable from the Severn to, or near to Coventry, well beyond Warwick. Thereafter, Sandys used his private fortune to purchase the necessary land and property to build the weirs, channels and locks needed to make the Avon navigable. By 1639 the work was said to be finished up to Stratford and by 1641 the river was said to be navigable to within four miles of Warwick. The navigation was taken over by William Say but, being a regicide, he forfeited it to the Crown in 1661 on the restoration of the monarchy after the Civil War. In 1664, Sandys tried unsuccessfully to revive the navigation scheme to Coventry and, although he died in 1669, the river was certainly being used for the carriage of goods during that period.

4. The navigation was divided into Lower (Tewkesbury to Evesham) and Upper sections in 1717. The Lower Avon experienced a series of restorations and declines, the revenue seemingly rarely able to support the maintenance. The river became unnavigable above Pershore during the Second World War and was fast approaching complete disintegration when, in 1949, following a conference called by the Inland Waterways Association, a Birmingham industrialist and boating enthusiast purchased the moribund Lower Avon Navigation Company. The Lower Avon Navigation Trust was incorporated in 1950, and between 1950 and 1962 the Trust restored the derelict navigation through to Evesham. The link with the Upper Avon, Evesham lock, was reopened in 1964.

5. Following the division of the navigation into lower and upper sections in 1717, the Upper Avon experienced similar crises and improvements to the Lower Avon until 1856, when the navigation was taken over by the Oxford, Worcestershire and Wolverhampton Railway, which, in order to eliminate the competition of the waterways, ceased to take tolls or to maintain the structures. Although there were changes of ownership after that and although there was always some pressure, plans and interest in reopening the navigation (the last recorded boat using the Upper Avon navigation was in 1874), the Upper Avon Navigation remained in a state of dereliction for over 100 years until 1969, when the Upper Avon Navigation Trust, incorporated in 1965, began the restoration. This was completed in 1974 in compliance with the original intention of providing a safe, workable, money-earning navigation as quickly as possible and then improving it as more money became available.

6. Thus, after an interval of some 120 years, through navigation on the Avon, from the Severn to and beyond Stratford, was finally restored in 1974, 20 years ago, since when LANT and UANT have depended for their financial success entirely on recreational boating: neither Trust receives any form of subsidy, from either the local governments or the National Government.

7. The Avon is navigated now by craft based on the river and by those visiting it from other waterways. Some 900 private craft (excluding canoes and sailing boats) are based on the Lower Avon together with two trip boats but there are no bases for hire craft. A much smaller number of private craft is based on the Upper Avon, about 520, but there are four hire craft bases on the Upper Avon with a total of 54 boats, together with nine tripping boats and four other commercial craft in Stratford and a large number of punts, rowing boats and motorised dinghies (the river through Stratford is by far the most heavily navigated part of the Avon). Hire craft are based on nearby waterways also, and the "Avon Ring", a circular route including the Rivers Avon and Severn, together with the Birmingham and Worcester, Northern and Southern Stratford canals, is particularly popular with hire boaters.

Boats and the Avon Environment

8. The requirements for navigation are:

(a) Adequate depth of water: by far the majority of boats on the Avon have a draught of 2ft or less while the shallowest waters in the navigable channel are 3ft 6in on the Upper Avon, in one short stretch over the marl slab immediately upstream of Marlcliff lock, with 10ft deeps (4ft on the Lower Avon with 20ft deeps). The bottom of the representative boat is, therefore, a long way from the river bed and there are notices which advise boaters if the navigable channel is not along the mid line of the river.

(b) Adequate clearance under bridges, electricity wires and so on (air draught).

(c) Adequate lateral clearances: very many of the craft operating on the Avon have a beam not exceeding 6ft10in, which allows them to pass through the narrow (7ft) locks of the Southern Stratford canal.

9. The works needed to make a river navigable are not the same as the river management works undertaken by or on behalf of the river authority for the benefit of the whole community, and should not be confused with those works. The nature of the river bed and the banks, the width of the river and its curves and bends, the riverside trees and the quality of the water, all are essentially irrelevant for successful navigation. They do not have to be modified in any way from the perfectly natural condition to permit this popular leisure activity: to change them would in fact detract from the pleasure of inland boating. Nevertheless, boats and boaters stand accused (eg WARNACT 1978, Jeffray 1980, Smith 1982) of a wide range of harmful effects on the Avon aquatic environment and the wildlife including bank erosion, the destruction of marginal aquatic vegetation by boats and by dredging, the swamping of birds' nests and bank-side breeding holes, pollution through the emission of oil, petrol, dirty cooling water, exhaust gases and waste water, of stirring up silt so forming a persistent cloudy barrier preventing sunlight reaching the plant life, and basic disturbance to the wildlife in all its forms. They are accused also of needing elaborate physical structures, particularly extensive reinforced river banks for mooring, and of indiscriminate mooring when these banks are not provided. Inevitably these generalized accusations hold a small element of truth: boats do create a wash as they move through the water and not every navigator handles his craft with exemplary skill all the time, but inland waterways, where craft move only slowly (4-6mph) and create very little wash, attract responsible people: family groups and retired people form the major component of inland navigators. They take waterways holidays because they enjoy the tranquillity of the countryside through which canals and rivers mostly pass and they take pleasure in the aquatic wildlife that is unusual to those not living beside a waterway.

10. The busiest lock on the Avon is at Strensham on the Lower Avon. During the busiest recent season (April-October 1990), Strensham lock recorded a total of 9,638 boat movements during the 2,030 daylight hours the lock was manned, which represents an average of one boat movement every $12^{1}/_{2}$ minutes. This number was made up of craft making a through passage of the navigation but greatly enhanced by the large number of private boats based in the vicinity of the lock, making short excursions. In more recent seasons (the recession has had an effect) and elsewhere on the river, other than in Stratford which, with its concentration of powered dinghies and other small craft (which do not pass through the locks) and other pleasure boats, is quite exceptional, boat movements have been much less numerous, Strensham 1992: 5,719 1993: 5,362, Evesham 1992: 3,637 1993: 3,584 (3,584 boat movements represent 1 boat movement every 34 minutes).

11. The Evesham records of boat movements include all craft from adjacent waterways making a through passage of the navigations together with the movements of craft based on the river. Because Evesham is a toll station where licences are checked and issued, some crews on the Upper Avon not wishing to pay a further toll would not pass through the lock, but

would return upstream. It is to be expected, therefore, that boat movements on the Upper Avon itself would be greater than the Evesham records. Let us assume these movements to be twice as great, say 7,000/year.

12. On a canal, undoubtedly 7,000 boat movements in a season would have a marked effect on the environment (Murphy & Eaton 1983), but canals are very different from rivers: apart from being, usually, relatively static bodies of water, canals were built economically to provide a minimum means whereby deeply laden craft could move and pass one another. Like any other river, the Avon varies greatly in width and depth, so much so that the concept of an "average" width or depth may be difficult to accept (Table 4); nevertheless, all the navigated Avon is certainly much wider and deeper than the average canal, with a cross-sectional area several times that of a canal (Leeds & Liverpool canal 16m^2, Basingstoke canal 13.8m^2, Staffordshire & Worcestershire canal at Dunstall 7.6m^2, Birmingham & Fazeley canal at Hademoor House 7.0m^2, Southern Stratford canal 5.7m^2: for comparison, the cross sectional submerged area of a narrowboat is about 1.3m^2). The river banks, the bed, and all the many varieties of river wildlife are also subjected all the time to the scouring and the buffeting of the water flow: the wildlife is tolerant not only of the gentle summer conditions but also of the very great seasonal and other changes that can occur so that, all things considered, boat movements have much less effect on the riverine wildlife than they do on a canal.

13. In the analysis of studies on the effect of boat movements on canal flora carried out by Murphy & Eaton (1983), they compared canals of different dimensions by reducing all data to a hypothetical canal 1km long, 10m wide and 1m deep. Their results appeared to justify the assumption that boat movements on a canal, say 20m wide and 1m deep, would have half the effect they would have on the hypothetical canal. They reached some significant conclusions:

a. Canals with little or no boat traffic suffer growths of macrophytes (larger plants) sufficient to impair navigation, angling and water flow, "undesirable from the management viewpoint."
b. Canals with low traffic densities, less than 2,000 boat movements per year in terms of the hypothetical canal, supported the highest quantities of <u>submerged</u> aquatic vegetation and the greatest number of plant species.
c. Canals with boat movements of 2,000-4,000 per year supported increasingly lower quantities of submerged aquatics as traffic increased.
d. At high traffic densities, above 4,000 movements/year, submerged crop values were very small and the range of plant species was lower.
e. <u>Emergent</u> macrophyte abundance was much less precisely associated with traffic density.

14. Murphy & Eaton went on to consider possible explanations of these conclusions. They dismissed water pollution from boats, arising from such causes as sewage, exhaust fumes and fuel spills, as a reason but they did observe that canals used heavily by pleasure boats usually have very turbid water, suggestive of a heavy content of suspended silt. Further analyses showed that there were significant associations between traffic density, submerged crop and turbidity and that turbidity starts to increase markedly only when traffic exceeds 2,000 movements/year. The reduction in the crop of submerged aquatic vegetation may be due to the reduction in light penetration, or silt landing on and covering the leaves, so retarding underwater photosynthesis. The discovery that the crop of emergent vegetation was less dependent on boat traffic might be explained by this since they do not rely on underwater light for their photosynthesis.

15. An overall conclusion by Murphy and Eaton was that boat traffic in the range 1,000-2,000 movements/year seemed to create a satisfactory balance between the ecological and other features of canals.

16. To what extent do these conclusions bear on the navigated Upper Avon? If the Avon were a uniform canal and not a river then the boat movements could be referred to the standard of the hypothetical canal, that is 7,000 movements in a channel 45m wide (and 1m deep - Table 4) would equate to 1,556 boat movements/year, well within the range considered by Murphy and Eaton as being most beneficial. The Evesham lock record of 3,584 boat movements/year would equate to 796, too few to be beneficial. However, the differences between the canal and the river environment are now considered to be so great that it is impossible to predict what might happen on a self-scouring river from studies carried out on a canal (Eaton 1994), and in the absence of specific riverine data the only realistic approach is to compare navigated and unnavigated rivers. So, to move away from speculation, just what has been the effect of boat movements on the specific Avon riverine environment and the wildlife? In short, the answer is seen readily to be very little (which is what one would expect, from the evidence above, if the Avon were a canal).

<u>Erosion and silt</u>

17. Considering first the question of erosion and silt; in the summertime, at the height of the boating season, the river in general runs clear and clean. Although the river may look dark when viewed from the bank, this is due largely to organic matter

drifting naturally downstream: a drinking glass of river water would be seen to be clear, which can be tested at any time simply by dipping in a glass. At such times it is most unusual to see any part of the river contaminated by suspended sediments. While the marginal aquatic vegetation may be rooted in silt/mud, the banks and bed of the navigable Avon are firm: they are not colloidal clay, which is the nature of many canals, so that if a boat does cause some momentary disturbance the effect is very short lived. This is in total contrast with the winter conditions when the river is very frequently heavy with silt washed into the river by rainfall and stirred up by the high and fast flowing water. In winter the signs of bank erosion due to the high flow are clearly to be seen but in the summer the river banks show no obvious signs of erosion due to the passage of craft. Neither LANT nor UANT report any evidence of bank erosion due to the passage of craft; and even if there were bank erosion it would be impossible to distinguish between that due to craft and that due to the waves generated by the wind in the quarter of an hour or more between the passage of any two boats.

Aquatic vegetation

18. Abundant submerged, floating and emergent aquatic vegetation, associated with the shelf lying either side of the navigable channel, is a feature of the navigated Avon throughout its length. Apart from the main course of the river, with its stands and beds of marginal aquatic vegetation, there are many side arms, heavily occupied by aquatic vegetation. The restoration of the Upper Avon was carried out under the directions of a former Water Authority and the requirements of riparian owners so far as levels are concerned. Thus, for reasons beyond its control UANT was required to set the new river levels in many sections lower than the original levels, in some places very much lower. The present river level below Luddington lock, for example, is now below the original river bed. There is no doubt that the works needed to put those directives into effect caused severe disruption locally to the wildlife. When the works were finished the environment of the aquatic vegetation had been altered dramatically, yet only a few years later there was abundant marginal aquatic vegetation again, all of it having regrown despite the river traffic which, it is alleged, is so harmful, and it continues to grow.

19. The extensive stands of marginal aquatic vegetation may well contribute, of course, to the absence of bank erosion by damping down both wind generated waves and boat wash. So far as the destruction of birds' nests and the swamping of bank-side breeding holes is concerned, the wash from the boats on the Avon is far too small to be a significant factor and the wildlife in question is at far greater risk from the natural flooding that can take place at any time, winter or summer, as it has done since time immemorial. In point of fact, the higher banks of the Upper Avon compared with the Higher Avon, resulting from the creation of the new land drainage levels, provide enhanced opportunities to all bank-roosting species.

20. So far as dredging is concerned, the dredging of some lock cuts is needed almost every year because of the silt brought down during the winter floods, but these lock cuts are artificial canals; they are not a part of the river channel. On the other hand, the river itself may be dredged for several reasons other than navigation, such as to improve drainage, temper floods and to improve sewage transport. Although the aquatic vegetation of the marshy areas, usually set some way back from the river bank and the navigable channel, may be restricted to shallow water, the aquatic vegetation of the river margin (the swamp flora, by far the visually dominant group of river plants) does not need very shallow water. Some species may be restricted to relatively shallow water, 2-3ft, but many others can grow well in water adequately deep for navigation (1.2m 4ft). Submerged aquatics can grow so long as they have light enough for photosynthesis (10ft or so): the common reed (*Phragmites australis*) grows well in water of 4-5ft; water lilies can grow in water down to 3m (10ft) deep, while one of the most common emergent plants of the Avon, the bulrush (*Scirpus lacustris*) not only grows in water down to 2m deep (6-7ft), it may grow even totally submerged as underwater meadows. On the other hand, reedmace (*Typha latifolia*) may form mats of vegetation floating over deep water (Christiansen 1979, Hopkins & Brassley 1982). Despite suggestions to the contrary (Jeffray 1980), the Upper Avon Navigation Trust has never deepened the river through Stratford for the purposes of navigation although it has undertaken dredging, under contract to the Water Authority, for the benefit of the community as a whole and it has dredged the entrance to the Bancroft Gardens canal basin. The dredging which it has been alleged might have destroyed the County rarity *Carex vesicaria*, Bladder sedge (Jeffray 1980 p14) was not carried out either by UANT or to improve the navigation but by the Water Authority: UANT in fact raised objection to that dredging. Nor does UANT "dump" dredgings on the river bank. When dredging is carried out by UANT, then in consultation with the riparian owners the spoil is either buried, ploughed into the soil or carted away (Note: Table 1 lists the IUCN status categories, ie. the degrees of "rarity". "Rare" species are, in fact, not at all rare, only somewhat unusual: thus, *Carex vesicaria* may be a County rarity but it is scattered throughout the British Isles and is widespread in the temperate zones of the Northern Hemisphere - Christiansen 1979, Fitter & Fitter 1984).

Water pollution

21. Since the Upper Avon was made navigable again in 1974, the regime of environmental control has become more stern. Nevertheless, although the National Rivers Authority Consultation Report on The Warwickshire Avon Catchment Management

Plan (NRA 1994a pp22-24) lists some 20 failures of the Avon to reach certain River Quality Objectives, not one of these bears in any way on navigation. The Bye-laws of both LANT and UANT prohibit the release of oil, petrol, paint and all similar noxious substances into the river or on to the land adjacent to the river and in the 20 years since the Upper Avon was reopened to navigation UANT has identified only a single serious infringement, and that was the result of terrestrial vandalism, not boating. This list from the Bye-laws does not include either cooling water or exhaust gases. Many boats on the Avon do not discharge cooling water because they are either not water-cooled, but air-cooled, or they use a closed cooling water system; but in any case, cooling water is never chemically contaminated; it is simply water that has been passed through a system of pipes and has been returned to the river. However, powered craft do need fuel and lubricating oil and the possibility of contaminating the water is appreciated. A process of establishing minimum standards of construction for boats on navigations controlled by the British Waterways Board, the National Rivers Authority and the Broads Authority is currently in hand. These standards will be adopted and enforced by both LANT and UANT as soon as they become mandatory on the waters adjacent to the Avon, that is, we believe, within a year or two. These standards require all boats to be fitted with mechanisms which prevent oil and petrol from entering the bilges (and hence from being pumped into the river). While the navigation Trusts are able to enforce such regulations, they have no control over the oil and other vehicular waste which drains or is washed straight from the roads into the river, and there are far more engines with their accompanying wastes on the roads than there are boats on the river. The potential for disastrous pollution arising from a road accident is recognised by the NRA in its Avon Catchment Management Plan Consultation Report (NRA 1994a p9). In their study of the effects of boat movements on the flora of canals Murphy and Eaton (1983) rejected pollution by oil from boats as a cause of environmental damage.

22. When it comes to considering the possible harm to the Avon environment from boat exhaust emissions, there can surely be no serious comparison between the Avon's three or four craft per hour and the roads and motorways with their many dozens or even hundreds of vehicles an hour, most of them with engines many times more powerful than the craft on the Avon? It has been recognised that soil adjacent to roadways, some plants growing beside roads and some of the animal wildlife living close to motorways may show higher concentrations of heavy metals and organic pollutants the closer they are to heavy traffic (Beslaneev & Kuchmazokova 1991, Hinkel et al 1989, Heck et al 1989, Linder 1989), but in other cases the density and species variety of the wildlife has been shown to be dependent on the width of the verges concerned and not on the amount of traffic which had no apparent effect on the wildlife populations (Munguira & Thomas 1992). Despite some obvious disadvantages of living beside a busy road, roadside verges are in fact now recognised as representing possibly Britain's largest nature reserve in which the danger from mowing is of far greater concern than that from vehicular exhausts (Young 1991). Murphy and Eaton (1983) dismissed exhaust gas emissions as a cause of environmental damage on canals.

23. The discharge of waste water from boats, arising from such activities as the preparation of food and washing, has been blamed for river pollution but the quantities involved are minute and this factor was rejected by Murphy and Eaton (1983). At a rate of 1 boat moving every 15 minutes there would be 1 mile between the boats if they were all travelling upstream (4mph) and 1½ miles between the boats if they were all travelling downstream (6mph). Assuming they were all travelling upstream, it would need 47 boats spaced as I have indicated to occupy the whole length of the continuously navigable river: if they were all travelling downstream it would need 31 boats: on average 39 boats, some travelling upstream, some downstream, would give 1 boat movement every 15 minutes, say 40 boats. With, say, double that number moored for the time being it may be estimated that there could be 120 boats cruising the river at any one time during the cruising season. The mean flow of the Avon at Tewkesbury is $2{,}660 \times 10^6$ litres per day (NRA 1994a). If all 120 boats were to discharge 50 gallons of washing up water in a day (a grotesquely high figure), all at Tewkesbury, it would still represent only 0.0013% of the Avon flow, while the proportion of any detergent would be only about 1 part in every 100 millions of river water. Need any more be said than to refer to paragraph 60 where I have noted that the NRA confirm that the water of the navigated river is of higher quality than that of the Higher Avon.

Weirs, locks and moorings

24. Boaters certainly need some navigational structures if they are to make use of the river and to do so in safety: of these structures, weirs, locks and flood-safe moorings are the most important. Weirs are needed to provide an adequate depth of water, but every weir constructed also provides a rapid flow or even a white water habitat down stream, excellent for some species of fish such as brown trout, grayling, dace and chub, and for the aeration of the water passing over it, a matter of some importance in cases of low flows coupled with high temperatures. This same process is important also in restoring the quality of water that has been contaminated by sewage.

25. Locks are needed in order to by-pass the weirs. By their nature, all the locks are built in separate, artificial lock cuts (and would be on the Higher Avon), which may be quite long, off the main course of the river which flows over the weir: their

construction adds to the variety of environmental habitats; it does not reduce them. The much slower water-flow in a lock cut provides for the deposition of silt and also a habitat for freely floating plants that might otherwise be washed downstream. The lock walls and the gates also provide a habitat for a range of algae, mosses and liverworts and the animal life such plants support, there being otherwise very little in the way of hard rock faces along a lowland river for such plants (stones used to construct weirs and in bank reinforcing also provide this additional habitat).

26. Moorings that enable boaters to visit shore-side locations are essential. These same moorings, with their riding poles and sliding rings, provide also for the safety of boats and boaters alike in the time of flood. Their general excellence, numbers and convenience must explain, at least in part, the scarcity of indiscriminate mooring, which even Jeffray (1980 p43) noted was "quite well controlled on the Avon" (extracts from letters written by many Upper Avon riparian owners, and reproduced elsewhere, confirm this). Along the whole length of the navigated Avon, by far the greater proportion of these UANT moorings are constructed in the lock cuts, off the course of the main river, in keeping with Local Authorities' policies of "cluster moorings". Except for two short lengths of boat moorings, in Stratford (mentioned below) and Bidford, the Upper Avon retains all its original banks except where the navigation authorities or the NRA have provided bank protection to prevent erosion or where riparian owners, for their own purposes, have undertaken bank protection. The river banks in Stratford are an example of this, where the local Council has provided bank reinforcement for the convenience and pleasure of the townsfolk and the very many tourists who visit the town. Although boats have moored beside the left bank in Stratford since the navigation was reopened, the bank protection was not constructed for their use and it is only in the last year that one section has been rebuilt specifically with boaters in mind, that is with mooring rings set into the ground and hard standing provided. Other boat moorings do not need protected banks in any form but are designed and constructed so that the river bank is retained in its original condition behind a pathway built over the river on piers driven into the river bed. The UANT mooring at Pilgrim lock, moorings at Bidford Boats and the LANT moorings in Evesham are examples of this.

27. The protected river banks in Stratford exceed in length <u>all</u> the other boat moorings along the banks of the Upper Avon. These other moorings include those provided by the four hire boat bases (Evesham, Bidford, Barton, Stratford), by Welford Boat Station, by the Fish and Anchor public house, and by UANT (at Bidford, downstream of Welford and Weir Brake locks and upstream of Luddington lock). However, even accepting the whole 620yd length of the left bank in Stratford as boat moorings although it was not built for that purpose, the total of all boat moorings along the Upper Avon river banks still amounts to only about 1,000 yards, that is $1^{1}/_{2}\%$ of the banks along the 19½ miles of the Upper Avon. The remaining $98^{1}/_{2}\%$ of the banks remain in their natural state exhibiting the wide range of natural habitats one would associate with a lowland river. There are some vertical banks, some shallows, shingle banks, marshy areas, some rock faces, a variety of marginal aquatic vegetation, overhanging trees, bushes and other vegetation, and so on except, as noted above, where they have been modified by riparian owners for their own purposes, by house holders as an attribute to their gardens, or for the purposes of farming or angling.

<u>General disturbance of the wildlife</u>

28. With regard to the accusation that the general disturbance of the wildlife caused by navigation is a prime factor the importance of which would be hard to exaggerate (Smith 1982 p6), I know of no published detailed survey of the flora and fauna of the continuously navigated Avon, so that indications of the general ecological health of the river have to be extracted from more general observations. Comments from riparian owners give the first indication. To quote three from many:

> *"I have suffered neither loss or damage, trespass nor rudeness from those using the river; I put my trust in the good sense of the majority of the British public, and that trust at no time - by any boat user, has been abused."* Bidford Grange.

> *"We have found that people using boats on the river have behaved in a reasonable and responsible way and we have no evidence of any damage or nuisance caused by them."*

Brook Farm, Abbots Salford.

> *"As a riparian owner with land adjacent to the town of Stratford, may I dispel any ideas that boat users are trespassers or vandals. I am well aware of who are the trespassers and vandals of Stratford and they have a tendency to be on foot not on boats".*Cross o' the Hill Farm.

29. The most recent publication extolling the beauty of the river and the variety of the wildlife is the 1994 NRA Avon Catchment Management Plan Consultation Report (NRA 1994a) which states (p5) "The Avon is a river of great natural beauty representing the very best in English landscape. It provides the perfect habitat for a wide range of birds, such as the kingfisher and the marsh warbler. Many riverside plants, mammals and trees thrive in the catchment. ***Throughout its route*** (my italics) the Avon is therefore recognised as a river of very special environmental importance." It also notes (p11) "The catchment is of high

conservation value with rich flora and fauna. It supports a wide variety of habitats, including woodland, scrub, parkland, marshy grassland, water meadows, marsh, reedbed and natural rock exposures." and while the document goes on to note that "The quality of the habitat improves generally towards the headwaters *of the tributaries* (my italics) and away from settlement and the availability of public access.", nowhere does it compare the ecological quality of the continuously navigated river unfavourably with the river upstream of Alveston. On the contrary, it states (p5) "the river is in better condition now than it has been for many decades." and it goes on to extol the virtues of the fisheries of the Avon, noting (p10) that "Fish populations are very much dependent on the variety and quality of the habitat and the quantity of water present.", referring, in proof of this, to the World Fishing Championships, which, in 1981, were held on the navigated Upper Avon (at the height of the boating season).

30. The NRA Plan Report also notes (p12) that the bird life is rich and varied and that the only population of the very rare marsh warbler (*Acrocephalus palustris*) on the river is on the navigated Lower Avon. The NCC notification of the Avon Valley SSSI, in 1985, gave as the reasons for the notification:

> "The Avon Valley between Tewkesbury and Bidford-on-Avon represents the last major breeding area in Britain for one of its rarest birds. This is the marsh warbler (Acrocephalus palustris). An estimated 70% of its population in Britain is located in this area.
>
> The Avon Valley SSSI consists of fifteen sites on small islands and flat areas along the banks of the River Avon, the Bow Brook and their tributaries."

LANT holds large scale plans of all the ten SSSI's that lie beside or within the river. They provide a suitable habitat also for many other birds of which the *Acrocephalus* warblers are particularly notable. Thus LANT can exercise care in the operation and maintenance of the navigation. However, there has been a recent decline in the population of the marsh warbler, the reason for which is unknown, and now only about half-a-dozen pairs survive (Harrison & Sankey 1987). It says much for the disturbance caused by navigation that the site of one of these half-a-dozen pairs should be beside one of the Lower Avon locks, just where boaters moor to pass through the lock! The NRA Plan Report also states that "The catchment is known generally to provide excellent invertebrate habitat" and goes on to note that the rare club-tailed dragonfly (*Gomphus vulgatissimus*), the future of which, in 1982, was judged to be "not very bright" (Hopkins & Brassley), has extended its range from its previous territory on the (navigated) Severn on to the (navigated) Lower Avon as far upstream as Evesham. The general disturbance caused to the wildlife by navigation would appear to have been grossly exaggerated.

Specific accusations of environmental harm

31. As well as the rather sweeping generalizations with regard to the alleged harmful effects of boats and boaters on the Avon environment, there have been some specific accusations too. Smith (1982) wrote of the damage to the Upper Avon as a result of the works undertaken to reopen the river to navigation, listing dredging, tree felling, the removal of aquatic vegetation which exposes the banks to erosion and removes sites for nesting and cover for both birds and small mammals, and the removal of fast, shallow riffles and sharp bends, and he went on to say (p10) "Such have been the changes on the navigated section of the river that it seems doubtful whether any steps could be taken to repair the damage caused by them." In point of fact, no steps were taken, nor were any necessary. Nature is remarkably resilient and within a short time, as I have noted already, the river looked beautiful again, with abundant marginal aquatic vegetation and its associated wildlife. This does not mean that UANT is unconcerned about the environment: on the contrary and for example, over the years UANT has planted several hundred trees at lock sites and elsewhere, some of which are now well grown, and with the sponsorship of other bodies, and having gained planning consent, it has created picnic areas where boaters and others can rest and appreciate the river scenery. The outstanding beauty of the continuously navigated Upper Avon is illustrated in the series of photographs prepared by one of my colleagues for this Inquiry.

32. Smith (1982) made a number of other statements which I consider were fundamentally inaccurate: (p12) "The Upper Avon lacks shallows, clearness of water and food (for herons)" "No such reed beds now exist on the Upper Avon" (p13) "The lack of this (aquatic vegetation) on the Upper Avon has led to an almost total decline of this species (the mute swan)" "Nevertheless the population (of moorhen) on the Upper Avon is relatively miserably depleted compared to the Higher Avon due to interference by both disturbance of sitting birds and swamping of nests by boats' wash and lack of sites for nest, display and brood platforms" (p14) "No such areas (bare shingly ground) occur in the dredged Upper Avon" "The physical requirements of navigation on the Upper Avon have largely removed this type of habitat (undisturbed marshy vegetation)" (p15) "Muddy river margins and spits as are found commonly on the Higher but not on the Upper Avon supply this material (mud for nest building)" "The Sand Martins natural nest site is a vertical river bank, which although conspicuous is a good natural defence against nest predation, except from boat-borne hooligans". One has only to stand on the banks of the Upper Avon anywhere

beyond the confines of Stratford to see for oneself just how untrue these statements are. As I have noted already, over 98% of the banks of the Upper Avon are just as natural as those of the Higher Avon, of which they are simply a continuation.

Fish and fisheries

33. Turning now to some specific comments by Smith (1982) on the supposedly detrimental effects of navigation on the fish and fisheries of the Avon, he said (p9): "Establishing locks and dredging effectively extends the habitat of the Bream and some of its congeners to the detriment of the Barbel and those species more dependent on sandy, gravelly beds with clearer cool running water." As noted already, locks are built in totally new excavations (lock cuts). They do not alter significantly the nature of the original river, the river bed, or the temperature and clarity of the water. Each lock cut creates a new habitat and while it certainly extends the habitat of such species as the bream it does not destroy a previously existing habitat.

34. Smith (1982) also said (p9): "In contrast to the richness of the fish fauna of the Avon above Alveston, a decline in certain species has been recently noted on the navigated river below Stratford." The basis for considering the fish fauna above Alveston to be relatively rich is hard to justify. The species compositions of the Higher and Upper Avon are much the same (Table 3) while the quantity and quality of the fish of the navigated Avon are far superior. The banks of the navigated river are always well populated by anglers. Coleman (1987) wrote:

> "The Warwickshire Avon is one of the most popular and prolific coarse fishing waters in Britain yielding contest catches of up to 80lb (36kg) along its length." and "Leading match anglers from all parts of the country recognise the Warwickshire Avon as one of the best contest rivers in Britain. It has varying characteristics from fast shallow runs to much more sedate flows. There are also many weirs, and the river holds many specimen-size fish."

Twenty years ago there were virtually no fish of consequence on the higher river downstream of Rugby (see paragraph 60) and the stocks down to and past Warwick were very poor indeed. In 1976 the Severn-Trent Water Authority conducted experiments with caged fish (chub, dace) to see if, as a result of improvements at sewage treatment works, the water in the River Avon below the Sowe confluence was yet capable of supporting fish life (STWA 1976), and as a consequence of further tests in 1978 and 1980 it was concluded that this part of the Avon "has the potential for becoming a first class fishery in many places" provided the higher quality of the Rugby sewage was maintained and there was a clamp down on the producers of other effluents (STWA 1980). However, with the exception of the record mentioned by Coleman, above, the best match weight on the Avon of which I am aware, exceeding 75lb, was caught at Eckington (Lower Avon) while the Lower Avon has also recorded the biggest chub (Evesham 6lb), bream (Pershore 8lb 3oz), roach (Strensham 2lb 4oz) and carp (Birlingham 15½lb). Both the Lower Avon and the Upper Avon have produced perch up to 3lb and pike up to 10lb (Worth 1977). All these records relate to the navigated Lower and Upper Avon, which continue to produce record catches (biggest barbel, 15lb, Chadbury 1994): the Higher Avon does not feature in any of these published angling records. In paragraphs 13 & 15 I made reference to the apparent benefits derived by the canal flora from a modest level of navigation: it is possible that the modest level of navigation that would result from extending the navigation through to Warwick might contribute to the recovery of the Higher Avon fish populations.

35. The NRA (1994a) acknowledged that "the Avon is considered as a high class coarse fishery" but that there had been a decline in angling catches in recent months. They noted that some anglers blamed the zander for the deterioration of angling match results (and at NRA 1994b they reported on a study of the problem - paragraph 72).

36. Smith (1982) went on to say (p9): "According to careful annual records kept by Stratford anglers, bottom feeders like Roach and Gudgeon have sharply declined (on the navigated river below Stratford) and the Dace decreased in weight and quantity by fifty per cent in the late 1970s." By implication, Smith suggested the cause of the decline was the opening of the Upper Avon to through navigation in 1974. However, in reporting on the angling success on the River Severn during the coarse fishing season 1980-81, the Severn-Trent Water Authority made this interesting comparison:

> "Over recent seasons there have been many reports from anglers to the effect that rapid and extreme changes were taking place in the species composition of the fish populations of the River Severn. In particular, barbel and dace were reportedly declining at an alarming rate and chub, roach and eels were also supposedly less abundant than was the case previously".

In other words, the same complaint over declining catches of the same species over the same period was being made by anglers on the River Severn, totally removed from the (then) newly navigated Upper Avon.

37. STWA scientists went on to study the situation on different sections of the Severn, on both lightly navigated sections (Upper Severn, Mid Severn 1) and heavily navigated sections (Mid Severn 2 and Lower Severn) (Table 2). They concluded:

> "Upper Severn: In this river section dace were the most abundant species in 1976-77 since which time there have been relatively fewer dace caught although there is no evidence of a continual decline. Chub have remained steady over the last three seasons but this species too, was more abundant in the first three years of the census. Barbel showed an overall increase in relative abundance from 1975 to 1980, but 1981 would appear to have been a poor season for this species. Gudgeon have remained stable over the whole six-year period, showing no great fluctuations in relative abundance.
> Mid Severn 1: More reports of declining sport have been received concerning the Mid Severn than any other river section. Barbel and chub have been the mainstay of anglers' catches since 1975. Whilst barbel have shown fluctuation in their relative abundance there is no evidence of any continual trend and with the exception of the first season monitored they have been the commonest species caught. Chub, in contrast have shown a steady decline in abundance over the six years of monitoring and although this may simply reflect the passing of one or two particularly strong year classes, there may be cause for real concern if there is no upturn over the next three or four seasons. Other species in the Mid Severn 1 section have also fluctuated with the passage of time but show no definite trends in either direction.
> Lower Severn: In the Lower Severn anglers have repeatedly reported an absence of bream in their catches. Whilst it can be seen from Table 1 *(not shown here)* that bream are one of the less abundant species, their contribution to the total catch has remained fairly constant at around 10 per cent and there is no evidence to suggest that bream have declined in relative terms over the past six years. Chub in this part of the river have not shown the decline which was evident in the Mid Severn 1 section and continue to be the most abundant species in the Lower Severn. Catches of roach have also remained fairly constant over the study period and there is no support for the claims of some anglers that roach have virtually disappeared from the Severn."

STWA noted that because monitoring of Mid Severn 2 had been underway for only three seasons there were not sufficient data to show any trends.

38. In summary, STWA scientists refuted the anglers' belief that catches of particular species had declined in the late 1970s, and whether the river section was navigated was quite irrelevant. What they were able to do was to confirm, once again, that fish population sizes fluctuate, sometimes sharply, and that almost always it is impossible to define precisely the features that distinguish the conditions that have led to particularly good larval survival (which might lead to excellent catches in subsequent years), even with the benefit of hindsight.

39. In view of these STWA conclusions, it seems highly likely that the fish populations of the Upper Avon were responding to perfectly natural fluctuations in exactly the same way as the same species of the Severn and that opening the Avon to navigation had nothing whatsoever to do with any decline there might have been, and in view of all these observations, the alleged disturbance to the wildlife of the navigated Avon caused by boats and boaters and the requirements for navigation is very hard indeed to identify. It must be concluded that navigation, as practiced and controlled on the Avon, is certainly not inimical to wildlife, which is a view generally in keeping with that taken by Members of the Worcestershire Branch of the **Council for the Protection of Rural England** at the end of a visit to the Upper Avon in June 1988.

> *"The river passes through charming peaceful scenery: we enjoyed the sight of banks covered with wild flowers, with lots of bird life, ducks galore, swans, moor hens and dab chicks, though we missed the resident kingfishers. To see Bidford from the river made one realise what an attractive little town it is. It is always interesting to go through locks (especially if you are not required to do any handling) and members got out to watch the operations. The surroundings of the locks and mooring bases were in excellent condition, with no litter at all.*
>
> *The Trust has a project for extending the navigation above Stratford, which is meeting with some opposition, partly on the grounds of potential damage to the environment. We certainly saw no such damage on our 16 mile trip."*

40. It is to be regretted that WARNACT has declined similar invitations from UANT to visit the Upper Avon and thereby confirm for themselves just how wrong are the accusations of environmental damage resulting from navigation on the Avon.

THE HIGHER AVON

The Higher Avon Scheme (Upper Avon Phase II)

41. The Higher Avon between Alveston weir and the confluence of the Avon with the River Leam is 12.04 miles in length (Ove Arup & Partners 1977). It is formed of five relatively level sections joined by four steeper, shallower sections, at Alveston, Hampton Lucy, near Sherbourne and near Warwick Castle. The fall over the 12.04 miles, to the crest of Alveston weir, is 28.44ft giving an average of about 2.37ft/mile, about the same slope as the Upper Avon (c.$2^1/_2$ft/mile) and about double that of the Lower Avon (c.$1^1/_3$ft/mile). Four weirs or groups of weirs, at Alveston, Hampton Lucy, Barford and Warwick Castle, already control the minimum water level upstream and through the level sections. Thus, over a distance of 9.99 miles (83%) the Higher Avon already meets the criteria for navigation (a minimum depth of 1.20m over a width of at least 5m, and an air draught of at least 2.50m).

42. Unlike the scheme to reopen the Upper Avon, which was more a land drainage exercise than the construction of a navigation, the scheme to make the Avon navigable between Alveston and Warwick is not complex in engineering terms and is explained in detail elsewhere. From Alveston to the Avon/Leam confluence, the wide, deep, slow-flowing reaches behind the man-made impoundments already support a range of craft, mostly operated by their riparian owners, which, at least in the 1970's, included the trip boat GRACE DARLING operating from close to Warwick Castle. The presence of these craft on the Higher Avon is the reason for referring to the Avon downstream of Alveston weir as the "continuously navigated" river, to distinguish it clearly from the "intermittently navigated" Avon upstream of the weir, where navigation is practiced only on the reaches between the weirs.

43. The wide, deep reaches of the Higher Avon would remain essentially unchanged. The proposed works would not impair the function of the river to provide drainage or the ability to provide water for irrigation and for stock during times of low flow. All that is needed to enable boats to pass through to the confluence with the Leam is the construction of four locks to by-pass the existing weirs; a new canal half-a-mile in length running beside the proposed Barford by-pass road and incorporating two locks to by-pass $1^3/_4$ miles of the ecologically valuable, natural gravelly shallows of the "Barford loop" (which loop constitutes most of the 17% of shallower, unnavigable water to the Avon/ Leam confluence); and very limited spot dredging, some of which may require the construction of a weir off the navigable channel at Barford to retain navigation depth along the dredged sections. Restoring the summer-time crest levels of Alveston and Hampton Lucy weirs closer to their traditional levels (possibly by the use of inflatable crests rather than the use of Fletcher boards) would eliminate the need for some of the dredging and improve the ability of the river to provide water for irrigation and for stock at times of low flow.

44. These works can be summarised:

Location	Existing weirs	New weirs	New channels	New locks
Alveston	Y	.	Y	Y
H. Lucy	Y	.	Y	Y
Barford loop	.	.	Y	Y
Barford	Y	(Y)	Y	Y
Warwick	Y	.	Y	Y

Y = Yes . = No

The separate scheme to link the Higher Avon with the Grand Union canal is outside the area of jurisdiction of Stratford District Council and, at the time of writing, is being prepared in support of Warwick District Council proposals for the River Leam.

Environmental issues

45. With 83% of the Higher Avon already fully navigable, just where exactly might lie the alleged potential environmental harm from putting into effect these changes that would enable craft to pass from the currently navigable Avon through to the Grand Union canal? The changes themselves can be identified:

a. The direct effects of boating and boaters
b. Maintaining a greater depth of water behind Alveston and Hampton Lucy weirs during the summer
c. The effects of a new weir at Barford
d. The construction of the locks and lock cuts

The direct effects of boating and boaters

46. This subject has been examined in some detail in relation to the continuously navigable Avon. What needs to be done now is to consider the situation on the Higher Avon itself, and the first matter is that of the numbers of boats. In paragraph 10 I noted that the number of boats using the busiest lock on the Avon in the busiest recent season was 9,638 although more recently the number had been about 5,500 while Evesham lock had recorded about 3,600. A new length of navigable waterway in the heart of England, passing such famous features as Warwick Castle and Charlecote Park, would be bound to attract a good deal of attention, at least during the first few years it was open. However, the recession has had an effect on boating so that for some time interest may not be translated into actual usage. UANT does not plan any boat bases for the Higher Avon and as there are no other guides to the boating activity the new navigation might generate, let us assume it would be higher than the current use of Evesham lock but less than that of the Avon's busiest lock in 1990 where local boats provided much of the activity, that is between 3,600 and 9,600, say 6,600 boat movements/year.

47. Much of the Higher Avon is wide and deep: the average cross sectional area is 53m^2 (Table 4). Referring 6,600 boat movements to the hypothetical canal of Murphy & Eaton gives 1,245 boat movements/year, much less than the 1,556 boat movements noted for the continuously navigated Upper Avon (paragraph 16), which has had so little effect on the river environment and the wildlife. By comparison with the navigable river, it must be concluded that 6,600 boat movements per year on the Higher Avon should have no perceptible effect on either the river or its wildlife.

Maintaining a greater depth of water behind Alveston and Hampton Lucy weirs

48. There is already deep water behind Alveston weir but towards Hampton Lucy there are small patches of river bed that would need to be dredged to provide a navigation channel of 1.2m depth. Implementing this summer-time measure would eliminate the need for this dredging. The effect on the environment would be minimal and not detrimental: it would, in fact, increase the amount of aquatic vegetation and the wildlife it supports by extending the area of wet ground during the summertime, which at present dries out after the higher waters of winter recede. Deep water is present also behind Hampton Lucy weirs where the miller already operates his own scheme to control the depth of water during the summer. Ensuring a greater head of water over the current weir crests during the summer-time would relieve the miller of that need and ensure navigable water up to the southern end of the proposed Barford canal. It might also be possible, through this measure, to restore a flow along the half-mile length of the old river course just above Hampton Lucy weirs, so providing for enhanced water quality and a new area of wet land habitat.

The effects of a new weir at Barford

49. This weir, which is at present only under consideration, would not be on the navigation channel and, therefore, it would not need to be by-passed by a lock. Below the upper Barford weir, along the proposed navigation channel, the river runs in a narrow, shallow, sinuous, overgrown channel for about 400 yards before the flow from the lower weir joins it, and for a further 400 yards the river remains too shallow for navigation. Some dredging would be needed, but in the absence of any other retaining mechanism, the dredging might also lower the water surface to an unacceptable degree. The purpose of the tentatively proposed weir, to be located downstream from where the Barford canal leaves the main line of the river, would be to restore the water level up to the foot of Barford weir to the present summer level. Inevitably the dredging would remove a small section of reeds and rushes currently occupying the navigation channel but I would expect the marginal vegetation to reestablish itself quickly, just as it did on the Upper Avon (paragraph 31).

The construction of locks and lock cuts

50. None of the proposed lock cuts would pass through ground of particular environmental sensitivity and, with the exception of the new Barford canal, they would all be short. Each would include, in addition to the lock itself, provision for mooring both above and below the lock, the opportunity for developing picnic sites and new lengths of fishing water. All this mooring would be off the course of the main river channel. Progressing upstream:

Alveston weir: the lock cut would be on the right bank, passing through regularly flooded, heavily scoured wooded land.

Hampton Lucy weir: the lock cut would be on the right bank across a field heavily overgrown with nettles.

Locations further upstream fall within the jurisdiction of Warwick District Council and have few implications environmentally. The longest of these new canals would be the proposed line of the half-mile-long Barford canal, on the left bank, crossing currently arable land and sheep pasture, and designed to be an effective and attractive screen between the village of Barford and the proposed new Barford by-pass.

51. What, then, is so unusual about the twelve miles of river between Alveston and Warwick and its wildlife that it can withstand the existing local boat traffic but it needs to be protected against the boats and boaters that do so little harm to the Lower and Upper Avon navigations?

WARNACT objections

52. The Warwickshire Nature Conservation Trust (WARNACT) published in 1978 a paper setting out the objections of the Trust to the proposed Higher Avon navigation.

Birds: Following a general statement on the range of habitats available for birds on the Higher Avon, all of which are equally available on the Upper Avon, the paper selected the case of the decline in numbers of the mute swan on the Upper Avon as being illustrative of the effect of navigation on the bird population. The paper even carried the statement "....it would be inappropriate and misleading to designate anglers as the major culprits in this matter", yet we all know now, from such accounts as Birkhead (1981) who showed that 44 (77%) of the 57 dead swans from the Avon examined between 1974 and 1980 had died from lead poisoning, that it was the anglers and their lead weights who were responsible for the decline, not the boaters (see also NCC 1981).

53. Plant Life: The WARNACT paper referred to the more uniform conditions said to be now prevailing on the Upper Avon and listed six species of plants said to be present above Alveston but "which have now markedly decreased or disappeared from the Upper Avon". I have no information on the frequency with which the plants occurred but in three of the cases these plants were so rare, at least in the vicinity of the study (although otherwise not rare), they could not be found even on the Higher Avon during a survey carried out by WARNACT (edited by Jeffray, 1980): in the other three cases they were found during the survey on both the Higher and the Upper Avon:

Species	Observation by Jeffray (1980)
Bogbean (*Menyanthes trifoliata*)	Neither Upper nor Higher Avon*
Flowering rush (*Butomus umbellatus*)	Neither Upper nor Higher Avon*
Spined hornwort (*Ceratophyllum* spp)	Neither Upper nor Higher Avon*
Sweet flag (*Acorus calamus*)	Both Upper and Higher Avon
White waterlily (*Nymphaea alba*)	Both Upper and Higher Avon
Gibbous duckweed (*Lemna gibba*)	Both Upper and Higher Avon (Genus only listed by Jeffray)

(*) I have not looked for either the bogbean or the spined hornwort but the attractive and easily recognised flowering rush is not uncommon elsewhere on the Upper Avon and can be seen readily.

54. The paper also noted that "an abundance of commoner and attractive aquatic plants such as arrowhead, branched bur-reed, various rushes and sedges, duck-weeds and pond-weeds are a feature of the Higher Avon". The paper could equally have been describing the continuously navigated Avon.

55. Fish: The paper listed 22 species of fish found on the Higher Avon and it went on to say: "Radical changes in the structure of the river-bed, water level, temperature, rate of flow and vegetation would seriously threaten the future of at least eight species on the above list and create unfavourable conditions for several others." However, despite the allegedly serious shortcomings of the Upper Avon, at least 19 of those 22 species are known also from the Upper Avon (Table 3). It is possible that the other 3 species (rudd, crucian carp, stone loach) are also present: entirely suitable habitats exist for the rudd and stoneloach, which have both been taken also on the Lower Avon, but the crucian carp is a fish of still or stagnant water and is tolerant of unfavourable conditions so it may not be found on the Upper Avon where the water flows freely and is of higher quality. However, it is of particular importance to emphasise that no radical changes to endanger the fish fauna are proposed in the Higher Avon scheme; the reaches would remain essentially unchanged, simply connected by locks to permit through navigation, while the ecologically important Barford shallows would be by-passed.

56. Insects: The paper identified no particular areas of concern over this group.

57. Mammals: The paper made reference to the dramatic decline of the otter in central, southern and eastern England and to the sighting of two otters on the Higher Avon in June 1976. Due to the work undertaken by the NRA, otters are again living on the continuously navigated Avon.

58. The paper then moved into an account of the effects that might result from the construction and operation of the navigation, to which I have already referred at some length and have shown to be quite groundless (paragraphs 17-32). Thus all the concerns and objections of WARNACT to the Higher Avon scheme can be seen to amount to nothing at all substantial.

Comparative observations on the Higher Avon and the Upper Avon

59. During 1991, at the request of UANT, I began to explore the possibility of conducting independent environmental studies on the Higher Avon. I held discussions with the staff of the Biological Sciences Department of Coventry Polytechnic who were prepared initially to consider supervising the work of undergraduate students. The scheme had to be abandoned, however, because a number of riparian owners to whom I wrote refused permission for even an exploratory passage by dinghy. I have, therefore, no independent data to offer on the Higher Avon: all the information on the Higher Avon quoted in this account is from other sources.

Water quality

60. A consideration of the present condition of the Higher Avon would be incomplete without some mention of the recent history of the river, to which I have already alluded in paragraph 34. The Avon has a large (civilian) population in the upper catchment. Under dry weather conditions the sewage effluent derived from these settlements provides 80% of the flow downstream to the confluence with the River Sowe (even as far downstream as Tewkesbury the proportion is still 40-50%: NRA 1994a p8). If sewage effluent is of high quality the major problem lies in the stimulus to organic productivity by the high concentrations of fertilisers it contains (nitrates, phosphates) some of which productivity may be undesirable (eg blue-green algae). However, 25 years ago the quality of the effluent was low: the animal wildlife of the higher river had become greatly depleted and the fish stocks greatly reduced. Even in 1976, caged fish placed in the Finham effluent channel to test the quality of the water were all killed within 24 hours. Because of this organic pollution, the quality of the Avon water between Rugby and Stratford, which includes all the Higher Avon, has never been good enough to allow for its designation as a cyprinid (carp) fishery under EEC directives. Although there has been some improvement in water quality as a result of the refurbishment of the sewage treatment works in Coventry, Rugby and Warwick in recent years, and the fisheries have recovered to some extent, the Rugby to Stratford reach is still not a designated cyprinid fishery, whereas downstream of Stratford the quality of the water is higher due entirely to the natural processes of regeneration, and all the navigated length from Stratford through to Tewkesbury is a designated cyprinid fishery (NRA 1994a). A recent survey (NRA 1994b) confirmed that the water of the navigated Avon between Harvington and Evesham (Upper Avon) was of the highest quality recognised (Class 1a): dissolved oxygen levels were above 88% saturated at Twyford, while at Barford on the Higher Avon the level was only above 61% (Class 1b).

Highly ranked ecological sites

61. A WARNACT paper of 1975, an ecological survey of the Avon, the Arrow and Stratford on Avon canal, provided a detailed listing of highly rated ecological sites on a part of the Upper Avon and the full length of the Higher Avon. It graded the sites; "Outstanding" being a site ranking highly in national or regional importance and including all the Sites of Special Scientific Interest (SSSI) through to "Fair", a site already much affected by man's activities but retaining some general wildlife importance:

	Numbers of sites			
	All sites		R. Avon aquatic sites	
Site rating	Upper Avon (14 miles)	Higher Avon (12 miles)	Upper Avon (14 miles)	Higher Avon (12 miles)
Outstanding	3	0	0	0
Prime[+]	6½	2½	2½	1½
Good	12	6	11	2
Fair	2	2	2	0
Total	23½	10½	15½	3½

([+]) One site shared between the Upper and the Higher Avon

It will be seen that the navigated Upper Avon supports more sites of all types than the Higher Avon, even allowing for the greater length, and many more of the purely aquatic sites.

62. A recent (October 1994) check with the NRA of the water-dependent SSSI's within the whole Avon catchment revealed a total of 60. Of these, 11 were either beside or within the River Avon itself (eg on islands), with the following distribution:

Higher Avon 0
Upper Avon 1
Lower Avon 10 (These 10 sites included all the main river sites referred to in paragraph 30)

This proves once again that navigation is not inimical to even the most sensitive wildlife.

63. Referring back to the 1975 WARNACT paper quoted in paragraph 61, it also made a number of general comments on the high quality of habitats on the Upper Avon, such as with regard to two of the prime sites (p11): "a rich and undisturbed habitat" and "important bird roost: many rarities recorded". Also on good sites (p12,13): "an astonishingly rich and pleasant area", "excellent habitat for birds", "a good area for wildlife", and "valuable habitat for birds", yet the paper concluded that the Higher Avon was much richer than the Upper Avon (p10), that the greater part of the Upper Avon was ecologically dull (p13), and that "to render the Avon navigable to Warwick would have far-reaching and undesirable results on the wildlife" (p10). Those conclusions were simply not consistent with the facts quoted in the paper which gave no justification whatsoever for its pejorative stance (but because it emanated from a supposedly reputable authority it was likely to be believed by those who did not have enough time to read the paper in detail or by those not able to judge for themselves).

64. Both UANT and LANT are very conservation conscious (see paragraphs 30, 31). In view of the interests of the majority of those who take holidays on the inland waterways referred to in paragraph 9, it would be totally contrary to the interests of UANT to support a scheme that was environmentally harmful: in this respect, the interests of UANT coincide with WARNACT.

Higher Avon ecological survey

65. The most detailed account of the flora of the Higher Avon of which I am aware is that edited by Jeffray, 1980. I know of no similar study of the Upper Avon but the Jeffray study extended on to the Upper Avon for 6 miles, through Stratford and downstream to Luddington. The study involved the analysis of sample sites chosen at random in a series of 0.5km lengths. There was an interruption in this series upstream of the Higher Avon but the series was continuous through the Higher Avon and downstream on the Upper Avon to Stratford weir. There was then a further unexplained interruption, of about 1½ miles to the confluence of the Avon with the Stour, when three more 0.5km lengths were sampled. In total there were 39 sample sites: 4 were upstream of the Higher Avon, 21 were on the Higher Avon and 9 were on the Upper Avon. Of these 9, 4 were upstream of Stratford, 2 were in Stratford and 3 were downstream of the Stour confluence. A further 5 sites were off the main line of the Avon, on the Sowe, Leam, Dene and Stour.

66. The larger plants of the river margin and up to 2 metres up the river bank were identified and counted and a floristic index was established based on the abundance and rarity of the species. The highest floristic index observed (154) was at Tiddington on the continuously navigated Upper Avon: the lowest floristic index (59) was in Stratford, not surprisingly where the banks are protected and are heavily trampled by residents and visitors alike, but even so the index there was only a little lower than Charlecote Park (66), on the Higher Avon. The authors summarised their observations on the floristic index by identifying three areas which they considered to be of particular conservation value. Two of these were on the Higher Avon; the third was on the navigated Upper Avon, in the vicinity of Tiddington, already mentioned as having the highest floristic index.

67. A second test undertaken by the authors to assess the conservation value of the sites was to determine the species richness (the numbers of species per unit area). Most of the sites with the highest values were along the Barford loop, which, it is proposed, would be by-passed by the navigation. The lowest value was in Stratford, again not surprisingly, but three other areas were identified with a low value, all on the Higher Avon: no common factor to explain the paucity of these four areas was found but navigation was clearly exonerated.

68. A third test conducted by the authors was to determine the similarity of sample areas, testing the terrestrial and the aquatic species separately, and again, as one would expect, the site in Stratford with its protected banks was found to be unusual for both types of vegetation.

69. The authors of the Jeffray report also undertook analyses of some of the larger invertebrate animals such as the snails, mussels, worms, leeches, crustaceans, insects and insect larvae. The graph they produced of the variation in species richness showed low levels upstream of the Higher Avon, fluctuating but generally increasing levels along the Higher Avon, and high

levels on the Upper Avon except for the two stations in Stratford where the richness was lower and approximated to that of some of the less abundant stations on the Higher Avon. Other graphs, of indices of diversity and biotic indices, confirmed that the Upper Avon water, even in Stratford with its protected banks, is equally as rich in invertebrate life as the rural Higher Avon, if indeed not richer.

70. The authors then went on to use their data to make comparisons between "navigated" and "unnavigated" reaches of the Avon, but there is some doubt whether they were altogether clear about the limits of navigation. On page 43 they noted that 8 of the 0.5km lengths were on the navigated river and 23 lengths were unnavigated, but that is just not true (paragraph 65).

71. Of much greater significance was the authors' comparison of the frequency of the truly aquatic plants of the "unnavigated" and "navigated" reaches. This comparison must be criticised from the beginning because of the great disparity in the observations of the navigated and the unnavigated river habitats: only 9 of the 39 sample sites were on the continuously navigated Avon. However, their Figure 6.10a is a valuable indication of the great influence of the protected banks of Stratford on the relative scarcity of plants in that reach, but the authors were quite wrong to attribute that scarcity to navigation (p43: "As the two reaches apparently differ significantly only in the presence or absence of pleasure boating, a logical interpretation is that navigation directly reduces macrophyte frequencies, probably due to a reduction in habitat diversity."). The river banks in Stratford were protected at least half-a-century before the river was re-opened to through navigation in 1974, and even before that, as old turn-of-the-century photographs show, the river banks in Stratford were equally as devoid of aquatic marginal vegetation as they are today. The Jeffray Report could have made roughly the same comparison of the vegetation of the same geographical locations, with the same result, any time during the previous eight decades, and all the conclusions with respect to the contrast between the navigated and unnavigated river, repeated by Smith (1982), are thus quite valueless. Had the authors wished to make a serious contribution to the study of navigation and wildlife, they should have selected at least an equal number of similar sites and they should have discounted Stratford totally.

Fish and fisheries

72. I know of only one recent objective analysis of fish populations bearing on the comparison of the navigated with the unnavigated Avon, namely NRA 1994b. In 1993 the NRA received complaints of a deterioration of match angling results in the Evesham area. In their report, NRA confirmed the decline and noted that the average angling returns for all reaches recently had been 148g/angler/hour (1990), 120g (1992) and only 73g at the start of the 1993 season (these figures may be compared with those quoted in Table 2). There were, however, some exceptions, and they identified Bredon and Twyning, both on the Lower Avon. NRA undertook an investigation which included electric fishing at 26 sites from Barford (Higher Avon) to Eckington (Lower Avon), continuous dissolved oxygen monitoring at Barford (Higher Avon) and Twyford (Upper Avon) and invertebrate sampling. Unfortunately, because the centre of interest was Evesham, most of the observations were on the navigated Avon but there were some Higher Avon observations for comparison.

Fish population composition: The breakdown of the catches is given in Table 3. This shows clearly that, while there may well be many species of fish in the river, only a few species dominate the populations. Even this 1993 breakdown is somewhat unusual because, depending of course on the reach and the method of fishing, chub, dace and roach, about equally, frequently constitute the largest proportion of the catch, possibly over 90%, with the balance being made up of predatory fish, perch and pike.

Fish growth rates: The growth rates of roach, chub, dace and bleak were all found to be above average for the Severn Trent Region. So far as feeding was concerned, although no note was taken of Higher Avon fish, all the coarse fish of the navigated Avon that were examined "were found to have been feeding well". This is in line with three surveys of invertebrates (fish food organisms) carried out by the NRA in 1993 when it was concluded that invertebrates were "diverse and abundant at most sites". The two sites with the poorest invertebrate fauna were both upstream of the Higher Avon.

Fish biomass: This was recorded in grammes per square metre. 6 observations on the Higher Avon had the range 0.3 to 12.6g/m^2 (the Barford loop). If the fish populations of the navigated Avon were truly as poor compared with the Higher Avon as Smith (1982) contended, one would have expected a number of the 21 observations on the navigated Avon to be below the 0.3g/m^2 recorded on the Higher Avon, but the lowest of the 21 observations was 1.0g/m^2 while the highest was 141.3g/m^2 (Marlcliff). There may have been some exceptional circumstance in the high Marlcliff catch but three other Upper Avon catches exceeded Barford (Pilgrim lock 54.6, Harvington 17.6, Barton 14.6) and one other was close (Twyford 12.3g/m^2).

73. These observations serve to confirm just how much more abundant are the fish of the Upper Avon than the Higher Avon.

Birds

74. The British Trust for Ornithology (BTO) is conducting a waterways bird survey and, since 1991, observations have been made on the bird fauna of one 3.1km length of the Higher Avon and one 3.4km length of the Upper Avon. A further length of the Upper Avon, of 4.6km, has been included in the programme since 1992. The survey involves a number of visits to each length by an observer (or observers) who marks the identity and location of every bird seen or heard on a map; thus the nature and location of individual breeding territories can be identified. For most species it can be assumed that a territory is occupied by a single breeding pair of birds. The BTO data are shown in Table 5 and are of particular value in view of the harm that Smith (1982) alleged would result to the bird fauna of the Higher Avon should navigation be permitted.

75. As with the Avon fish fauna, a straightforward view of the species composition shows that the bird fauna of the continuously navigated Upper Avon is very similar to that of the intermittently navigated Higher Avon: the heron, mute swan, Canada goose, mallard, moorhen, lapwing, kingfisher, sedge warbler, reed warbler, whitethroat and reed bunting are all well represented. If one compares the total numbers of species by the standard of species per kilometre the Higher Avon and the Upper Avon are the same, 4.4 species/km and both parts of the river experienced a "good" year in 1992. 20 years of continuous navigation on the Upper Avon would seem to have had no dire effect on the bird fauna. However, there are some differences between the faunas, and they favour the Upper Avon.

76. Twelve species have occurred only intermittently during the BTO survey: one, the teal, was observed only on the Higher Avon; two, the grey wagtail and the herring gull, were observed on both the Higher Avon and the Upper Avon; the remaining nine, the little grebe, tufted duck, snipe, grasshopper warbler, greylag goose, common tern, pochard, black swan and white-cheeked pintail were observed only on the Upper Avon. Even taking into consideration the differences in length (3.1km along the Higher Avon against 8km along the Upper Avon) it is apparent that navigation and the presence of boats and boaters has not been, and is not, a deterrent to these less common birds.

77. Some of the birds listed in Table 5 warrant further attention:

Little grebe (dabchick): Smith (1982 p12) noted that this species is shy and very sensitive to disturbance, that the floating nest requires vegetation for support and is very vulnerable to water surface movement, and that in contrast with the situation on the Higher Avon the "Upper Avon has very few pairs and they fail to breed successfully", yet the only two observations of the little grebe in the BTO survey have been on the Upper Avon.

Grey heron: heron most frequently nest and breed in trees, some distance from water. Smith noted that quiet and secluded riverside shallows are essential for this shy species to find food but that these conditions do not obtain on the Upper Avon. The BTO data prove this is not the case and as everyone who cruises the Avon knows, heron are a regular feature of the cruising day.

Teal: teal often nest on moors or bogs, well away from open water. Smith referred to this species as a winter visitor: it is likely to be present, therefore, only when there is virtually no boating activity.

Mallard: Smith noted that this species is a prolific and resourceful breeder and that it is found on the Upper Avon in large numbers, "imparting an impression to the average boat enthusiast that the Upper Avon "teems with wildlife"". In point of fact, BTO data show that the Higher Avon has twice as many mallard per kilometre as the Upper Avon, 7.1 breeding pairs per kilometre compared with 3.6/km for the Upper Avon.

Tufted duck: the breeding population of the tufted duck in Britain has increased rapidly in recent years. Smith noted that while this species colonised a part of the Upper Avon after the dredging to create the navigation, it "had to leave as soon as boats came through due to disturbance", yet BTO observations show the tufted duck to be present on the Upper Avon, but missing from the Higher Avon.

Moorhen: the population of this species on the Upper Avon was reported by Smith to be "relatively miserably depleted compared to the Higher Avon due to interference by both disturbance of sitting birds and swamping of nests by boats' wash and lack of sites for nest, display and brood platforms", yet the BTO data prove that the Upper Avon has twice as many moorhen per kilometre as the Higher Avon, 2.1 breeding pairs per kilometre against 1.1/km for the Higher Avon.

Coot: the imposition of lower water levels on UANT and the Upper Avon means that much of the river is more confined within steep banks than either the Lower Avon or the Higher Avon (Table 4). The effect of this can be seen in the distribution of the coot, which prefers large, open stretches of water and which is, therefore, more numerous on the Higher Avon.

Common sandpiper: Smith referred to this species "feeding on passage on the shingle spits of lowland rivers" "which would be entirely removed by dredging". Dredging does not remove such habitats, which are still to be found on the Upper Avon along with a wide variety of other habitats, and the sandpiper continues to be well represented.

Kingfisher: Smith was concerned about the disturbance likely to arise from navigation in respect of the two basic requirements of the kingfisher, namely undisturbed vertical banks for a nest site and an opportunity to perch undisturbed above its fishing sites. Clearly the Upper Avon still provides for these requirements, in proof of which the kingfisher is also a regular feature of Avon cruising.
Sedge warbler: Smith stated that this species "is more plentiful on the Higher Avon, mainly because of the more luxuriant aquatic vegetation". The BTO data clearly refute that claim. No breeding sedge warbler were found on the Higher Avon although there were many breeding pairs on the Upper Avon, convincing proof of the high quality of the Upper Avon aquatic vegetation.
Reed warbler: noting that reed bed (*Phragmites*) margins are an essential feature of reed warbler territories, Smith (1982) went on to say that such beds are "a scarce component of riverside vegetation on the Upper Avon" and that the "relative scarcity of records since the restoration of navigation on the Upper Avon confirms this". Again, BTO data totally refute that claim.
Reed bunting: Smith acknowledged that this species breeds along both the Upper and Higher Avon. BTO data show it to be very much more abundant on the Upper Avon, further proof, if any were needed, of the high quality of the aquatic vegetation of the continuously navigated river and that navigation is not inimical to wildlife.

78. **The inevitable conclusion from this BTO data, brief though the period of observations may have been, is that the bird populations of the continuously navigated Upper Avon are equally as good as those of the Higher Avon, if not better, and that all suggestions of possible disturbance, or of actual harm, due to the passage of boats are and have been grossly over-exaggerated**.

CONCLUSION

79. To answer the question posed in paragraph 51, excepting the shallows of the Barford loop, which would be by-passed by a new canal, the Higher Avon is an impounded river just like the continuously navigated Avon: there is nothing in any way unusual about the Higher Avon and its wildlife and there is no reason why anyone should seriously oppose the extension of navigation on environmental grounds.

80. The Higher Avon is **not** a natural lowland river but one that runs through channels that are substantially man-made and managed. The scheme to render the river navigable through to Warwick is simple in engineering terms and would have minimal effect. The water of the Higher Avon is of lower quality than the navigated river and although it is better now than it was, for decades the poor quality of the Higher Avon water was reflected in other aspects of the environment, the low populations of invertebrates and fish in particular. The banks of the Higher Avon and the terrestrial and aquatic vegetation are neither more nor less than a continuation of the Upper Avon: the sites of outstanding ecological importance are far fewer in number and of no greater consequence than those of the continuously navigable Avon: the invertebrate life is increasingly rich downstream towards and into the Upper Avon as the water quality improves, while both the fish and bird populations of the Higher Avon are inferior to those of the continuously navigated river.

81. The high quality of the wildlife on the continuously navigated Avon proves conclusively that the alleged harm inflicted on the wildlife of the Avon by navigation is quite untrue, that the problem of the general disturbance to wildlife from navigation has been greatly exaggerated, that boating and wildlife can co-exist in harmony and that the wildlife of the Higher Avon has nothing to fear from the extension of navigation through to Warwick.

82. Reduced access by the general public to many parts of the Higher Avon was quoted by Jeffray 1980 and Smith 1982 as being important in maintaining the quality of the wildlife. While not wishing to discourage all those who enjoy walking in the countryside and along river banks, nevertheless if the river and its wildlife is to be appreciated, boating is the least harmful way in which this can be done.

83. In summary, the Upper Avon is ecologically superior to the Higher Avon. The Upper Avon environment and the wildlife it supports are unharmed by navigation. The Higher Avon has nothing of outstanding environmental merit that might be harmed by the Higher Avon scheme or by either boating or boaters, while the Higher Avon flora and fauna are essentially the same as the Upper Avon and would be equally as unaffected as that of the Upper Avon.

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84. My grateful thanks are due to:

- the Tewkesbury office of the National Rivers Authority, who have provided me with data on the fisheries of the Severn and the Avon over many years, and survey data on the Avon and the Leam.
- the British Waterways Board, for survey data on several canals including the Southern Stratford canal.
- the British Trust for Ornithology, for bird survey data from the Higher and Upper Avon.

Table 1. The Status Categories of the International Union for the Conservation of Nature and Natural Resources (IUCN 1983).

Extinct (Ex)	Species not definitely located in the wild during the past 50 years.
Endangered (E)	Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.
Vulnerable (V)	Taxa believed likely to move into the "Endangered" category in the near future if the causal factors continue operating (over-exploitation, extensive destruction of habitat or other environmental disturbance - may include taxa with populations which are still abundant but are under threat from severe adverse factors throughout their range).
Rare (R)	Taxa with small world populations that are not at present "Endangered" or "Vulnerable", but are at risk (taxa usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range).

Categories below this line do not constitute a part of the series of reducing degrees of rarity but contribute to the general description of rarity.

Indeterminate (I)	Taxa known to be "Endangered", "Vulnerable or "Rare" but where there is not enough information to say which of the three categories is appropriate.
Out of Danger (O)	Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken or the previous threat to their survival has been removed.
Insufficiently Known (K)	Taxa that are suspected but not definitely known to belong to any of the above categories, because of lack of information.
Commercially threatened (CT)	Taxa not currently threatened with extinction but most or all of whose populations are threatened as a sustainable commercial resource, or will become so unless their exploitation is regulated.
Threatened Community (TC)	A group of ecologically linked taxa occurring within a defined area, which are all under the same threat and require similar conservation measures.
Threatened Phenomenon (TP)	Aggregates or populations of organisms that together constitute major biological phenomena, endangered as phenomena but not as taxa.

Table 2. A comparison of Milcote on the Upper Avon with the Avon generally and with four reaches of the Severn, based on results of organized angling competitions monitored by the Severn-Trent Water Authority.

Season	Catch (grammes[1]/man/hour)					
	Milcote	Avon	Upper Severn	Mid Severn 1	Mid Severn 2	Lower Severn
1978-79	109	77	46	114	125	92
79-80	121	89	107	134	113	108
80-81	135	72	75	149	105	86
81-82	112	81	91	167	122	105
82-83	170	91	82	176	127	141
83-84	138	101	124	174	137	183
84-85	187	125	115	173	93	168
85-86	186	91	153	209	124	142
86-87[2]	197	na	na	na	na	na

Notes: Avon - Lower Avon: Bredon, Charlton, Cropthorne, Mythe Farm, Twyning, Pershore
- Upper Avon: Milcote, Seven Meadows
Upper Severn : Underdale, Buildwas, Cound Lodge, Atcham
Mid Severn 1 : Knowle Sands, Eardington, Highley, Arley, Quatford
Mid Severn 2 : Grimley, Hallow, Holt Fleet
Lower Severn : Severn Stoke, Uckinghall, Ripple, Upton (BAA), Upton (STWA)

(1) 454 grammes = 1 lb
28.35 grammes = 1 oz
1.0 metre = 39.37 inches = 3.28 ft

(2) June to December only

Table 3. Fish from the Higher and Upper Avon.

Note	Species	Higher Avon (Smith 1982)	Upper Avon	1993 species composition percentage by numbers (")
	Brown trout *Salmo trutta*	Y	Y	
	Rainbow trout *S. gairdneri*	Y	Y	
	Pike *Esox lucius*	Y	Y	2
	Roach *Rutilus rutilus*	Y	Y	71
	Dace *Leuciscus leuciscus*	Y	Y	
	Chub *Leuciscus cephalus*	Y	Y	4
	Minnow *Phoxinus phoxinus*	Y	Y	
1	Rudd *Scardinius erythrophthalmus*	Y		
	Tench *Tinca tinca*	Y	Y	
	Gudgeon *Gobio gobio*	Y	Y	6
	Barbel *Barbus barbus*	Y	Y	
	Bleak *Alburnus alburnus*	Y	Y	3
	Bream *Abramis brama*	Y	Y	
	Crucian carp *Carassius carassius*	Y		
	Carp *Cyprinus carpio*	Y	Y	
	Mirror carp *Cyprinus carpio var.*	Y	Y	
2	Stone loach *Noemacheilus barbatulus*	Y		
	Eel *Anguilla anguilla*	Y	Y	8
	Perch *Perca fluviatilis*	Y	Y	2
	Ruffe *Gymnocephalus cernua*	Y	Y	
	Bullhead *Cottus gobio*	Y	Y	
	Three spined stickleback *Gasterosteus aculeatus*	Y	Y	
3	Zander *Stizostedion lucioperca*		Y	1
3	Spined loach *Cobitis taenia*			
4	Grayling *Thymallus thymallus*			
5	Salmon parr *Salmo salar*			

Y = Yes, present

Notes

1 Recorded from the navigable Avon eg Hampton Ferry, Twyning
2 Recorded from the Navigable Avon eg Hampton Ferry
3 Not confirmed on Higher Avon. The zander is likely to be present on the Higher Avon as it has been found both upstream and downstream of the Higher Avon.
4 Not confirmed on the Higher Avon: susceptible to pollution and therefore more likely to be found in the Harvington-Evesham reach of the Upper Avon where the highest water quality is to be found.
5 Not recorded by Smith but recorded from the navigable Avon at many places.

(") Please refer also to paragraph 72.

Table 4. Widths of river sections and cross sectional areas (based on NRA data, sections along each reach being about 1000m apart).

River section	Width (m)	Width (ft)	Area (m^2)	Overall average area (m^2)
Higher Avon				52.9
Leam confluence to Warwick Castle	29.0	95	66.3	
Warwick Castle to Barford	28.6	94	70.0	
Barford to Hampton Lucy	22.7	74	36.2	
Hampton Lucy to Alveston	26.5	87	39.1	
Upper Avon				45.1
Alveston to Clopton Bridge	22.2	73	30.3	
Clopton Bridge to Stratford weir	44.2	150	70.3	
Stratford weir to Weir Brake	43.9	144	52.0	
Weir Brake to Luddington weir	27.2	89	34.7	
Luddington weir to Welford weir	30.1	99	52.8	
Welford weir to Pilgrim weir	24.1	79	27.0	
Pilgrim weir to Barton weir	28.1	92	48.6	
Barton weir to Marlcliff weir	26.5	87	44.5	
Marlcliff weir to Harvington weir	31.8	104	57.8	
Harvington weir to Anchor Meadow	25.0	82	50.4	
Anchor Meadow to Evesham weir	28.4	93	53.7	

On the Lower Avon, within 2km of Strensham weir the cross sectional area varies between $65m^2$ and $130m^2$

Table 5. Birds from the Upper and Higher Avon (Based on data from the British Trust for Ornithology).

	Upper Avon Ref 409*		Upper Avon Ref 275*			Higher Avon Ref 397*		
Species	1992	1993	1991	1992	1993	1991	1992	1993
Little grebe	Y	.	.	Y	.	.	.	.
Grey heron	Y	Y	Y	Y	Y	Y	Y	Y
Mute swan	1	1	2	Y	Y	2	1	1
Canada goose	8	8	1	5	1	1	3	2
Teal	.	.	.	.	.	.	Y	.
Mallard	13	14	13	18	11	22	27	17
Tufted duck	Y	.	Y	Y	.	.	.	.
Moorhen	16	14	5	3	2	3	4	3
Coot	Y	.	.	1	.	5	2	.
Lapwing	Y	.	1	Y	2	Y	Y	.
Snipe	Y	.	.	.	.	.	.	.
Common sandpiper	.	Y	Y	Y	.	.	Y	Y
Black-headed gull	Y	Y	.	Y	.	Y	.	Y
Kingfisher	Y	Y	1	2	2	1	1	1
Yellow wagtail	Y	Y	Y	.	.	.	Y	.
Grey wagtail	.	1	.	.	.	Y	Y	.
Pied wagtail	Y	.	Y	.	Y	.	Y	.
Grasshopper warbler	Y	.	.	.	.	.	.	.
Sedge warbler	11	8	5	9	6	.	Y	Y
Reed warbler	Y	3	2	Y	3	Y	1	.
Whitethroat	1	2	2	.	2	Y	2	1
Reed bunting	7	7	4	Y	6	.	Y	Y
Lesser black-backed gull	Y	Y	.	Y	.	.	.	.
Herring gull	Y	.	.	.	.	.	.	Y
Greylag goose	Y	.	.	.	.	.	.	.
Common tern	.	.	Y	.	.	.	.	.
Pochard	.	.	.	1	.	.	.	.
Black swan	.	.	.	Y	.	.	.	.
White-cheeked pintail	.	.	.	Y	.	.	.	.
Number of observer visits	9	9	13	8	9	9	11	11
Observation period (notes)	A	A	A	B	C	A	A	A
Number of species	22	15	16	19	12	12	17	12
Species per kilometre	4.8	3.3	4.7	5.6	3.5	3.9	5.5	3.9

(*) Ref 409 Upper Avon: 4.6km length, Bidford-on-Avon to Harvington.
Ref 275 Upper Avon: 3.4km length, Welford-on-Avon to Bidford Grange.
Ref 397 Higher Avon: 3.1km length downstream from the M40 bridge.

. = No observation
Y = Yes, present but not breeding
Numeral = Numbers of territories (usually breeding pairs)

Observation period notes:
A March to July
B March to May
C April to July

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