Book reviews

Amphibians and reptiles of Surrey. Julia Wycherley and Richard Anstis. Surrey Wildlife Trust, Woking. 2001. 112 pp., £13.00 hardback. ISBN 0 9526065 6 9.

This publication is the seventh in a series of county atlases produced by the Surrey Wildlife Trust. Previous atlases have been well received by the relevant specialist groups giving this latest work a high standard to live up to. That it exceeds this standard is due entirely to the experience of the authors and their long-standing association with the county, together with the strength of the Surrey Amphibian and Reptile Group.

The book is, however, much more than just a standard county atlas. In addition to the usual species accounts that comprise around half of the text, there are substantial introductory sections about the county, its geology, dinosaurs, pond history, a study about pond loss, a summary of national herpetofauna, biology of the taxa, surveying and recording, conservation and garden habitats.

Particular mention must also be made of the excellent thirty-two colour plates, each with two photographs, illustrating the twelve native British species, all of which have been recorded since 1980 in this important county for amphibian and reptile conservation.

In summary, this book represents a mammoth recording effort to achieve the level of coverage shown on the tetrad distribution maps for each species and the work stands as a testament to achievements of the thriving Surrey Amphibian and Reptile Group without whose data the atlas would never have reached publication. This book is a highly recommended read for anyone with a passing interest in herpetofauna and it deserves a place on the shelf of any naturalist with a connection to the county of Surrey.

CLIVE HERBERT

Mammals, amphibians and reptiles of Hertfordshire. Michael Clark. Hertfordshire Natural History Society in association with Training Publications Limited, Watford. 2001. 311 pp., paperback £20.00. ISBN 1 84019 012 4.

At first glance this book appears to be one more in the stable of an ever-growing number of county atlases but it is, in fact, unique in several aspects. Firstly, as the title suggests, it combines herpetofauna with mammals, and this has been achieved with success although the author is perhaps best known as an extremely experienced and knowledgeable mammalogist with a long association with the county and its natural history society.

Secondly, it is more than just a standard county atlas with the usual series of tetrad distribution maps. There are, for instance, numerous photographs throughout the work, often up to six per page, which enliven the species accounts that form the majority of the book. The species text covers the distribution and status data that you would expect in any such work but also includes some unusual records and numerous anecdotes to make this an exceptionally entertaining read.

Unusually, the author has taken the opportunity to profile various individuals connected with mammals and herpetofauna over the past decades and this successfully adds to the overall interest of the book. It does not detract, however, from the primary purpose of documenting these animals in the county since records began and to provide an extremely comprehensive reference book.

There is also a useful introductory section about Hertfordshire and the book ends with nearly a hundred pages covering topics as diverse, yet relevant, as farming and game rearing, extinct species, conservation and management, recording and no less than nine appendices, including a section on LNHS mammal records from that part of the county within our recording area. As well as providing a detailed historical record, including the relevant sections of the Victoria County History, it is also up to date with reference to the county Biodiversity Action Plan and forthcoming *Red Data Book*, together with an extensive and well-researched bibliography.

In summary, the book is an essential read for anyone interested in the species groups covered or the county and deserves to be widely read. An extraordinary amount of effort has gone into producing this work by both the publisher (their first and hopefully not last foray into natural history books) and the author — a true 'labour of love' that will stand the test of time and become a key reference for many years into the future.

CLIVE HERBERT

Fish diversity in the River Thames

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Abstract

One hundred and twenty species of fish have been identified from the River Thames according to surveys of the river by the Environment Agency (tidal Thames survey 1992–2001 and lower freshwater Thames survey 1995–2001). This diversity includes species of conservation importance, notably sea lamprey, lampern, twaite shad and smelt in the tidal Thames. Non-indigenous fish such as grass carp are now found in the lower river. Sea lamprey appears to have made an annual spawning attempt at Barnes in the upper estuary since 1999. This is the first reported spawning of sea lamprey in the Thames catchment this century. Marine and estuarine species of fish displayed marked seasonal migrations and patterns of distribution. Information acquired in the surveys is being used to inform fisheries management policies.

Introduction

The decline of fish populations in the River Thames in the late nineteenth century and their return as a consequence of improved control of organic and thermal pollution has been well documented (Wheeler 1958, 1969, Marlborough 1972). The dissolved oxygen content of the water has increased and is maintained by use of the 'Thames Bubbler' system during deoxygenating water quality incidents. The 'Thames Bubbler' is operated by the Environment Agency and Thames Water UL and can inject up to thirty tonnes of oxygen per day into selected regions of the river (R. Oatley pers.comm.).

Regular monitoring of the Thames in the last two decades by the former Thames Water Authority (Andrews and Rickard 1980, Pilcher 1989), former National Rivers Authority (Thomas 1989, 1995) and Environment Agency (Colclough et al. 1999), in addition to work by university research teams (e.g. Araujo et al. 1999), has shown that the river now supports a diverse community of resident and migratory fish species. This paper presents a summary of fish records collected from 1992 to 2001 and describes trends in patterns of fish distribution and seasonal migrations.

Data sources

Over the last decade, fisheries officers and biologists from the South East Area of the Environment Agency, Thames Region have collaborated with other organizations to conduct an extensive survey programme of the River Thames. The marine, brackish and freshwater sections of the tidal Thames (Figure 1) have been surveyed by the Tideway Fisheries team of the Agency from 1992 to date (Colclough et al. 1999). The power station monitoring work reported by Thomas (1995) ceased in 1994. The Environment Agency has collaborated with CEFAS in an annual autumn trawling programme since 1997 (Colclough pers. comm.).

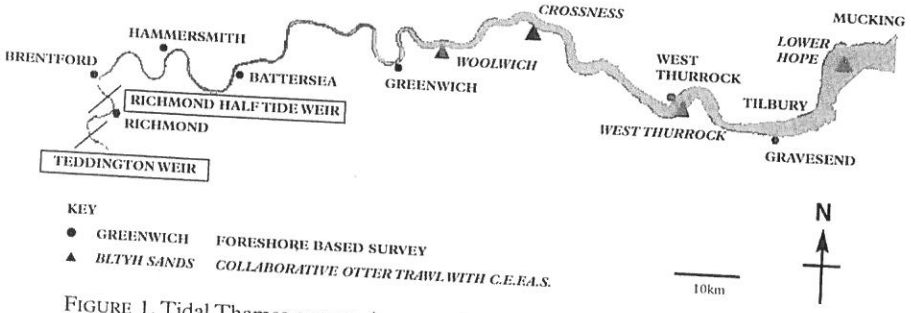

FIGURE 1. Tidal Thames survey sites sampled during the period 1994–2001. Teddington to Battersea is considered as a freshwater zone, Battersea to Mucking as a euryhaline zone and Mucking onward is fully marine. These are artificial boundaries in a dynamic continuum.

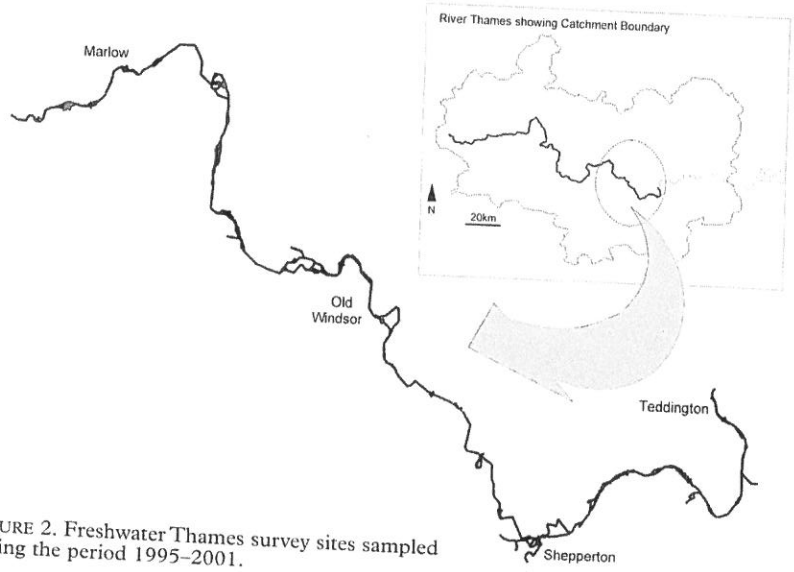

FIGURE 2. Freshwater Thames survey sites sampled during the period 1995–2001.

The lower freshwater Thames (Figure 2) has been surveyed by fisheries staff of the Environment Agency, Thames Region and its predecessors since 1995. The regular monitoring of the freshwater Thames and its tributaries are documented in a series of Environment Agency survey reports (Butterworth and Sheridan 1995, Sheridan 1999), angler surveys (Clough et al. 1999, Went 1999) and juvenile fish surveys commissioned by the Agency (KES 1998, 1999, 2000).

Sampling methods

Tidal Thames sampling

Eleven shingle foreshore sites between Teddington and Greenhithe were surveyed once a quarter for five quarters over the period May 1992 to September 1993 to establish the seasonality of fish movements in the estuary. This information permitted a rationalization of the survey programme. Since 1994 six sites between Richmond and West Thurrock have been surveyed twice a year in May/June and September/October at slack water low tide. Sites were fished using a standard combination of three techniques. Shore seine netting from a boat sampled fry and small fish species with a 5-mm knotless mesh net (35 × 2 m) and larger more active species with a 10-mm knotless mesh net (50 × 2.5 m). Boat beam trawling with a 2-m beam trawl was used to capture demersal species. One-minute timed kick sampling of the river bed with a standard biological hand net (1-mm mesh) sampled small fry and larvae. Twin otter trawls with a 5-mm knotless cod end were deployed at twelve stations from Woolwich to Southend during the annual autumn trawling programme in collaboration with CEFAS, an agency of the Department for Environment, Food and Rural Affairs (DEFRA).

Lower freshwater Thames sampling

A variety of sampling techniques was employed to overcome difficulties associated with the scale of the river environment. Electric fishing provided information on fish species present and was carried out using a specially designed 'boom boat' with large anodes fixed to booms which were lowered into the water. Specialized acoustic (hydroacoustic, sonar) methods enabled quantitative estimates of abundance and information on size distribution. Juvenile fish were sampled using a fine-meshed seine net. Other sampling methods employed include angler catch assessment and trapping.

Results and discussion

Tidal Thames

Diversity and conservation species

Table 1 lists 119 fish species caught in the tidal River Thames between Fulham and Tilbury since 1964. Over sixty per cent of the marine, euryhaline and freshwater species reported to date have been recorded in the current survey programme. There have been developments associated with three rare or notable species. Recent reports of sea lampreys and lamperns (river lampreys) suggest that these species may be re-establishing in the Thames catchment. Both species are listed in the Habitats Directive (Annex IIa), the Bern Convention (Appendix III) and both are UK Biodiversity Action Plan species. They are considered to be very sensitive to water quality due to their spawning requirements for fast flowing water and clean gravels. Sea lampreys and lamperns are ectoparasitic on marine fish as adults and migrate into fresh water to spawn. Most adults die after spawning and may remain on the shore or in the water for several weeks when they are at their most visible. Freshwater juvenile stages (ammocoetes) live in the mud and spend approximately 4–5 years filter-feeding on micro-organisms before migrating to sea as a adult (Miller and Loates 1997). Lamperns are smaller than sea lampreys and remain closer to their native catchments whilst at sea.

Sea lampreys do not appear to have been common in the tidal Thames (Wheeler 1958) and there are no published reports in the past century. Six sea lampreys were found dead on the shore in the Barnes area, apparently after spawning, in July 2000. Subsequent reports, in response to requests for further information, revealed that another three sea lampreys had been observed between Hammersmith and Kew during the same period and that a similar phenomenon had occurred at Barnes in 1999. Marine fishermen reported catches of sea lamprey in the lower estuary during the spring. There were at least eleven other sightings of sea lamprey in the same area in 2001. This information suggests that a new spawning migration has begun in the River Thames, but the precise location of the spawning site is unknown. Dead sea lampreys could be transported many kilometres with tidal action. The Environment Agency plans to investigate the location of the spawning site and ammocoete nursery grounds.

By comparison the lampern fishery was previously substantial in the Thames, but there are only few reports of the species in the past century (Wheeler 1958, 1969). In November 2001, five lamperns were reported from the screens at Tilbury Power Station and later in the month single reports were received from Wandsworth and Teddington. Third-hand reports indicate that lamperns may have been present in the upper estuary and associated dock basins for several years, but there are no data at present to predict which catchments upstream of the estuary will support any future spawning.

Twaite shad numbers have been building up in the lower estuary over the past decade, with a steady increase in the size ranges apparent. This species breeds mainly in estuarine water and there is evidence for the location of a nursery ground in the inner estuary above Southend. Twaite shad were known to be abundant in the last century (Wheeler 1958), so their return may indicate an improvement in water quality. Although twaite shad are not valued as commercial species, they are common as incidental by-catch in inshore fisheries off the southern coasts. The conservation importance of this species, therefore, has been emphasized to commercial marine fishermen.

Marine species

Dover sole fry were observed to penetrate up to Greenwich and adult Dover sole were generally found as far upstream as Gravesend, although they have been recorded up to Thamesmead in some summers. The Thames Estuary has become one of the largest nursery grounds for Dover sole in England and Wales (Thomas 1995). Thin-lipped grey mullet were common in the Thames up to Woolwich in summer. Adult fish penetrated up to Chelsea and there is thought to be a permanent population in this area of the river, attracted by the warm effluent from Lots Road Power Station. Fry appeared in August and September and were found as far upstream as Chiswick. Thick-lipped grey mullet were found to be common downstream of Woolwich in summer.

Euryhaline species

The principle euryhaline species recorded were bass, eel, flounder, common goby and smelt. These species displayed marked seasonal migrations. They entered the upper estuary in spring and summer and then moved down to the lower estuary in the winter, although some smelt may permanently live in some of the remaining dock basins.

Surveys indicate that the Thames Estuary has become one of the largest new sea bass nurseries in the southern North Sea in the past decade (G. Pickett pers.comm.). Multiple waves of bass fry appeared in the tidal Thames from June to August, probably representing different spawnings separated in time and space in the English Channel (Sabriye et al. 1988). Bass fry were observed to penetrate to the edge of the saline wedge at Richmond by the end of each summer and second-year fish occasionally penetrated as far as Chelsea.

The flounder is an important and abundant species in the estuary and breeds in the lower reaches. Flounder is the only flat fish generally found in the river above Woolwich. The survey showed that post-larvae first ascended in early May and were observed in large numbers at Putney, utilizing selective tidal stream transport to migrate. They selectively moved on the flooding tides in the extreme margins of the channel and remained in the upper estuary until late autumn. Autumn rains provided the stimulus to move back to the lower reaches below Dartford. Two-year and older flounder are recorded throughout the tideway and are commonly found in most of the tidal creeks entering the estuary below the Pool of London (Tyner 1993).

European eel elvers (65 mm) initially appeared in the estuary in early April, although elver runs appeared to be very modest, possibly reflecting a decline in eel recruitment throughout Europe (Knights et al. 1996). Eels exceeding 30 cm can be found throughout the estuary.

Common gobies appeared in June at 9 mm and penetrated to Teddington, whereas sand gobies were rarely found above Battersea. Common gobies were abundant as far upstream as Richmond and together with flounder constituted the most abundant benthic species throughout the upper estuary by late summer.

Smelt is considered to be of vulnerable status due to its sensitivity to anthropogenic environmental changes (Winfield et al. 1994). The establishment of a spawning population of smelt in the Thames Estuary by the late 1970s (Wheeler 1979) can therefore be considered to indicate an improvement in water quality. Smelt are now abundant in the Thames. Prespawning shoals congregated below Gravesend during the winter and then ascended to spawn near Wandsworth in March/April. Adults returned to the lower reaches soon after spawning, whilst young fry rapidly spread through the estuary and remained until the late autumn. In other British estuaries smelt is absent or rare (reviewed in Araujo et al. 1999).

Atlantic salmon returned to the Thames in 1974 for the first time in 150 years (Solomon 1975). Consequently, Thames Water Authority instigated a Salmon Rehabilitation Programme in 1979 with the long-term objective of restoring a self-sustaining population. The programme includes fish-rearing and stocking, fish pass construction and monitoring schemes and has achieved a regular salmon run since 1982 with an estimated return of over 500 fish in 1993 (Darryl Clifton-Dey pers.comm.). Sea trout have become increasingly common throughout the estuary in the past decade.

Freshwater fish

Freshwater fish were restricted to the upper estuary above Battersea in the summer, but could extend downstream to Greenwich and beyond in the winter. The principal freshwater species sampled were dace, roach, perch and bream. Salinity-tolerant dace were the most abundant freshwater species in the tidal Thames. Dace close to spawning were captured at Battersea in 1994. Post-larvae appeared in May and were washed down through the Pool of London, migrating upstream to the river above Battersea by late summer. Dace fry also use selective tidal stream transport to migrate upstream.

Roach is sub-dominant to dace in the estuary and substantial evidence of recruitment has been observed in Chelsea Creek. Roach found as far downstream as Thamesmead in the winter may be displaced populations from the rivers Lea and Roding. Perch and bream have shown evidence of recruitment at Richmond and Brentford. However, suitable spawning habitats for these species will probably only exist upstream of Richmond. Bream have been found down to Greenwich and Thamesmead in winter and a localized population of large bream and carp is associated with the warm water outfall at Lots Road Power Station.

Maintenance of most freshwater fish populations is presumed to occur by displacement from the freshwater catchments due to a shortage of spawning habitats which are probably limited to the river upstream of Richmond. For example, carp fry were collected at Hammersmith in 1992 probably originating from adjoining streams and rivers. Stone loach, bullhead, nine-spined stickleback and minnow are rare fish in the Tidal Thames.

Lower freshwater Thames

Table 2 gives the current fish species list for the lower freshwater Thames based on surveys and information collated between 1995 and 2001. The most common species in the lower river in terms of abundance are chub, roach, perch, bleak and gudgeon. Other common fish are dace, bream, pike and eel. Minnows are fairly common in the Thames, whilst bullhead and stone loach are generally found in smaller numbers. Large common carp have become more prevalent in recent years, probably due to stocking of ponds and lakes for angling.

A run of salmon has been recorded at Molesey and Sunbury fish traps every year since 1994 and averages 150 fish. In addition, flounder are encountered in the freshwater river, upstream of Teddington as far as Molesey weir.

A recent non-indigenous addition to the species list in the River Thames is grass carp, probably originating from an angling lake. These herbivorous fish were imported from Asia from the 1970s to control aquatic weed. Similar escapes from lakes in the Thames area include a wels which was recently found in the River Darent, a tributary of the River Thames, and there have been unsubstantiated reports from the Thames Ditton area of the Thames.

The diversity of species found in the main river is largely dictated by habitat availability, particularly for species with more specialized spawning requirements. Fish habitats have been degraded in the River Thames through man-made modification for navigation, flood defence, milling and bankside development. The lower reaches of the Thames are the most heavily impacted by physical modification and abstraction. For these reasons, generalists such as roach and perch dominate. Accessibility to both lotic and lentic habitats is an issue on the river because numerous weir structures have limited the migratory requirements of most indigenous species of freshwater fish. Fish passes have now been constructed in the weirs, primarily for salmon, although some are capable of providing passage for other species. The Environment Agency is currently investigating the creation of natural bypass channels around the weirs to assist migration and diversify habitat availability for all species. One such channel has been constructed at Penton Hook and has enabled active upstream migration of ten fish species. A further sixteen fish species, including large numbers of stone loach and bullhead, utililize habitats within the channel for nursery and spawning activities.

The lower freshwater Thames was also previously affected by organic and thermal pollution. However, water quality has now improved due to control of discharges and regulation of management practices such as dredging. The increased clarity of the freshwater river has resulted in expansion of submerged macrophyte communities which, in turn, have favoured the abundance of predators such as perch and pike.

The inherent diversity of fish in the River Thames could be considered as unusual. The river was historically composed of a variety of habitats in terms of size, depth and flow. Large river channels, pools, braided stream channels, oxbows and sloughs, and habitats of the floodplain would have been common. Although the great habitat variety of the Thames has been decreased in modern times, pockets of diverse 'artificial' habitats still remain, such as marinas and connected gravel pits which mimick floodplain backwaters and improve lateral connectivity. Dock basins create backwater refuges for fish. Mill and weir

streams provide habitats for rheophilic species and spawning areas for lithophilic species. Thus the river not only operates on the longitudinal dimension of a riparian corridor, but as a multi-dimensional series of habitats, supplemented by accessible tributaries.

Conclusions

The tidal and freshwater elements of the Thames support an abundance of fish life. The intensive series of fish survey programmes is an approach unique in the UK and the estuary programme may become a model for use in estuaries elsewhere. Information acquired in the surveys is used to inform fisheries management policy, facilitate habitat enhancement schemes and regulate riparian management practices such as dredging. Such measures should help preserve, and in some cases, restore the diversity of fish species in the River Thames. In addition, the data are used to encourage more sustainable development solutions in planning issues such as encroachments, barrages, port development and power stations, water resource management regimes and in water quality improvement initiatives.

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