

## THE NATURAL HISTORY OF SLAPTON LEY NATURE RESERVE

### XIV: THE HISTORY AND MANAGEMENT OF THE FISHERY

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#### ABSTRACT

Records of a coarse fishery in Slapton Ley, the largest natural body of freshwater in south-west England, are extant from the fourteenth century and the lake has been regarded as an important recreational fishery for many years. The last decade has, however, seen a reduction in its reputation: a fact which has stimulated a research programme into the reasons for this change. It is concluded that the fishery is currently unmanageable, given the Ley's status as a Nature Reserve and the available resources.

#### INTRODUCTION

SLAPTON Ley, the largest natural body of freshwater in the south-west of England, has long been regarded as an important recreational coarse fishery in an area dominated by salmonid species. Accounts of the formation and history of the Ley basins are given by Mercer (1966) and Morey (1976). The fishery has been in continuous operation for many years, but in the last decade there has been a reduction in demand following a decline in its reputation. This has stimulated interest in the possibilities of improving the fishery through rational management, and a number of scientific studies on the fish fauna have been completed as a first step. This paper provides an account of the background history together with a review of research findings and a discussion of their relevance to the formulation of fishery management policies.

The fish which are of most importance in the Ley are the "coarse" species which are attractive to anglers, the pike (*Esox lucius* L.), perch (*Perca fluviatilis* L.), roach (*Rutilus rutilus* (L.)), rudd (*Scardinius erythrophthalmus* (L.)), and eel (*Anguilla anguilla* (L.)). Small numbers of the three-spined stickleback (*Gasterosteus aculeatus* L.) and lampreys (*Lampetra* spp.) also occur, together with the bullhead (*Cottus gobio* L.) and stone loach (*Noemacheilus barbatulus* (L.)) in the river Gara, the main feeder stream. A few brown trout (*Salmo trutta* L.) migrate into the Ley from inflowing streams, but do not contribute significantly to the fishery.

#### HISTORY OF THE SLAPTON FISHERY

There are records of fishing in the Ley from the fourteenth century, but little concrete information is available beyond an unsubstantiated rumour that the priests from the chantry in Slapton village fished the Ley and were responsible for the introduction of pike (Craig, 1973). By the late nineteenth century the lake was enjoying a considerable reputation as a pike fishery, and many references to it occur in the angling literature of the period, some including data on catches and average sizes of the fish. For example, a correspondent to *The Field* of 14 October 1876 claimed that the largest pike caught over the previous two seasons were of 21, 27

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and 30 lb respectively, and that three anglers took 23 pike in a single day with an average size of around 7 lbs. "A Visitor" writing in *Land and Water* (2 October 1886) recorded a catch of 17 jack (pike) on one day, and described recent catches of a 15 lb pike and a 2 lb 2 oz rudd. Another instance of impressive angling is quoted by J. C. Jacomb, writing in *The Field* (30 October 1850), claiming a catch of 94 pike with a total weight of 485 lb in 15 days fishing in October. The largest of these fish were 10, 13 and 15 lb.

At various times an encroachment of the shingle ridge which separates the Ley from the sea has been reported, sometimes causing a fish-kill. "A Visitor" in the article quoted above went on to describe a breach of the shingle bank at Torcross which resulted in substantial fish mortality, with 63 pike counted amongst the casualties. Earlier, at an unknown date, the sea had repeatedly broken through the shingle at every tide, apparently "killing all the fish" eventually, although this can hardly have been the case (Yarrell, 1836).

From 1855 the estate, which included the Ley, was in the hands of Sir Lydston Newman, who had begun some conservation measures as early as 1870. Prior to 1878 the villagers of Slapton and Stokenham had held fowling and fishing rights, but in a successful court case in that year Newman defeated the villagers and gained control of the fishery (*The Field*, 1878). At that time the fishing season extended from 1 April to 20 October, and towards the end of the 1880s there was a reserved section of water at the Torcross end of the Ley where no fishing was permitted ("A Slapton Visitor", 1886).

Extensive reference to the Slapton fishery was made by Spence (1928) in his book *The Pike Fisher*, which includes some interesting insights into past management practices. Before 1898 the habit had prevailed of killing all pike taken of above 4 to 5 lb. New management policies introduced after this date restricted the killing of any but the occasional specimen pike, and this apparently led to a marked improvement in the quality of fishing. Spence states that before this restriction 4 or 5 pike were considered a good catch for one day, while a 7 lb fish was regarded as a specimen and the modern record was claimed by the captor of a 17 lb fish. Since the instigation of the new policy, Spence asserted that the fishing had "improved enormously", and that his own mean catch over a 10-day period worked out at 18 pike a day with an average weight of 4 lb 5 oz. He had taken as many as 30 fish in a single day. Later, average size continued to rise, so that the mean weight of a subsequent catch of 75 fish was 6 lb 1 oz. By this time a few fish of 20 lb were being caught, and many of between 10 and 19 lb.

An indication of the popularity of the fishery is that no less than four professional fishermen were attached to the staff of the "Royal Sands Hotel", which was sited close to the present monument on the beach and was destroyed during World War II by United States armed forces in battle practice.

In 1917 the Stokely estate was purchased by Herbert Whitley, and recently early records in the form of outgoing letters from the estate offices have been found; these are now in the possession of the Herbert Whitley Trust. The records cover the years between 1918 and 1939.

During this period the Lower Ley was still divided into a "public" and a "private" section, the public water being supervised by the tenants of the hotel while the private sector near Torcross was retained for Whitley and his friends. Frequent applications from members of the public to fish the latter section were generally

refused in an attempt to avoid overfishing. Although the hotel fishery was at first closed from 2 November to 2 March each year, from 1920 winter fishing was permitted in a restricted area including most of Ireland Bay. The Higher Ley could only be fished for live-bait.

Throughout the period of Herbert Whitley's ownership, there seems to have been considerable interest not only in improving the fishery, but also in some form of scientific assessment of potential. The possibility of introducing zander (*Stizostedion lucioperca* (L.)), then something of a curiosity, was discussed, and a firm order was made for 100 metal fish tags (numbered W1 to W100, cost, 25/-\*). It is apparent that catch records were also kept, but unfortunately these have been lost. The number of boats in operation varied between 6 and 10, and at this time shooting was still taking place over the Ley, probably twice yearly.

Little information on the immediate post-war years is available. The Royal Sands Hotel which had been destroyed was not rebuilt, and after Herbert Whitley died in 1956 the fishing rights passed through several hands. The estate was taken over on lease from the Herbert Whitley Trust by the Field Studies Council in 1958, but the fishing rights remained in private hands until 1964. With the relaxation of fishing restrictions, there was a period of exceptional catches. The recent pike record for the water stands at over 30 lb, and a rudd breaking the then current national record was taken in the close season (Venmore, *personal communication*); nevertheless, this fish could not be claimed as a record.

#### CURRENT OPERATION OF THE FISHERY

There has been little change in the operation of the fishery. The number of boats available is restricted to ten, and the hiring of a boat carries with it the permission to fish, no other permit being required. Boats may be used for no other purpose. Bank fishing is not allowed, and anglers must not land on the west side of the Ley. Fishing is by rod and line only, and no more than two pike rods may be used in one boat. Fishing north of Slapton bridge (i.e. in the Higher Ley) is permitted only between 1 October and 28 February, when one boat at a time may enter to obtain live-bait. No fish can be retained, and all must be returned to the water unless used for live-bait. Gaffs must not be used. Guns and dogs are not allowed in boats. No close season is operated at Slapton, and the water can be fished throughout the year. There is no attempt to manage the fish stocks. Occasionally perch are netted and used in laboratory exercises by students.

#### *The problem of roach and rudd*

One difficulty that has been encountered in the investigation of the history of the fishery concerns the status of the roach population (Burrough, 1978a). Until recently it was thought that roach were not part of the "natural" fauna of the lake, but had been illegally introduced by persons unknown. In support of this view was the fact that the roach had not contributed in post-war accounts to the reputation of the fishery. Earlier accounts, however, mention both roach and rudd in Slapton Ley. Yarrell (1836) reported the presence of roach in a lake in Devon, which from its description could hardly be anywhere other than the Ley. Couch (1877) thought that Slapton was the only site in Devon where roach occurred. The capture of 1,050

\* 25 shillings = £1.25.

perch and roach was noted in *The Field* (14 October 1876), and roach were described as the food of pike in *Land and Water* (24 January 1885). An angler's diary covering the latter part of the nineteenth century contained reference to the fishing for pike, perch, roach, rudd and eel as "first rate" at Slapton, whilst Day (1880–1884) in his book on the fishes of Britain and Ireland observed roach to be present in Slapton Ley, where rudd were said to breed in enormous numbers and reach a considerable size. Spence (1928), however, made no mention of roach in his writings concerning Slapton Ley.

It appears that in the immediate post-war years up until the mid 1960s roach were not generally thought to occur, although while the fish population was undoubtedly dominated numerically by perch and rudd, some people consider that occasional roach were present, at least latterly (Peters, Mercer, Solomon, *personal communication*).

Without doubt the picture is further confused by the difficulty of separating these two very similar species. It became evident during our research that many fishermen cannot consistently distinguish roach from rudd, an inability that has been noted by other authors (e.g. Berg, 1964). Local anglers apparently recognised "golden" and "silver" varieties of rudd, and as, in general, roach are more silver-coloured than rudd, this may represent a mis-identification of the two species.

In view of the wide reputation of Slapton rudd, it seems likely that they have been present in numbers throughout the recorded history of the lake. On the balance of the available evidence it appears that the presence of roach must be accepted over the same period, at least as a poorly represented member of the fish community. Netting operations revealed the nucleus of a roach population, with increasing catches being recorded after 1967. The timing of these increased roach catches admittedly coincided with the rumours of illegal introductions of roach, but there has never been any evidence that such introductions took place, and it seems unlikely that the catches being recorded (for example, about 5,000 roach of up to 2 lb in weight in 1968) derived from such a source.

#### SUMMARY OF FISHERIES RESEARCH

It is only comparatively recently that comprehensive studies on the fish fauna of Slapton Ley have been undertaken. Canning *et al.* (1973) studied fish parasites, but the first serious fisheries work was that of Craig (1973), who confined himself to the study of the population dynamics of perch; these findings were subsequently published (Craig, 1974*a, b*; 1975*a, b*).

The perch population between 1970 and 1971 was large and unexploited, with a rapid turnover of individuals and a comparatively young age composition. The mortality rate was high, and sexual maturation occurred early, with males maturing in their first year, and most females in their second. The fecundity (the number of eggs produced per fish or unit of body weight) was low. Growth was good compared to other British waters, but as mortality occurred early there were few large individuals in the population. A spawning migration of mature perch into the higher Ley in the early spring of each year was observed.

The necessity for further study before the formulation of management plans was recognised, and this was undertaken by the present authors between 1974 and 1977, in an investigation covering four species: roach, rudd, pike and perch.

Before 1967, perch and rudd had been numerically dominant, but from this time

the roach population expanded greatly, apparently at the expense of the rudd, which had virtually disappeared by 1974. Initial growth of roach had been good, but a general decline was observed in 1972 which coincided with the appearance of a very strong 1972 year-class. This increase in population density was seemingly sufficient to result in decreased growth (stunting) of roach, an effect compounded by another strong 1973 year-class.

In 1975 extensive mortalities of roach occurred, caused by the tapeworm *Ligula intestinalis* (L.). An immediate improvement in growth followed in 1976, the thinning of the population being enough to alleviate stunting. Changes in reproductive biology also occurred, with an increase in average gonad weight and fecundity of the smaller fish, the effect not being apparent in older and larger specimens. There was also a decline in the numbers of roach maturing at a small size. These changes were thought to be a consequence of an improvement in conditions for individual fish following the population decline (Burrough and Kennedy, 1979).

There was a partial recovery in the rudd population following the roach mortalities in 1975, with strong 1975 and 1976 year classes, while the effects of *Ligula* were not marked between 1976 and 1978. Few rudd were present in 1978 and none were caught in 1979, whilst some were taken in 1980. There is thus strong evidence that there is a competitive relationship between the two species, with the roach replacing the rudd when not reduced by *Ligula*.

No outbreak of rudd disease was observed, and comparatively few roach-rudd hybrids were found, so a genetic merging of the stocks was not suspected. Although there is some overlap in the adult diet of the two species, there is a difference in emphasis, with roach taking more detritus and benthic material, and rudd more surface invertebrates and plant matter. It was suspected that food competition at the fry stage, when both species feed on planktonic invertebrates, could have been responsible for the dominance of roach, which spawn earlier than rudd, a factor which could confer a competitive advantage. The factors which have acted to change the historic dominance of the rudd in this water were not identified (Burrough, 1978*b*; Burrough, Bregazzi and Kennedy, 1979).

Study of the perch population was resumed between 1974 and 1977 to establish whether any important changes had occurred since the original study by Craig. Some intermediate data on trap catches for 1973 and 1974 were available (Towner, unpubl.). Windermere-type perch traps (Worthington, 1942) have been set at Slapton in all perch investigations, and it became apparent from analysis of catches that the perch population had undergone a steady and continuous decline in numbers over the period involved (Bregazzi, 1978; Burrough, Bregazzi and Kennedy, 1979). Despite this decline, there had been no adaptive change by the perch population in response to decreasing numbers, or any other changes (Bregazzi and Kennedy, 1982). A slight decline in growth up to age III was noted, and the proportion of fish maturing early had fallen.

Once again a competitive relationship with roach was implied by these findings. Slapton Ley has become increasingly eutrophic in recent years (Troake and Walling, 1973), a condition which often benefits roach (Svardson, 1976), but the precise nature of any competition was not identified. Competition at the fry stage may have been of less importance than in the case of roach and rudd, as perch fry at Slapton Ley grow more quickly than those of rudd, and depend on planktonic food for less time before adopting a benthic diet; however, some form of perch-roach inter-

action was strongly suggested.

No information was available on past fluctuations of the pike population. Growth was intermediate when compared to that in other waters, but once again life-span was comparatively short, and few large individuals were present (Bregazzi and Kennedy, 1980). Only fish of 450 mm fork length (length between snout and fork of tail) and above were susceptible to capture with the gear available, but population estimates of this group were made; attempts to estimate populations of the other species proved unsuccessful. An estimate of  $870.6 \pm 389.3$  pike (total population of Ley) was obtained for 1975, and in 1976/1977 the estimate was  $950.4 \pm 143.3$ . This represents a very high density of pike per unit surface area, expressed either as number or biomass, especially considering the inherent underestimate resulting from the failure to catch young pike.

The pike were predominantly fish-eating, although fry and small fish fed on invertebrates. The piscivorous habit develops early, and the smallest pike taken which had eaten fish had a fork length of 91 mm and weighed only 5.3 g. The roach was the chief prey species, contributing approximately 61 per cent of the diet, with perch the next most common item (34 per cent). Some eels were taken (4 per cent), and the invertebrates eaten by the smaller pike made up the last 1 per cent. The percentage figures are based on the total contents of all stomachs dissected. There was no evidence that larger pike select larger individuals as prey; the prey populations consisted predominantly of stunted fish.

Throughout most of the year the pike were non-territorial and their distribution was presumably dictated by that of the prey species. As with the perch there was a spawning migration, and in February-April large concentrations of pike could be found in part of the Higher Ley, and a second spawning site in the Torcross region of the Lower Ley was also identified.

The preponderance of relatively small fish reduce the value of the pike fishery, and it is thought that overcrowding, together with changes in the forage species available, may have led to this situation, compounded by the effects of increasing eutrophication. The perch, pike and roach populations had a common composition of comparatively young fish which in spite of reasonable growth rates tended to have a high mortality rate which resulted in a population with very few large specimens.

Parasitological studies on the Slapton fish fauna have indicated that the parasite fauna is comparatively sparse, and only *Ligula* has been observed to cause mortality. There were indications that levels of infection by two species of eyefluke were continuing to rise, although it is not known if these cause the death of the host directly (Kennedy and Burrough, 1977; Burrough, 1978a). Analysis of the parasite fauna has been used to confirm the recent origin of Slapton Ley (Kennedy, 1975).

#### FISHERY MANAGEMENT

Discussion of fish management policies at Slapton Ley must be seen in the wider context of management of the nature reserve as a whole, and any management steps would have to be consistent with this status. Angling interests cannot be allowed to conflict with the use of the Ley for teaching, conservation and research purposes.

Profit derived from the fishery during the period of research was small and declining (1975, £621; 1976, £587; 1977, £297. A. Thomas, *personal communication*). This undoubtedly reflects changes in demand resulting from the recent decline in

the reputation of the fishery which in part prompted the research programme. The number of bookings for angling boats is presented in Table 1 for 1976. Demand was strongly seasonal, being heaviest in the tourist season.

Table 1. *The seasonal distribution of the number of bookings for angling boats at Slapton Ley during 1976*

Month	Number of bookings
January	39
February	37
March	36
April	82
May	65
June	85
July	132
August	200
September	67
October	36
November	26
December	38

The opinions of visiting anglers were sought by questionnaire, and as anticipated the majority of anglers was found to be casual visitors and holidaymakers. A large percentage, 87.7 per cent, fished the Ley annually (31.1 per cent) or less often (56.6 per cent), with only 11 per cent fishing monthly, and 1.4 per cent weekly. Some 72 per cent were in favour of the introduction of additional coarse or salmonid fish species, with around 27 per cent opposed to this step. Anglers' preferences concerning introductions are shown in Table 2.

Table 2. *Anglers' preferences for fish introductions into Slapton Ley*

Species	Percentage of anglers suggesting introduction
Tench, <i>Tinca tinca</i> (L.)	59.6
Carp, <i>Cyprinus carpio</i> L.	40.4
Bream, <i>Abramis brama</i> (L.)	36.4
Trout, <i>Salmo trutta</i> L.	4.0
Chub, <i>Leuciscus cephalus</i> (L.)	3.3
Gudgeon, <i>Gobio gobio</i> (L.)	2.0
Dace, <i>Leuciscus leuciscus</i> (L.)	1.3
Barbel, <i>Barbus barbus</i> (L.)	1.3
Salmon, <i>Salmo salar</i> L.	0.7
Minnow, <i>Phoxinus phoxinus</i> (L.)	0.7
Mullet, <i>Crenimugil labrosus</i> (Risso)	0.7
Zander, <i>Stizostedion lucioperca</i> (L.)	0.7
Large-mouth bass, <i>Micropterus salmoides</i> (Lacépède)	0.7

Many of the visitors took pains to point out that they were satisfied with the present organisation of the fishery, and opposed to the introduction of bank fishing or additional boats. Apparently part of the appeal of the fishery lies in its unspoilt venue and the relatively uncommercial approach of its operators. There would therefore seem to be little justification in altering the operation of the fishery, as

both the angling clientele and the Field Studies Council are satisfied with current methods. The present system requires little labour to run, and environmental impact is minimal. Some suggestions were received from anglers who wished to see minor alterations in the way the fishery is run. Probably the most relevant of these was the desire to have bait sold on site; at present a round trip of some 40 miles is required to the nearest source of typical coarse fish baits. Some visitors suggested that boats should also be available at the Torcross end of the Ley to avoid the long row to the area.

Many anglers considered that the fishery was in decline, and the relatively high proportion in favour of the introduction of further species suggests that manipulation of the fish stocks to improve angling would be favourably received.

Given the present seasonal distribution of demand, it would be helpful to promote the angling at off-peak times of the year. This could be achieved by publicising the pike fishery, as this species is normally considered to be an autumn and winter quarry and is attractive to anglers. The pike fishery would have to be of a sufficient quality to maintain interest, which is not the case at present with the preponderance of relatively small fish. As numbers of pike are high, additional stocking would serve no useful purpose. There might be an improvement in individual growth if the population were thinned, a step which could be achieved relatively easily by netting or retaining angler-caught fish. However, the results of such a step are by no means certain, and it is possible that the formerly dominant rudd provided better pike forage than the roach. There may be a relationship between enhanced pike growth and size of prey, the larger the available prey, the better the pike growth (Buller, 1971). This is not always the case, and good growth has been recorded in a population feeding on small prey items (Mann, 1976). The effects of thinning pike are not fully predictable, and success may depend on active management to improve the forage species. At the present time at Slapton there is such a dynamic situation and complex interaction between roach, perch and rudd that it would not be possible to predict the consequences of any steps taken. In addition skilled labour and expensive monitoring of changes would be involved.

Consideration was given to the demand for the introduction of further coarse fish species. Many of those mentioned in Table 2 are not appropriate, but the three most favoured species, carp, tench and bream, are all fish adapted to slow-flowing or static waters. All three are susceptible to *Ligula*, especially the bream, which also hybridises with roach and rudd. Introduction would be expensive, and as all these species are associated with summer angling, increase in revenue might not be significant. The effects of introductions on the natural fauna cannot be assessed, and there are inherent risks of parasite or disease transfer. In view of these considerations it is felt that introductions should not be contemplated, especially when the current unstable and dynamic changes in the fish populations naturally present are taken into account.

It was concluded that the coarse fish population of Slapton Ley is at present unmanageable, and that the natural changes occurring make it extremely difficult to appraise the effects of stock manipulation. In addition the available financial and labour resources are insufficient to support an ambitious management programme, especially as the fishery is underutilised and likely to remain so. The situation, which is of considerable scientific interest, should remain under review, and more favourable conditions for management may prevail at a later date.



## ACKNOWLEDGEMENTS

The authors acknowledge with pleasure the assistance and hospitality of the Warden and staff of Slapton Ley Field Centre.

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