19

THE FISHES of THE RIBBLE ESTUARY

THE FISHES OF THE RIBBLE ESTUARY

19.1 Introduction

The Ribble Estuary is derived from a coastal plain and has a simple estuarine structure facing west and extending approximately 28.4 km. from its mouth to the docks at Preston with a tidal channel. The Ribble is estimated to have a total area of 11,924 ha. and shoreline of 107.5 km. (Davidson *et al.*, 1991). It is sited between Liverpool and Morecambe Bays. To the south are the estuaries of the Dee and Mersey, all within 45 miles of each other. There is a great deal of similarity with Dee and Mersey, in both fauna and habitats, but the Ribble is more exposed to the Irish Sea. The River Ribble is very broad, shallow, and is canalised by training walls of rough stone. It contains an artificial channel some 25km (15 miles) long which has been dredged near its northern shore to allow ship passage. There is a central channel some 200 m wide to which the river is confined at low water. The Ribble is known for a strong flood tide which has an effect on the mobile fauna of the estuary. The habitats studied in this estuary have concentrated on littoral areas (Popham, 1966; Davies, 1992).

The catchment for the Ribble Estuary is from a number of rivers, the main ones being; the Rivers Ribble, Hodder and Calder from the east, and the Darwen and Douglas from the south. In addition, there are a number of other smaller rivers running directly into the estuary. Preston is situated at the head of the Ribble Estuary with two towns, Lytham St. Annes and Southport, either side of the estuary mouth being holiday destinations for the population centres of Manchester and the North West.

The Ribble is of considerable nature conservation importance containing the Ribble marshes NNR and designated a Special Protection Area and containing a SSSI (Popham, 1966; Davies *et al.*, 1990, Davies, 1992) .

19.2 Estuarine habitats.

The main marine habitats found in the Ribble Estuary are described by Davies (1992). The offshore habitat consists of gently shelving coastal areas which lead into sedimentary mud and sand flats at the mouth of the estuary. Salt marshes form an important environment of the Ribble which have undergone an estimated 18 % loss since the beginning of the 19th century (Davidson *et al.*, 1991). The upper tidal limit is said to reach the docks at Preston where the salinity is reported to vary between fully fresh water, 5% (Dent, 1986) and 18%. The estuarine mouth is reported to vary between 13.5% and 34%. The Ribble undergoes considerable scouring as a result of the high current speeds which are responsible for the erosion of the mud banks and the transport of the sediment load down stream. The tidal range is between 8 m at spring tide and 4.3 m. at neap tide. The average sea temperatures are between 5 °C in February and 15 °C in August.

In 1974 there were grounds for "serious concern regarding the low dissolved oxygen concentrations" in the Ribble Estuary, as a result of the need for improvements to the sewage treatment processes in the Rivers Calder and Douglas. The impact on potential fish populations could be significant.

The habitat diversity and the recorded invertebrate communities indicate an environment capable of sustaining significant fish populations.

19.3 Fish lists

No complete fish list has been published for the Ribble estuary, although Conlan *et al.*, (1988) studied disused docks, as habitats for estuarine fishes and Sewell (1983) carried out surveys by netting. Other fishes have been recorded as part of scientific studies or were incidental to other surveys. (Popham, 1966; Holden *et al.*, 1975; Kelley, 1988; Priede, *et al.*, 1988). The number of fish species recorded from the Ribble Estuary is 14 (see Table 19.1).

19.4 Fish and fisheries

There have been a few studies in the Ribble Estuary relating to fishes. Priede *et al.* (1988) studied the behaviour of adult salmon (*Salmo salar*) in relation to variations in dissolved oxygen (DO) and tidal flow, and Conlan *et al.* (1988) examined Preston docks (now disused) as suitable habitats for estuarine fishes.

Priede *et al.* (1988) carried out work on the tracking of adult salmon in the estuary of the Ribble. Most fish were observed to move up the estuary on flood tide and out to sea on the subsequent ebb tide. Fish exploring the mouth of the estuary would inadvertently be carried quickly up river by the strength of the flood tide. They found these fish to be inhibited by low dissolved oxygen concentrations and that salmon in the Ribble were often on migration between other estuaries. The Ribble supports catches of salmon (*S. salar*) and sea trout, (*S. trutta*) with a small commercial drift net fishery. Conlan *et al.* (1988) found sea trout (*Salmo trutta*) were present throughout the year reaching a peak in February.

Popham (1966) mentions that the flounder, *Platichthys flesus*, is found upstream in freshwater. Conlan *et al.* (1988) found flounders to be most abundant in summer which reduced in the autumn as fish migrated seaward. The majority of flounder caught in the Ribble were O-group juveniles , but in Preston Dock the majority were age groups I-III.

Kelley (1988) in his paper on the importance of estuaries for sea-bass (*Dicentrarchus labrax*) mentions the Ribble as known to support stocks of young sea-bass. He adds these fishes are subjected to heavy commerical pressure and are likely to be susceptible to over-exploitation because of their slow growth and late maturation in U.K. waters.

Herring *(Clupea harengus)* is the dominant fish in the Ribble, showing two peaks of O-group fish (September and January-February). Conlan *et al.* (1988) found a very few fish over one year old which is consistent with the migration of young herring out of the estuary.

Smelt *(Osmerus eperlanus)* were present for most of the year, but in small numbers.

The sandy goby *(Pomatoschistus minutus)* has been recorded in large numbers (Sewell, 1983), but Conlan *et al.* (1988) only found them sporadically and in small numbers. This was believed to be a result of differences in the catching techniques.

19.5 Impacts

For the impacts of **commercial fisheries** see 4.1 and 4.3 above. Nets are operated by small one-man boats and catches are usually less than ten salmon (*S. salar*) and sea trout, (*S. trutta*) per tide (Priede *et al.*, 1988).

The Ribble is one of the more developed estuaries and is now primarily **urban**. The towns of Lytham St. Annes and Southport are holiday destinations, with an extensive beach at Southport that attracts visitors from all over the North West. There has been no study of recreational activites on the Ribble.

In the past, training walls were erected and the main channel **dredged** to allow access for ships. However, Preston Docks was closed to shipping in 1981 and converted into a marina. (Davies, 1992).

Progressive **land reclamation** for agriculture has reduced the saltmarsh area by 18% since the beginning of the 19th centuary, and runoff will have some effect on water quality. (Davidson *et al.*, 1991; Davies, 1992).

Trade effluent is deposited into the Ribble from industrial areas of N.E. and Central Lancashire. The Central Electricity Generating Board Penworthy **Power Station** is situated on the estuary, but cooling water was reported to have a minimal thermal effect. British Nuclear Fuels Ltd. discharges a conglomerate of chemical effluent (North West Water Authority, 1974).

The major **sewage** outfall is located 9 km. below the tidal limit, and sewage discharges receive varying degrees of treatment. There has been concern over low dissolved oxygen (North West Water Authority, 1974). This was further born out by Priede *et al.* (1988) in which fish were reported as prone to low dissolved oxygen concentrations in summer months associated with the sewage outfall, and that during the 1984 drought with high temperatures, low dissloved oxygen and low freshwater discharge, fish did not enter the estuary.

Sand extraction is reported by Davies (1992) to be 150,000 m3 per annum.

Heavy metals in estuarine sediments are identified from the Ribble Estuary (Burt *et al.*, 1992)

Mitchell (1969) reported that **radioactive disposals** from Windscale (now Sellafield) could be detected in the Ribble in terms of fission products, but the current status is not known, nor is the effect on fish populations.

19.6 Water quality

Estuaries are dynamic systems subject to significant changes in temperature, salinity dissolved oxygen, and sediment loading, depending upon the climate (particularly precipitation in the catchment areas), season and in tidal fluctuation. All will influence water quality and its suitablilty for the fauna found in estuaries and upon their consequent distribution. In addition to these natural influences on the estuarine environment there are also the human impacts as summarised in Section 19.5.

The water quality in the Ribble has been designated "Fair" according to the NRA scale. Closer examination indicates that the Rivers Hodder and Ribble are both graded of "good" water quality by the NRA (NRA,1991) (see Figure 19.1), but those draining from the industrialised conerbations of Burnley (R. Calder), Blackburn (R. Darwen) and Bolton (R. Douglas) are graded only poor to fair and will have a detrimental influence on the estuarine quality. Popham (1966) stated that the volumes of effluents in the Ribble were relatively small compared with Dee and Mersey, yet in 1974 the Ribble was described as having unacceptable levels of sewage. However, in the 1990 NRA water quality scale the Dee was rated as being of better quality than the Ribble and designated "Good". (NRA, 1991).

19.7 Summary

Only six species have been found to be mentioned in the literature on the Ribble Estuary. Nonetheless it is to be expected that the fish fauna will not differ significantly from the Liverpool and Morecambe Bays to the south and north of the region, and which are described in some detail in the fisheries literature. The main impacts on the region are the result of the high urban population with the attendant problems of land-claim, effluent and sewage discharges, and the industrial effluent from centres such as Burnley, Blackburn and Bolton.

19.8 Recommendations

It is recommended that;

1. a survey of the fishes of the Ribble be carried out to determine which species are present, how they are dependent on the estuary ie. for feeding and other factors, and how they are influenced by the adjacent fish faunas of Liverpool and Morecambe Bays.

2. owing to the absence of published information, local persons (anglers and fishermen etc.) should be contacted to provide preliminary species lists and give details on the effect of anthropogenic threats on the fishes in the Ribble.

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Table 19.1 The Fishes of the Ribble Estuary

Anguilla anguilla
Clupea harengus
Sprattus sprattus
Salmo salar
Salmo trutta
Osmerus eperlanus
Gasterosteus aculeatus
Dicentrarchus labrax
Ammodytes sp.
Hyperoplus lanceolatus
Pomatoschistus sp.
Pomatoschistus minutus
Platichthys flesus
Pleuronectes platessa
Solea solea

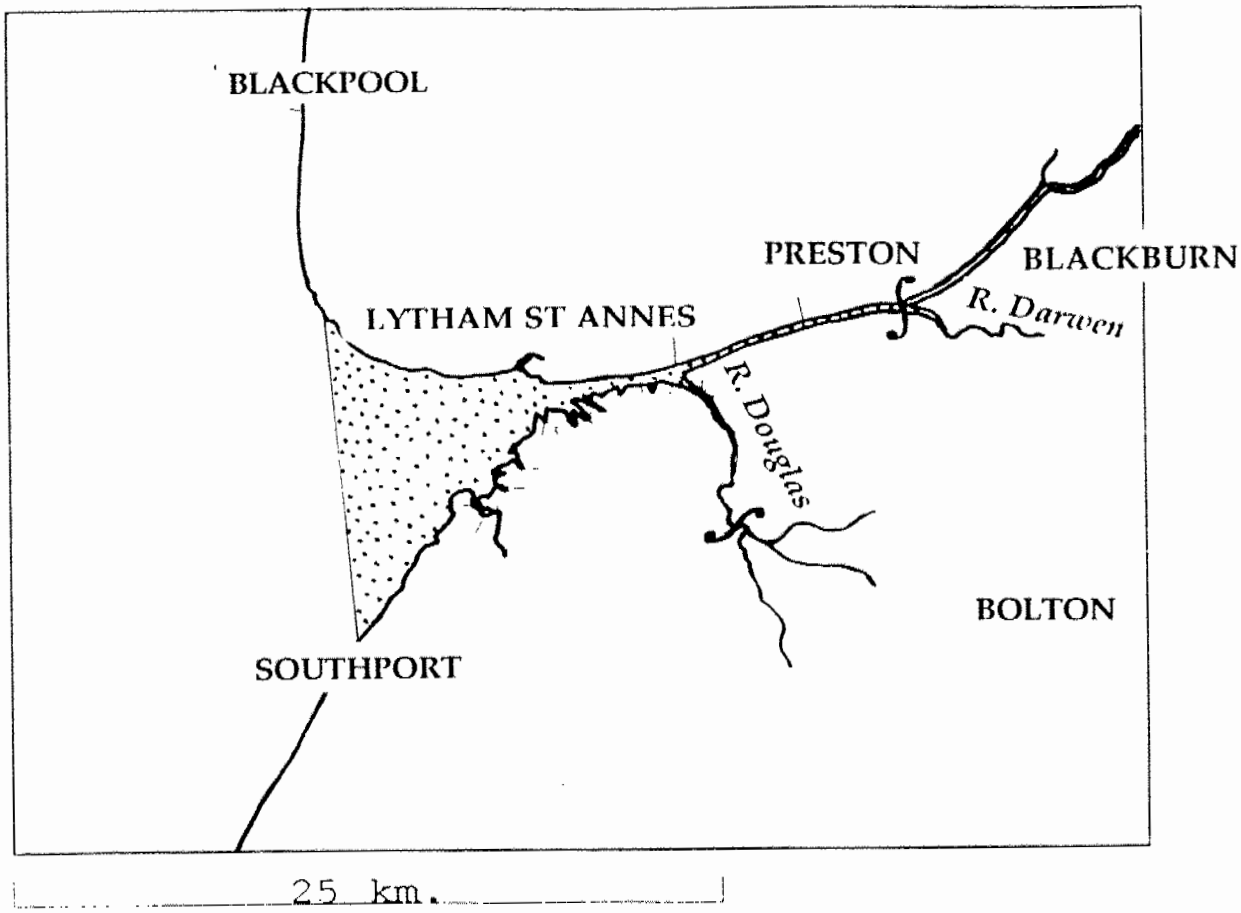

Figure 19.1 Map of the Ribble Estuary showing the upper and lower extent of the estuary, the upper tidal limits, and the water quality according to the 1991 NRA Survey. Water quality is characterised as "good" [unmarked], "fair" [medium stipple], "poor" [dense stipple], and "bad" [solid infill].

20

THE FISHES of MORECAMBE BAY

THE FISHES OF MORECAMBE BAY

20.1 Introduction

Morecambe Bay is a large (44,872 ha.) estuary opening to the Irish Sea and with a tidal channel of 40 km. The rivers that flow into Morecambe Bay are the Kent, the Leven, the Crake, the Bela, the Keer, the Lune, the Cocker and the Wyre. The towns of Fleetwood, Morecambe and Grange-over-Sands have frontages on the bay, the latter two being holiday resorts. The beaches are muddy rather than sandy which has probably protected the bay from over development as a tourist resort. (Robinson, 1987).

Morecambe Bay is an SSSI and is probably the largest single area of sand and mudflats in Britain and whose benthic fauna supports internationally important seabird, wader and waterfowl communities. It is also an Area of Outstanding Natural Beauty (AONB), a RAMSAR site and a Special Protection Area (SPA). (Davies *et al.*, 1990).

20.2 Estuarine habitats

There are extensive littoral sand and mud flats with rich invertebrate communities including large mussel beds and important saltmarsh communities. Anderson (1972) conducted extensive surveys of the littoral flats and Adams (1987) the hard substrata for invertebrate communitites.

The mussels scars provide the most suitable habitats for littoral fishes. Here the substrate consists of small stones with scattered larger stones and boulders interspersed with pools. (Corlett *et al.*, 1987).

20.3 Fish lists

There is one published fish list for Morecambe Bay which includes a section on littoral fishes (Corlett *et al.*, 1987). The number of fish species recorded from Morecambe Bay is 59 (see Table 19.1).

20.4 Fish and fisheries

There has been a long tradition of inshore fishing in Morecambe Bay, with the shallows being an important nursery ground for flatfish (Robinson, 1987; Davies *et al.*, 1990).

Plaice (*Pleuronectes platessa*) juveniles are found in the sandy areas throughout the middle and outer parts of the Bay, as are dab (*Limanda limanda*). Their depths overlap, but plaice occur right to the waters edge, while dabs are found slightly deeper. Plaice are commercially trawled for in the deeper channels (Corlett *et al.*, 1987).

Flounders (*Platichthys flesus*) are most common in the upper parts of the estuaries with most freshwater influence. Most of the whitefish commercial catch is flounder. They are caught in fixed nets (stake nets) which are set intertidally in long lines on the sand banks and mussel scars, and catches are made as the tide recedes. (Corlett *et al.*, 1987). High incidences of the disease lymphocytis in flounders is given by Driver (1976).

Corlett *et al.* (1987) reviews the water quality and fisheries of Morecambe Bay and the following notes are taken from this reference unless otherwise stated.

Soles (*Solea solea*) prefer the outer muddy channels and are trawled for in the deeper channels.

Whitebait, young herring (*Clupea harengus*), and sprat (*Sprattus sprattus*) are abundant throughout the year and are subject to a commercial fishery. The fishery takes place in late winter/early spring using stow nets and moored filter nets. Nets are set in the drainage channels and the fish are caught as the tide recedes. It appears that most of the whitebait in winter are sprats and in summer most are herring. The Lancashire and Western Sea Fisheries Joint Committee (1980) express concern at the whitebait fishery and the decline in herring stocks to a level well below the maximum sustainable yield, and an investigation was initiated in 1978. The catches between 1978 - 1980 were found to be almost all sprats.

Grey mullet (*Mugil sp.*) and bass (*Dicentrarchus labrax*) have occasionally been fished for using seine and gill nets on the edges of channels and also by drift nets from punts. Catches of bass were good in the early 1980s. Other species occasionally caught include skates and rays (*Raja sp.*) and cod (*Gadus morhua*).

Salmon (*Salmo salar*), sea trout (*Salmo trutta*) and eels (*Anguilla anguilla*) have runs in virtually all the rivers draining into the Morecambe Bay. The River Lune is one of the major salmon and sea trout rivers in England and supports extensive commercial and sport fisheries. The Kent and Leven also have significant runs of salmon and sea trout that are exploited, although stocks in the Leven have declined. The river Bela has few migratory fish, the impassable weir at Beetham prevents access to most of the potential spawning and nursery areas.

Eels (*Anguilla anguilla*) have been attracting increased interest and several fishermen are operating fyke nets under licence in the "estuaries" of the Lune and Wyre. Eels have also been recorded from the littoral zone.

Littoral fishes include the common goby (*Pomatoschistus microps*) which is the most abundant intertidal goby and intertidal fish. Seasonal migrations, age structure and life span have been studied by Jones & Miller (1966) and Miller (1975). The blenny (*Lipophrys pholis*) is frequently found, although restricted to the more saline regions. The butterfish (*Pholis gunnellus*) is found further down the shore, whereas the five bearded rockling (*Ciliata mustela*) is more common than the butterfish, but its distribution on the northern shores is not well known. Other fishes recorded from the littoral zone with some regularity include flatfish, the conger eel (*Conger conger*), and the three-spined stickleback (*Gasterosteus aculeatus*), which appears to be restricted to the saltmarsh pools and estuaries where it breeds.

Littoral fishes are restricted by suitable habitats, and few rockpools occur above M.T.L. However, cold winters are responsible for mass mortality of littoral fishes and heavy mussel sprat settlements reduce available habitats (Jones & Clare 1977; Corlett *et al.*, 1987).

20.5 Impacts

Sewage effluent discharge has probably had the most significant effect on the Bay from conurbations at Barrow-in-Furness, Morecambe and Lancaster (Robinson, 1987).

Industrial activities have centred around the main ports of Fleetwood, Heysham and Barrow-in-Furness. The power industry has a nuclear power station at Heysham that releases cooling water about 8°C higher than ambient with a small residue of chlorine. The fish communities taken on the intake screens are discussed in Henderson (1989).

Reclamation has taken place on a relatively small scale, but proposals are likely to be considered where sea defences are old (Robinson, 1987).

Virtually all the saltmarshes are in **agricultural** use for sheep or cattle grazing.

A **barrage** was proposed for Morecambe Bay with several alternative schemes being put forward. The ecological impact was assessed, the full barrage being the most damaging scheme. The water quality in a barrage reservoir was at risk from algal blooms, but this could be reduced by the elimination of phosphorous from sewage. However, following the studies no action was taken to develop any of the schemes put forward (Corlett, 1970; Bourne, 1972; Robinson, 1987).

Heavy metal levels are given in Burt *et al.* (1992)

20.6 Water quality

The water quality of Morecambe Bay is generally "good" (NRA, 1991) (see Figure 19.1) although sewage contamination of shellfish is a problem. Despite a number of crude sewage outfalls and one or two trade effluent discharges, the waters of the Bay, although still productive, have a lower nutrient concentration than Liverpool Bay. (Vivian, 1986; Crawshaw, 1987)

There has been some concern expressed about water quality as a cause for declines in migratory fishes, but there has been no evidence that passage has been obstructed. Improvements to sewage discharges, and freshwater flow requirements are being investigated (Crawshaw *et al.*, 1987). A survey of the Bay by Edmondson & Watts (1992) indicates an improvement in water quality since 1980.

20.7 Summary

Morecambe Bay is a large, relatively unpolluted estuary with significant fish populations. It opens onto the Irish Sea by a wide mouth and is likely to have a strongly marine fish fauna. A number of fishery activities take place. Sewage outfalls provide the main sources of pollution, although lower than Liverpool Bay.

20.8 Recommendations

It is recommended that:

1. a detailed survey is made of the commercial and non-commercial fishes of Morecambe Bay.

20.9 References

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Table 20.1 The Fishes of Morecambe Bay

Lampetra fluviatilis
Petromyzon marinus
Scyliorhinus canicula
Galeorhinus galeus
Squalus acanthias
Raja batis
Raja clavata
Anguilla anguilla
Conger conger
Clupea harengus
Sprattus sprattus
Salmo salar
Salmo trutta
Osmerus eperlanus
Lophius piscatorius
Ciliata mustela
Gadus morhua
Gaidropsarus vulgaris
Merlangius merlangus
Pollachius pollachius
Pollachius virens
Trisopterus esmarkii
Trisopterus luscus
Trisopterus minutus
Atherina presbyter
Gasterosteus aculeatus
Spinachia spinachia
Nerophis lumbriciformis
Syngnathus acus
Syngnathus rostellatus
Eutrigla gurnardus
Trigla lucerna
Myoxocephalus scorpius
Taurulus bubalis
Micrenophrys lilljeborgi
Agonus cataphractus
Cyclopterus lumpus
Liparis liparis
Liparis montagui
Dicentrarchus labrax
Chelon labrosus
Echiichthys vipera
Lipophrys pholis
Pholis gunnellus
Ammodytes tobianus
Callionymus lyra
Aphia minuta
Gobius paganellus
Pomatoschistus microps
Pomatoschistus minutus
Pomatoschistus pictus
Scomber scombrus
Tetrapturus albidus
Psetta maxima
Scophthalmus rhombus
Limanda limanda
Platichthys flesus
Pleuronectes platessa
Solea solea

Potts & Swaby (1993)

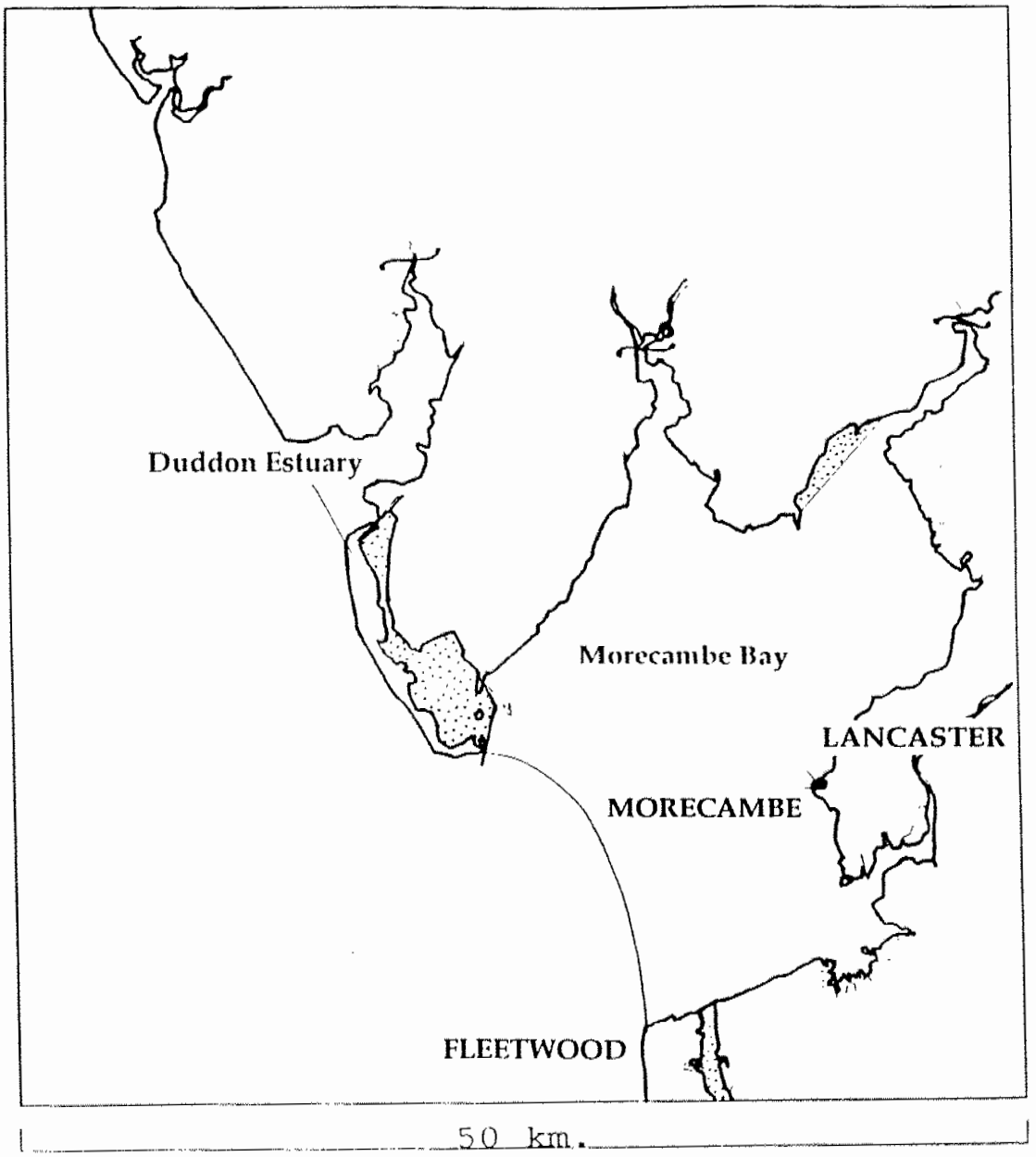

Figure 20.1 Map of Morecambe Bay showing the upper and lower extent of the estuary, the upper tidal limits, and the water quality according to the 1991 NRA Survey. Water quality is characterised as "good" [unmarked], "fair" [medium stipple], "poor" [dense stipple], and "bad" [solid infill].

21

THE FISHES
of
THE DUDDON ESTUARY

THE FISHES OF THE DUDDON ESTUARY

21.1 Introduction

The Duddon forms a major estuarine system that enters the eastern basin of the Irish Sea occupying 6,092 ha. and with a tidal channel of 23 km. It is located at the south west corner of the Lake District and comprises a large coastal plain formed by the River Duddon and the smaller Kirby Pool (Davidson *et al.*, 1992). It is orientated SW to NE and is exposed to the prevailing wind and waves. An unusual barrier island called Walney Island forms the southern seaward limit of the estuary. The mouth of the estuary consists of highly mobile sand plains that extend above high water to form dunes. Mean tidal ranges are 7.5 m. at spring tides and 3.5 m. at neap tides. The estuary is set primarily in a rural area, although there are urban developments at Millom and Barrow in Furness. The whole of the Duddon Estuary is an SSSI of marine botanical and ornithological interest. (Davies *et al.*, 1990).

21.2 Estuarine Habitats

The majority of the estuary comprises of mobile sand with crustacean/polychaete infaunal communities. At low tide the Duddon Estuary drains to leave the main river channels and smaller drainage creeks. The estuary becomes muddier with increasing distance up the estuary and is flanked by saltmarshes. Littoral habitats are bounded by sand dunes, and there are localised rocky habitats. Artificial structures made of large deposits of iron ore from mining operations were discovered adjacent to the estuary and saline lagoons. The few investigations that have included the Duddon estuary have concentrated on the invertebrate fauna, which exhibits low species numbers especially the muddier areas (Davies *et al.*, 1990; Davies, 1992).

21.3 Fish lists

There is no published fish list for the Duddon Estuary. However a list of fishes trawled as part of a study of the fauna of the Cumbria coast is given in Perkins & Ismay (1981). The fish samples were taken at Haverigg, which is situated on the northern edge of the Duddon Estuary mouth. The number of fish species recorded from the Duddon area is 12 (see Table 21.1).

21.4 Fish and fisheries

There are no published data available on the fishes of the Duddon Estuary.

21.5 Impacts

Low volumes of **sewage** are discharged into the Duddon Estuary.

The area is predominantly **rural** with few major sources of pollution. However, there is some agricultural run off into the system (Vivian, 1986; Davies, 1992).

The **mining** of iron ore and the dumping of waste will have had an effect on the estuary, but current levels of mining are not known (Davies, 1992).

21.6 Water Quality

The water quality of the Duddon is "good" (NRA, 1991) (see Figure 21.1). No trade effluent is directly discharged, but it does carry some sewage that is emptied directly into the estuary (Vivian, 1986). A survey of water quality was carried out by Edmondson & Watts (1991).

21.7 Summary

The Duddon is a relatively clean estuary to the north of Morecambe Bay, which is likely to influence its mobile faunal elements. While the variety of marine and estuarine habitats would suggest a rich estuarine fish fauna, to date no systematic surveys have been carried out on the fishes of the Duddon.

21.8 Recommendations

It is recommended that:

1. a detailed survey is carried out on the fishes of the Duddon Estuary.

2. an examination is made of the iron ore deposits to assess their worth as artificial reefs.

21.9 References

Davies, J. 1992 Littoral survey of the Ribble, Duddon, and Ravenglass estuary systems, east basin of the Irish Sea. 94p. *Joint Nature Conservation Committee Report,* No. 37.

Perkins, E.J., & Abbott, O.J. 1977. Final Report to the Cumberland Sea-Fisheries Committee. Solway Firth Survey - 1st April 1973 to 31st March 1974. Consultants Report. Cumberland Sea Fisheries Committee, 1970-1974, C.S.F.C./AR 73-74, 6p.

Perkins, E.J., & Ismay, D.J. 1981. A preliminary account of the fauna of the Irish Sea coast of Cumbria. 1969-1980. 21p. Cumbria Sea Fisheries Report 81/1.

Vivian, C.M.G. 1986. Water quality and sources of pollution - Duddon estuary, Walney Channel and Morecambe Bay. p. 69-72. In: Ineson, P., editor. *Pollution in Cumbria.* Abbots Ripton. Institute of Terrestrial Ecology. ITE Symp. No.16

Table 21.1 The Fishes of the Duddon Estuary

Raja clavata
Sprattus sprattus
Merlangius merlangus
Trisopterus luscus
Echiichthys vipera
Callionymus lyra
Pomatoschistus minutus
Limanda limanda
Pleuronectes platessa
Buglossidium luteum
Solea lascaris
Solea solea

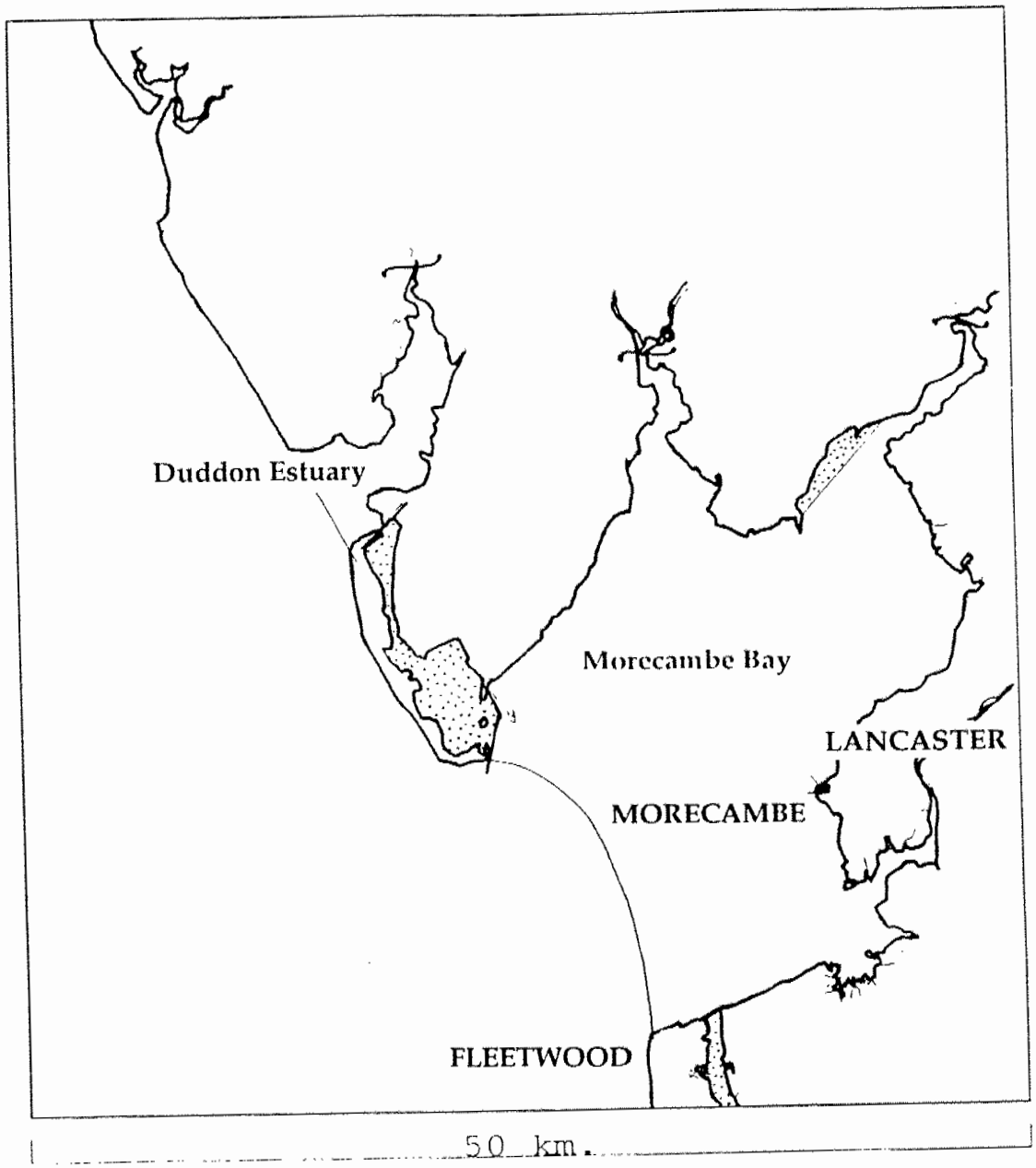

Figure 21.1 Map of the Duddon Estuary showing the upper and lower extent of the estuary, the upper tidal limits, and the water quality according to the 1991 NRA Survey. Water quality is characterised as "good" [unmarked], "fair" [medium stipple], "poor" [dense stipple], and "bad" [solid infill].