2

THE FISHES of THE HUMBER ESTUARY

THE FISHES OF THE HUMBER ESTUARY

2.1 Introduction

The Humber catchment drains 20% of England into one basin and is fed by the Rivers Ouse, Don, Aire, Wharfe, Hull, and Trent (Edwards *et al.*, 1988; NRA, 1992). Its area, 30,356 ha., makes it one of the largest in England with a tidal channel of 145 km (Davidson *et al.*, 1991).

The Humber Estuary is highly industrialised with ports and wharves that make the estuary one of the country's principal centres of shipping. It has good connections with the waterways of Yorkshire and the Midlands, and its improved road access, following the opening of the Humber Bridge in 1981, leaves scope for further development of the area (Edwards, 1985; NRA, 1992). The land around the estuary and the banks have been greatly modified over the centuries with large areas drained for rural, agriculture and later industrial uses (NRA, 1992). There are several urban conurbations sited on or near the estuary (Gameson, 1982)

The Humber Estuary has a number of SSSIs with the major areas of marine biological importance being the Humber Flats and Marshes. (Davies *et al.*, 1990).

2.2 Estuarine habitats

Habitats in the Humber Estuary are characterised by sloping gravel banks, sand flats, and saline lagoons. The south shore is muddy and becomes increasingly wide towards the sea. The north shore is also muddy with both shores becoming sandy at the mouth (Rees *et al.*, 1982).

2.3 Fish lists

A fish list has been compiled from a variety of surveys including Riley (1973, 1979) which deals primarily with eggs and larvae, Gameson (1982), and the NRA (1991) (see Figure 2.2). The number of species of fish in the Humber Estuary is 40 (see Table 2.1)

2.4 Fish and fisheries

The NRA and MAFF carried out beam trawl surveys to determine annual fish distribution. Fifteen species were caught. The abundance was lower than in previous years, but in general similar patterns of species variety and abundance increased towards the mouth of the estuary. Results from 1991 are given in Figure 2.2 (NRA, 1992).

Salmon (*Salmo salar*) pass through the Humber Estuary on migration to and from the Ouse system. They are generally caught at the mouth and higher up in the river using seine, click or draft nets. In the 1870s catches were good until the 1890s when fishing deteriorated . Since World War II there have only been a few good years. Low dissolved oxygen is believed to be the most likely factor limiting the salmon (Parry, 1973). Netting is now banned, and improvements of water quality may account for recent records. The combination of over exploitation and pollution in the Trent, Ouse and upper Humber appears to account for the much earlier decline in salmon catches (Rees, 1982).

The shallow margins at the seaward end and particularly the shoals off Grimsby, are the nursery grounds for young sole and plaice (Porter, 1973).

Cod (*Gadus morhua*) is caught by line fishing mainly in the lower part of the Humber in winter months by both part-time and full-time fishermen. Cod are also taken from the shore using set-lines along both banks as well as by local anglers. The numbers entering the estuary vary from year to year, but recent trends indicate concentrations of cod to be increasing near the Humber mouth (Rees, 1982). Cod have been identified as feeding on shrimps in the Humber (Parry, 1973).

Sole (*Solea solea*) is highly valued, but only supports one trawler in the estuary full-time, others take part on a part-time basis. They are caught in summer months by beam trawl. The eggs have been reported as being taken in the estuary, but the sole is on its northern limit for spawning on this coast (Parry, 1973; Riley, 1973, 1979).

Eel (*Anguilla anguilla*) fishing is carried out commercially using fixed stocking nets and fyke nets (Parry 1973; Gameson 1982). The eel fishery has long been low key and past records indicate an increase in commercial exploitation. The fishing season is from April to October and each net is licensed, although some part-time fishermen do not hold licenses. Good runs of elvers have been found in the Trent since 1977 which may be linked to improvements in water quality. Adults are found in association with organic waste discharge sites and sewage outfalls. Local reports suggest a decline in larger eels which may be a result of overfishing up river, others indicate the fishing to be better than ever (Rees, 1982).

Smelt (*Osmerus eperlanus*) fishing was a traditional seasonal pursuit. Smelt undergo a spawning migration in early spring where the young remain throughout the summer. It is relatively sensitive to pollution and can act as an indicator of changes in water quality. Historically, smelt stocks were recorded as erratic, although numbers of juveniles have been caught on the power station intake screen on the Trent. They are believed to be widely distributed, but there is no commercial smelt fishing (Rees, 1982).

Plaice (*Pleuronectes platessa*) are found in the Humber while in their first year. They have probably been spawned off the Yorkshire coast in late March to early April. (Riley, 1973, 1979). Plaice are caught particularly in the vicinity of Spurn Bright and mainly by part-time fishermen (Rees, 1982).

Flounders (*Platichthys flesus*) are common and locally abundant in the Humber. They are of less value than the other flatfish and are sometimes taken by set-net and used as crab bait. (Rees, 1982). Low numbers of flounders have been reported in the NRA report (1990) but no cause is given.

Sprat (*Sprattus sprattus*) may enter the estuary periodically and in large numbers (Rees, 1982).

The sand goby (*Pomatoschistus minutus*) contributes indirectly to the fisheries as food for the larger fish and as a predator on small shrimps (Riley, 1973, 1979).

The seasnail (*Liparis liparis*) was only found to occur in the middle reaches of the estuary. Its ability to stick to small stones allows it to cope with the tidal scour. (Riley, 1973, 1979).

Dogfish (*Scyliorhinus canicula*) and thornback ray (*Raja clavata*) are reported from the outer estuary (Rees, 1982).

Angling is carried out for cod (*Gadus morhua*) flounder (*Platichthys flesus*), whiting (*Merlangius merlangus*) and eels (*Anguilla anguilla*) (Gameson, 1982). Less common fish angled at Spurn Point include haddock (*Melanogrammus aeglefinus*), brill (*Scophthalmus rhombus*), turbot (*Psetta maxima*), spurdog (*Squalus acanthias*), and tope (*Galeorhinus galeus*). Also bass (*Dicentrarchus labrax*), mullet (*Mugil sp.*), conger eels (*Conger conger*), whiting (*Merlangius merlangus*), pouting (*Trisopterus luscus*), weever (*Trachinus sp.*), saithe (*Pollachius virens*) and mackerel (*Scomber scombrus*) (Rees, 1982).

Tidal scour and salinity are believed to be major limiting factors governing the distribution of many fish in the Humber (Rees, 1982).

2.5 Impacts

Hull was once the premier deep water **fishing port** of the U.K. The fish docks at Hull and Grimsby underwent modernisation, but the decline in the industry meant the loss of deep water trawlers, although fish processing still takes place. Smaller boats at Grimsby increased, and there is a highly productive inshore fishery, but much less so in the river (Parry, 1973; Edwards, 1985). There is also a **shellfish fishery** for cockles and shrimps (Parry, 1973).

Industrial activities include manufacturing iron, steel, coke, chemicals, metal refineries, gas, electricity, construction and fisheries (Goulder *et al.*, 1979; Edwards, 1985). **Oil refineries** on the Humber were facilitated by deep water channels that allowed access for large tankers, cheap land and close proximity to major markets. (Lees, 1973).

Industrial effluents and **sewage** are discharged into the Humber major sources being the Rivers Ouse and Trent. This includes such heavy metals as copper, zinc, cadmium, and lead, which can be detected in both sediments and organisms (Jones, 1979; Barr *et al.*, 1990).

Dredging is needed to keep channels open to allow access to ships and sewage, after being dredged from the Channel, is dumped at sea (Graham, 1973; Gameson, 1982; Edwards, 1985).

Recreational activities were at a low level in the past, but current usage includes sailing, water skiing, rowing, canoeing (Clark, 1973; Jones, 1979).

Agriculture includes intensive livestock production and arable crops (Edwards, 1985).

The **urban** population is at a stable level and not expected to increase significantly (Edwards, 1985).

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

2.6 Water quality

The decline in water quality can be seen in the decline of the estuary's fishes. The deoxygenation of the upper estuary has virtually barred the passage of migratory fish, and waste input must be considered as a factor influencing the decline in status of a number of the commercial fisheries (Porter, 1973; Edwards, 1985).

Improvements to sewage and trade effluent discharges are planned or in progess, and will do much to restore the quality of rivers entering the Humber Estuary. Efforts to reduce organic pollution should raise levels of dissolved oxygen (NRA, 1991, 1992). Water quality management is detailed in Edwards *et al.* (1987, 1988).

Discharges from industries along the Humber Estuary are being monitored by the NRA who have established limits, all were met in 1991, but firms and sewage works on the Aire and Don were prosecuted for going over these limits. The monitoring programme is given in NRA (1992).

Primary water quality determinands for the River Humber are reported by Edmondson & Watts (1992).

While the water quality of the mouth of the estuary is graded of "good" quality, the upper reaches are considered "fair" to "poor" largely as a result of the industrial and domestic effluents discharged. (NRA, 1991) (see Figure 2.1).

2.7 Summary

The Humber Estuary is one of the largest in England with a very large catchment covering much of north east England. The industrialisation and urbanisations around York, Leeds, Bradford, Huddersfield, and Sheffield have a serious impact on the upper reaches of the estuary. The port facilities and industrial activities at Hull are also likely to pollute the lower estuary.

A number of commercial fisheries are found in the estuary and a MAFF survey indicated that there had been an overall decline in the fish population in recent years, but that the species diversity was greatest near the mouth. There is some contradiction about the state of eel populations which is subject to commercial fishing. Fish numbers in the Humber Estuary are likely to be affected by over-exploitation and by pollution.

2.8 Recommendations

It is recommended that:

1. A survey of the distribution of commercial and non-commercial fishes in the Humber Estuary be carried out to relate to compare with the trawl survey carried out in 1991.

2. Pressure should be maintained to reduced pollution from the towns within the catchment area.

3. A review be carried out of the commercial fisheries on the Humber to assess the impact on fish stocks.

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Table 2.1 The Fishes of the Humber Estuary

Lampetra fluviatilis
Scyliorhinus canicula
Galeorhinus galeus
Squalus acanthias
Raja clavata
Anguilla anguilla
Conger conger
Clupea harengus
Sprattus sprattus
Salmo salar
Salmo trutta
Osmerus eperlanus
Ciliata sp.
Gadus morhua
Melanogrammus aeglefinus
Merlangius merlangus
Pollachius virens
Trisopterus luscus
Syngnathus acus
Syngnathus rostellatus
Trigla sp.
Agonus cataphractus
Liparis liparis
Dicentrarchus labrax
Trachurus trachurus
Mugil sp.
Trachinus sp.
Zoarces viviparous
Ammodytes sp.
Ammodytes tobianus
Callionymus lyra
Gobius sp.
Pomatoschistus minutus
Scomber scombrus
Psetta maxima
Scophthalmus rhombus
Limanda limanda
Platichthys flesus
Pleuronectes platessa
Buglossidium luteum
Solea solea

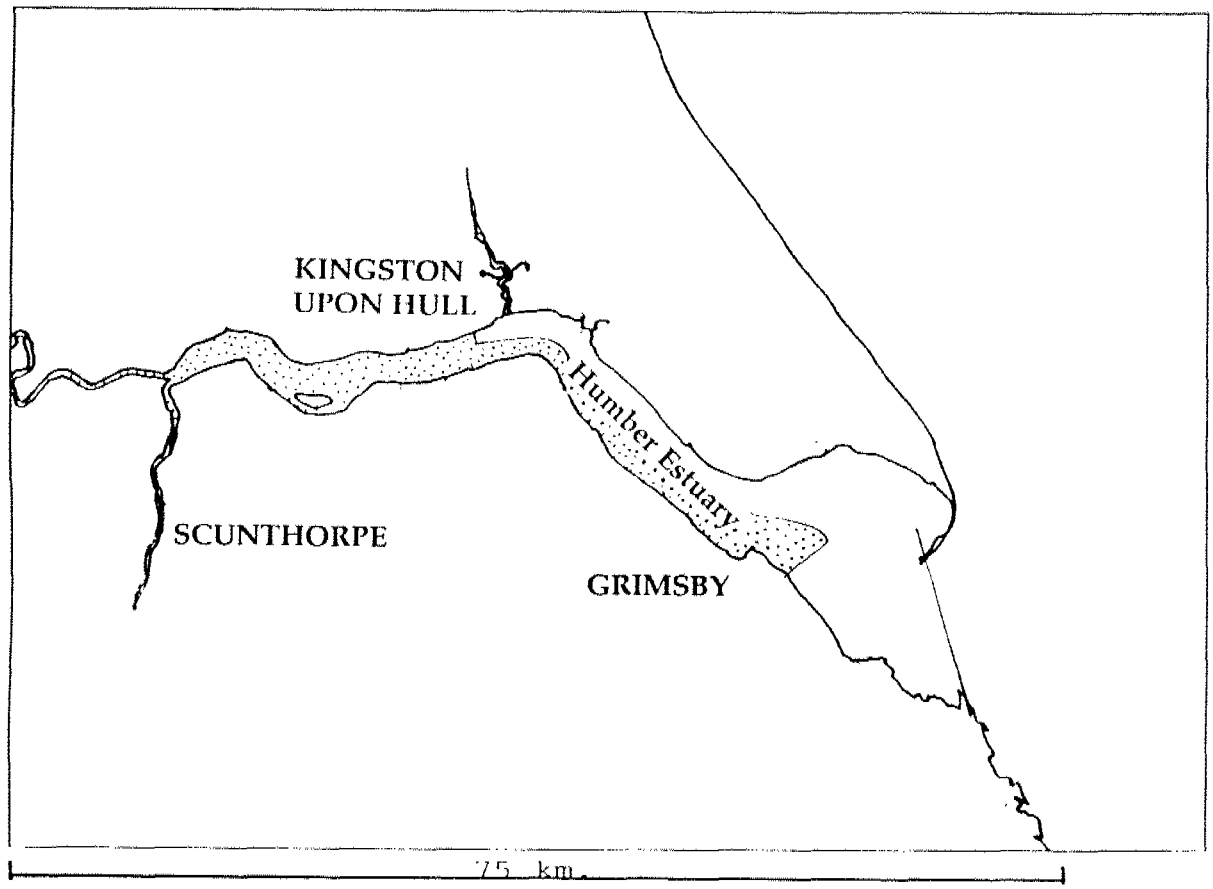

Figure 2.1 Map of the Humber Estuary showing the upper and lower extent of the estuary, the upper tidal limits, and the water quality according to the 1991 NRA Survey. Water quality is characterised as "good" [unmarked], "fair" [medium stipple], "poor" [dense stipple], and "bad" [solid infill].

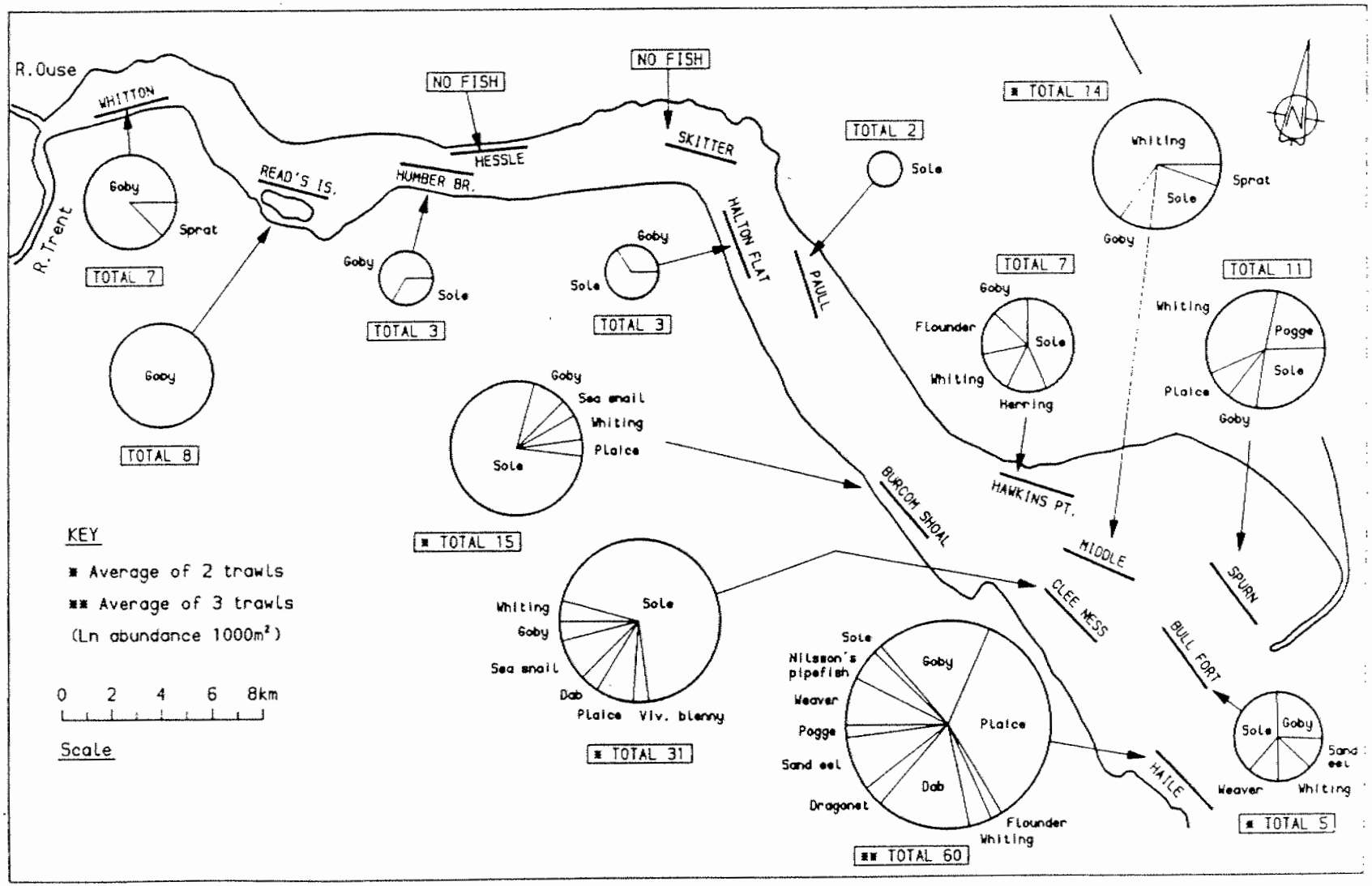

Figure 2.2 Distribution of fish in the Humber Estuary. Results of the 1991 trawl survey (reproduced with permission of the National Rivers Authority (1993)).

3

THE FISHES of THE WASH

THE FISHES OF THE WASH

3.1 Introduction

The Wash is a large sea inlet (66,654 ha.) between the north Norfolk coast and east facing Lincolnshire coast. Four large rivers flow into the Wash (Great Ouse, Nene, Welland and Witham), all are much modified. It has a tidal range of 6.7m on spring tide and 3.4m neap tide. The flood tide moves at right angles to coastline, and high water does not occur simultaneously throughout the Wash. There are strong tidal currents (2.5 knots at springs) and a high wave action. In the outer reaches there are deep channels down to well over 40m below chart datum in the Lynn Deeps. Salinity varies little throughout the Wash, as the water is well mixed (NERC Report 1969).

The Wash is a Grade 1 SSSI of particular interest for its wading birds and wildfowl, but also of marine biological interest and cited as important nursery ground for flatfish (Davies *et al.*, 1990).

3.2 Estuarine habitats

There are intertidal sand and mudflats, salt marshes, brackish ditches, and coastal lagoons. The substrata of the outer reaches is mixed, with flint, chalk and cobbles and patches of well sorted gravels. There are mobile sandbanks in the channels. Little data exists for sublittoral ecosystems (NERC Report 1969; Dipper *et al.*, 1989), no doubt as a result of the high turbidity.

3.3 Fish lists

The fishes of the Wash have only been recorded as a secondary part of other surveys as in Dipper *et al.*, (1989), or single species study as for the sprat (*Sprattus sprattus*) Johnson (1969, 1970). The number of fish species recorded from the Wash is 22 (see Table 3.1).

3.4 Fish and fisheries

There are few publications on the fishes of the Wash. However, the Wash is known to be an extensive nursery ground and refuge for commerical fish in North Sea including cod (*Gadus morhua*), plaice (*Pleuronectes platessa*) and sole (*Solea solea*). (NERC Report 1969; Dipper *et al.*, 1989).

The commercial fishery is dominated by whitefish and sprats (*Sprattus sprattus*) which occur in large schools. During the 1920s there was an extensive sprat fishery in the Wash, but following this it went into decline until 1959 when it recommenced (Johnson, 1969, 1970). The richest fishing grounds are said to lie within the line joining Heacham (Norfolk) to Wrangle Toft (Lincolnshire) (NERC Report 1969).

Dab (*Limanda limanda*) are present all year round in the Wash and other species are considered to be seasonal visitors.

Cod (*Gadus morhua*) and dense shoals of herring (*Clupea harengus*) move into the Wash during winter months. Plaice (*Pleuronectes platessa*), thornback ray (*Raja clavata*) come into spawn in June-August and may appear as early as April. Grey mullet (*Mugil sp.*) and sea trout(*Salmor trutta*) arrive July-September (NERC Report 1969).

Soles (*S. solea*), turbot (*Psetta maxima*) and brill (*Scophthalmus rhombus*) come into Wash to feed and breed in the shallow estuary, but not in any great numbers. When mature they move into deeper water. Mackerel (*Scomber scombrus*) and tope (*Galeorhinus galeus*) are reported from the Wash at various times, but are usually confined to the seaward, usually in pursuit of herring. No salmon (*Salmo salar*) run up any of the Wash rivers and there are only a few sea trout (*Salmo trutta*) reported from the Great Ouse (NERC Report 1969).

Flounders (*Platichthys flesus*) are found in lower reaches in saline conditions. Eels (*Anguilla anguilla*) are taken in rivers entering Wash (Dipper *et al.*, 1989).

Sturgeon (*Acipenser sturio*) have been recorded from Ouse (NERC Report 1969).

3.5 Impacts

For the impact of **commercial fishing** see 3.4 above.

A **barrage** was proposed for the Wash in 1969 which would have resulted in major ecological changes. Its effects would have resulted in changing the tidal regime and the loss of the present commercial fishing. It was identified as being detrimental to the nature conservation value of the area (NERC Report 1969; Nature Conservancy Council, 1969).

A **water storage scheme** has been proposed for the Wash and suggestions were put forward to include the farming of sea trout (*S. trutta*), apparently to appease the destruction of the sprat (*S. sprattus*) fishery. This proposal has been shelved (Dipper *et al.*, NERC, 1976).

The Wash has had a long history of **land reclamation** for **agricultural** purposes with cattle grazing on saltmarshes a long established practice (Doody & Barnett, 1987; Dipper *et al.*, 1989; Davidson *et al.*, 1991)

Sewage and **industrial effluent** are the main organic pollutants from the rivers entering the Wash causing eutrophication and enhancing algal blooms (Dipper *et al.*, 1989), especially during the summer months.

Heavy metals are increasing in the Wash as a by-product from the flower bulb industry (Dipper *et al.*, 1989), and other levels of heavy metal contaminants are considered by Burt *et al.*, (1992).

The **recreational** use of the Wash appears to be restricted to **bait digging** and bird watching.

The Wash is a bombing range for the **MoD** and has been reported as vulnerable to **oil spills** (Dipper *et al.*, 1989).

3.6 Water quality

Sewage runoff causes eutrophication which results in rapid algal growth. (see 3.5 above). Higher levels of phosphorous and nitrogen concentrations are also recorded (Corlett, 1972). Overall the water quality recorded by the NRA (1991) is "good" despite high sediment loads (NRA, 1991) (see Figure 3.1). Water quality determinands for the Wash is given in Edmondson & Watts (1992).

3.7 Summary

As England's largest estuarine inlet, the Wash is of particular importance for biological conservation. Primarily recognised for its wader and wildfowl populations, it is also an important North Sea nursery area for marine fishes. The current status of the sprat fishery needs to be reviewed.

3.8 Recommendations

It is recommended that:

1. a survey is carried out on the fishes of the Wash using a short beam trawl. Seasonal abundance of inshore species should be recorded and special attention given to non-commercial species.

2. the status of the sprat (*Sprattus sprattus*) fishery needs to be reviewed.

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Table 3.1 The Fishes of the Wash

Galeorhinus galeus
Raja clavata
Acipenser sturio
Anguilla anguilla
Clupea harengus
Sprattus sprattus
Salmo trutta
Gadus morhua
Merlangius merlangus
Myoxocephalus scorpius
Agonus cataphractus
Pholis gunnellus
Callionymus lyra
Pomatoschistus minutus
Pomatoschistus pictus
Scomber scombrus
Psetta maxima
Scophthalmus rhombus
Limanda limanda
Platichthys flesus
Pleuronectes platessa
Solea solea

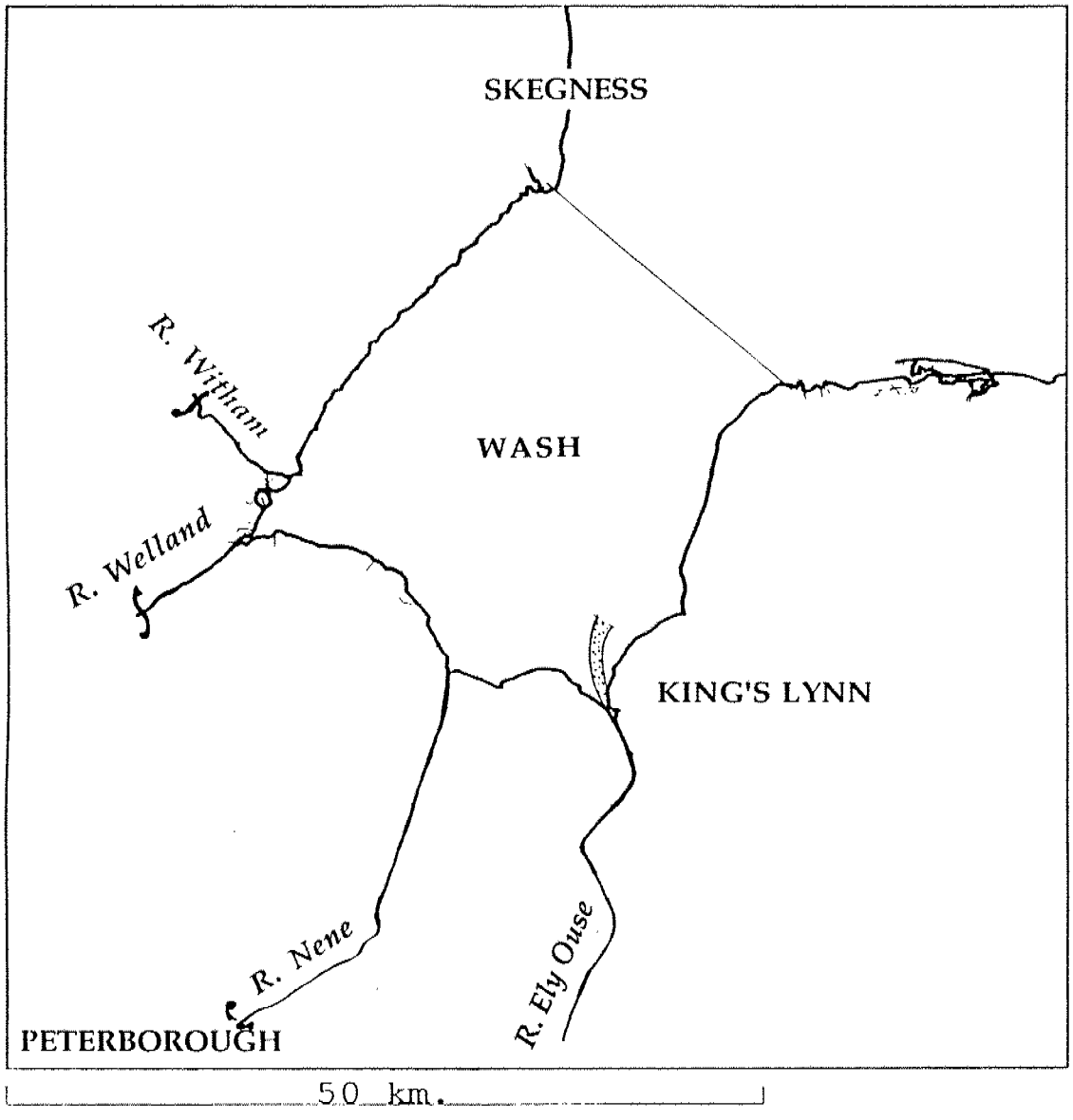

Figure 3.1 Map of the Wash showing the upper and lower extent of the estuary, the upper tidal limits, and the water quality according to the 1991 NRA Survey. Water quality is characterised as "good" [unmarked], "fair" [medium stipple], "poor" [dense stipple], and "bad" [solid infill].

4

THE FISHES
of
THE ORWELL ESTUARY

THE FISHES OF THE ORWELL ESTUARY

4.1 Introduction

The Orwell Estuary is a long, meandering shallow estuary and is a drowned river valley into which the River Gipping flows. It has a total area of 1,785 ha and a tidal channel of 18 km. (Arnott, 1954; Beardall *et al.*, 1991; Davidson *et al.*, 1991). The tidal range varies from approximately 2.9 metres on neap tides and 4.3 metres at spring tides.

The Orwell is considered an SSSI of marine biological importance (Davies *et al.*, 1990).

4.2 Estuarine habitats

The Orwell, had 560 ha. of intertidal flats, on which Kay & Knights (1975) have carried out a macro-invertebrate survey. Habitats include saltmarshes, firm muddy sandflats and mussel beds. The intertidal area is narrow in the lower reaches, but broadens upstream, particularly on the northern shore where the sea wall gives way to natural banks. The sediment is predominantly fine silt with some fine sand on the upper shore. The silt at the mouth is mixed with gravel Davies *et al.*, (1990). Formal tidal flats were reduced to 40 h. and have now been lost through expansion of Felixstowe Docks (Davidson *et al.*, 1991).

4.3 Fish lists

There is no published fish list available for the Orwell Estuary, however a list of the fishes found in the estuaries of Suffolk is given in Beardall *et al.* (1991). The number of fish species recorded is 11 (see Table 4.1).

4.4 Fish and fisheries

There is no published information on the fishes of the Orwell Estuary, but some information may be contained in the notes and field logs of anglers and fishermen.

Beardall *et al.* (1991) identify that the rich invertebrate fauna of the salt marshes and mudflats provide food for large numbers of fish. While a short list is given, including some of commercial importance, no details of their abundance or distribution is given.

Interesting changes are recorded in invertebrate fauna, from one dominated by molluscs in 1973 to polychaetes in 1985. While the reasons for this change are not explained, it could provide an important food resource for estuarine fishes. It is noted that the change has occurred at the same time as a 15% increase from a sewage outfall.

4.5 Impacts

In the past, there have been substantial historical **agricultural land claims**, but more recent land claim pressures have been for docks and marina developments on the upper parts of the estuary at Ipswich and close to its mouth at Felixstowe. The main area of former tidal flats is the lower estuary, Fagbury Flats, which have now been almost entirely lost through dock expansion. Planning consent conditions have been imposed to minimise the impact on the remaining parts of what, in conservation terms, is a internationally important estuary. These flats have been subjected to progressive land claim and a series of indirect effects that have claimed virtually the whole intertidal zone. The remaining 20ha of intertidal area was damaged by spoil dumping, run off from pumped spoil and cutting of a drainage channel (Davidson *et al.*, 1991).

Dredging was commenced following episodes of siltation and this is expected to expand into the mouth of the estuary to accommodate planned expansion programmes (Beardall *et al.*, 1991; Davidson *et al.*, 1991).

A **bulk storage** facility exists for **oil and chemical** products at Ipswich Dock. Anglian Water Authority have authorised a legal discharge of oil into the estuary. There is the possibilty of larger spills as well a continuous discharge at a low level (Beardall *et al.*, 1991).

Organic effluent is discharged into the Orwell through 23 outfalls. Most is untreated or only receives primary treatment. The dilution with freshwater can be less than half the volume of one outfall, in the upper reaches. The relatively large discharge and organic effluent from industrial sources and the long flushing time of the Orwell creates completely anoxic conditions in the sediment in the upper estuary (Beardall *et al.*, 1991).

Organotin contamination in sediments was studied by Dowson *et al.* (1992), who concluded that the major impact into the aquatic environment is via boat service facilities such as boat yards, marinas and mooring sites. High concentrations coincided with summer boat usage either from TBT leaking from boat hulls after the retail ban or desorption from contaminated sediments as a result of **dredging**. Sedimentary levels of mercury are high in the Orwell as a result of a historic industrial source that no longer discharges into the estuary (Beardall *et al.*, 1991). Levels of other **heavy metals** are given in Burt *et al.* (1992).

Recreational pressures include water-skiing, wind-surfing, canoeing, and the provison of a marina with attendant yachting and other sailing activities (Beardall *et al.*, 1991; Davidson *et al.*, 1991).

Bait digging is carried out on the Orwell, mainly during the late summer and autumn, in the remaining easily accessible areas. Collection is on a non-commercial basis (Beardall *et al.*, 1991).

4.6 Water quality

The upper reaches of the Orwell are graded as having "poor" water quality where the River Gipping drains into the estuary. The volume of water in dry summers can be low and less than the volume of sewage discharged from a single outfall at Cliff Quay. The resulting decomposition of organic products results in a reduction in available oxygen to levels that prevent the passage of estuarine fishes (Beardall *et al.*, 1991; NRA, 1991) (see Figure 4.1).

Below Ipswich the water quality improves to "fair" and "good", but deteriorates again at the mouth of the estuary at Felixstowe Docks.

Heavy metal contamination of the Orwell is summarised in Burt *et al.* (1992).

4.7 Summary

The Orwell, like the Stour, has undergone severe changes in character in the last hundred years. Through urbanisation, industrialisation and the extension of the dock complex, the estuary has become polluted and is unlikely to contain a representative fish fauna. The oil storage facilities with legal authority to discharge oil products and the extensive dredging operations are likely to pollute and so change patterns of sedimentation that few suitably stable habitats will remain. The levels of pollution in the upper Orwell are high and low summer oxygen levels will provide a barrier to the migration of estuarine fishes.

4.8 Recommendations

It is recommended that:

1. A survey is carried out of the fishes of the Stour and Orwell Estuaries.

2. Legislation should be enforced to improve the quality of the water in the region of Ipswich.

3. The monitoring of fish populations should be started to provide indicators of the recovery of the estuary, provided a programme of water quality improvement can be enforced.

4. No oil product discharges should be allowed if fish populations are expected to recover.

4.9 References

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Table 4.1 The Fishes of the Orwell Estuary

Anguilla anguilla
Clupea harengus
Salmo salar
Salmo trutta
Gadus morhua
Merlangius merlangus
Atherina presbyter
Dicentrarchus labrax
Platichthys flesus
Pleuronectes platessa
Solea solea

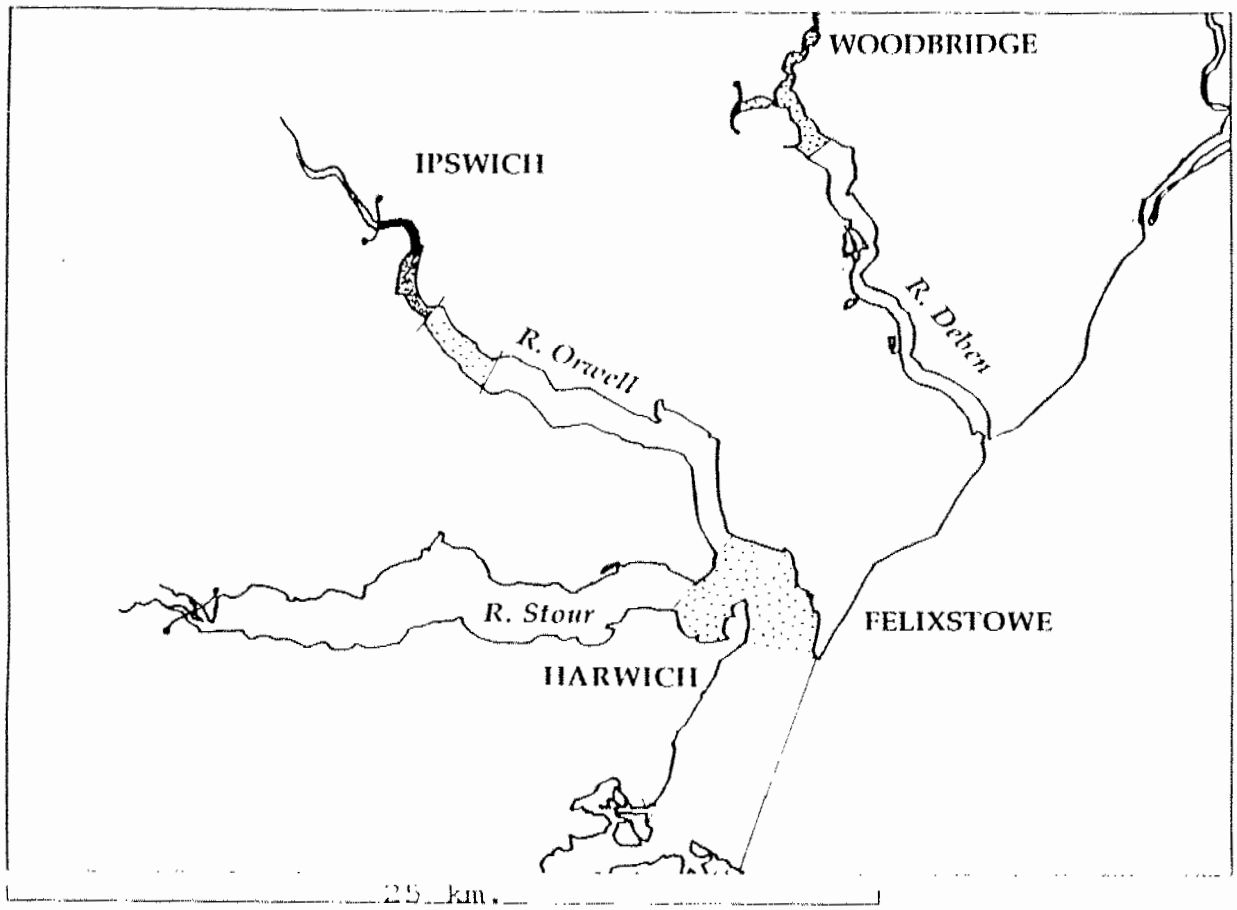

Figure 4.1 Map of the Orwell Estuary showing the upper and lower extent of the estuary, the upper tidal limits, and the water quality according to the 1991 NRA Survey. Water quality is characterised as "good" [unmarked], "fair" [medium stipple], "poor" [dense stipple], and "bad" [solid infill].