SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

ESTUARY PROFILE
FOR MOLLUSC CULTIVATION
TEIGN ESTUARY DEVON

Internal Report No. 1282

August 1987
Dr. Eric Edwards
Shellfish Association of Great Britain

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SUMMARY

The Teign Estuary, which is situated on the south Devon coast, is long and narrow and opens into the English Channel at Teignmouth.

Local fisheries are managed by the Devon Sea Fisheries Committee under their byelaw regulations. There is a regulated order area, allocated by MAFF to the Teign Musselmen's Society Ltd., covering a large part of the seabed, granting their exclusive rights to the mussels.

Mussels have been produced in the Teign for generations based upon the exploitation of natural stocks and by simple cultivation - which involved bringing seed from outside the estuary for relaying on plots in the Teign Mussel Fishery Order area.

Teign Mussel Fishery Order by encouraging reseeding on the lays, using seed collected from other areas.

Despite the sewage problem the area does have potential for mollusc culture - especially for Pacific Oysters and mussels.

The Teign Estuary and Shaldon Bridge

Despite the high meat yield from Teign mussels there has been a general decline in the amounts produced - falling from over 100 tons a season in the 1970s to 25-40 tons in the 1980s. The main reason for this reduction is the scarcity of good seed in the Teign to replenish the lays.

Since the late 1970s, Pacific Oysters have been introduced into the Teign where they grow well. Production is based on growing hatchery-bred seed in bags laid on trestles near low water. The growing period from seed to marketable size is around three years. Last year some 350,000 marketable oysters, worth around £400,000, were sold to various outlets by the 14 growers.

Fortunately, this developing Pacific Oyster industry has not suffered too badly from the toxic aspects of organotin (TBT) yacht antifouling paints and some excellent oysters are produced from the Teign.

The main problem to growers is the poor water quality in the Teign caused by sewage effluents and agricultural run-offs further up the river. Surveys have shown that levels of water contamination by pathogenic bacteria and viruses are so high that, despite purification, significant quantities of molluscs from this area are of unacceptable quality and can cause health problems.

More illnesses occur during the winter months and the growers are now relaying their oysters in cleaner areas to try to overcome this problem. Improved purification techniques and tighter controls on the discharge of untreated sewage into the Teign would help reduce the problem.

Mussels, which are normally cooked before eating, cause fewer public health problems. There is a need to help redevelop the

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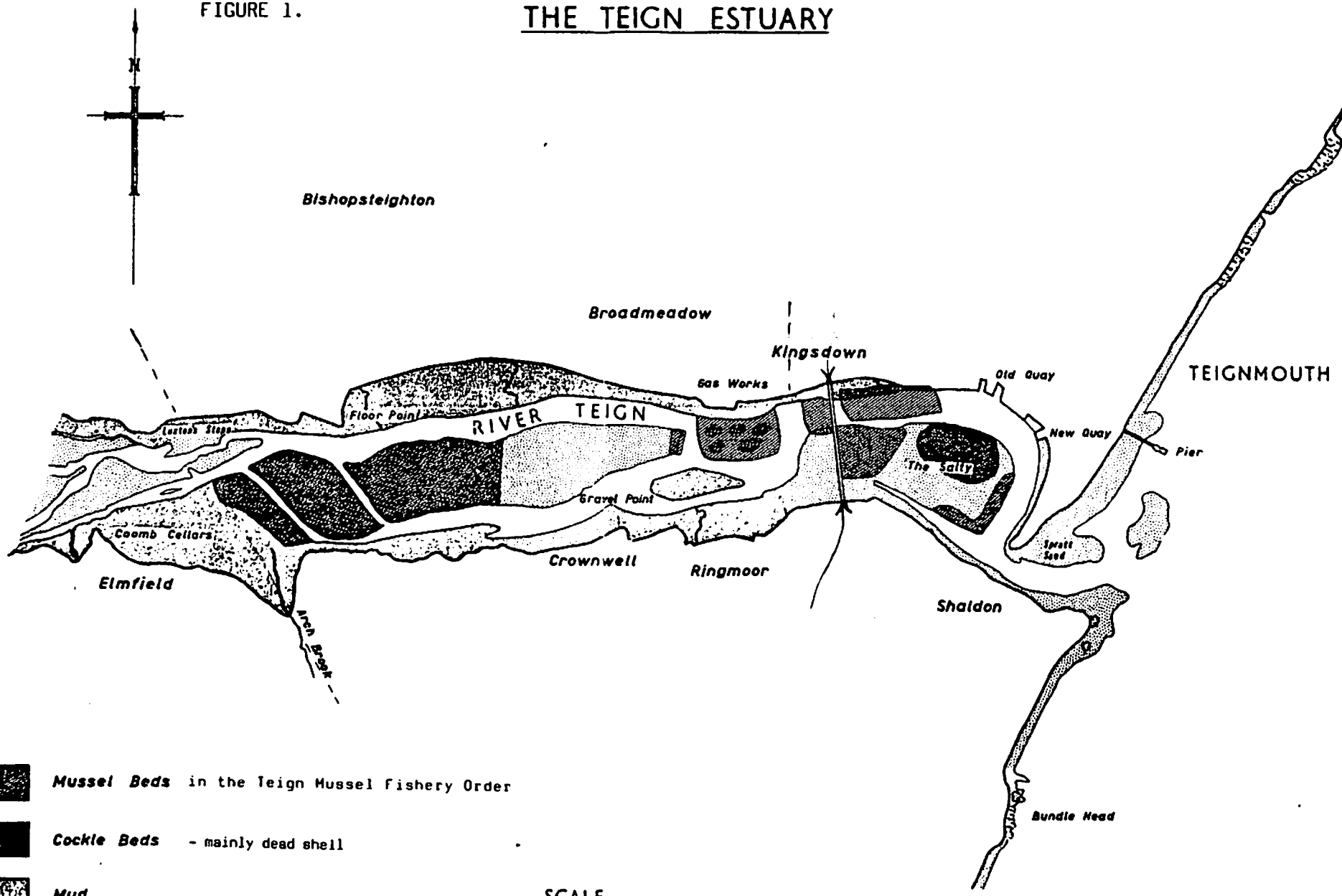
FIGURE 1.

THE TEIGN ESTUARY



The Shaldon road bridge crossing the Teign estuary allows access between Shaldon on the south bank and Teignmouth on the north, where there is a small quay, controlled by the Devon Trading Company. Coasters up to 1,000 tons can berth here and there is a steady export trade of china clay to the Continent and some general with other British and European ports.

Opposite the quay, fringing the large sand bank known as the "Salty", are moorings for yachts and small craft. This area is also used for relaying shellfish.

The depth of water at H.W. in the harbour is 18ft on spring tides and 13ft on neap tides. Salinity measurements during the summer range between 29°/₀₀ at low water to 32°/₀₀ at high water. Levels would be lower during the winter when rainfall is greater. Current velocity is greatest on the flood tide, reaching 100 cm/sec.(2 knots) at the surface at abour 2½h before H.W.

Sewards of Shaldon Bridge there is considerable silting and dredging operations are needed to allow the coasters to reach the quay.

Small trawlers, potters and scallopers also use Teignmouth harbour but yachting is growing in popularity - possibly at the expense of the shellfish industry (see P 12).

2. SEABED RIGHTS AND MANAGEMENT REGIMES

2.1 Fisheries Legislation

The area comes under the responsibility of the Devon Sea Fisheries Committee:

Clerk	Chief Fishery Officer
Council Offices, Kingsteignton Road, Newton Abbot, Devon, TQ12 2QD	Fisheries Office, Fish Market & Jetty, The Quay, Brixham, Devon.

Byelaws affecting the Teign shellfisheries include:

(a) No.3 Detrimental Substances

'relates to the deposit or discharge of any toxic solid or liquid substance detrimental to sea fish or sea fishing.....'.

(b) No.6 Restriction on Trawling in Estuaries

'..... in the area which lies to the landward side of a line drawn from the Lucette Beacon off Shaldon foreshore to the lighthouse at Teignmouth'.

(c) No.8 Shellfish - Redeposit of

'Any person who takes any shellfish, the removal of which from a fishery is prohibited by byelaw, shall forthwith redeposit them, without injury as near as possible to the place from which they were taken'.

(d) No.9 Temporary Closure of Shellfish Beds

'This byelaw allows the Committee to close a bed, or part of a bed, for protection of undersized stock or transplanted stock until it is established.

(e) No.10 Winkles

'No person shall remove from a fishery any winkle which will pass easily through a gauge within a square opening of sixteen millimeters measured over each side of the square'.

2.2 Fishery Orders

The Ministry of Agriculture, Fisheries & Food,

under powers of the Sea Fish Industry Act 1962(b), made The River Teign Mussel Fishery Order 1966. This is a regulating order which allows the Teign Musselmen's Society Ltd. the right to regulate the fishery for mussels.

This mussel fishery order covers an area of about 385 acres including the foreshore and bed of the Teign estuary in the area defined as ".....bounded on the west by a straight line drawn from Luxton Steps south-eastwards to Archbrook and on the east by a straight line drawn across the river 60ft. upstream of Shaldon Bridge".

The Order restricts mussel fishing by licence to members of the Society who are each allocated plots or lays where simple cultivation is practised (see P 7).

2.3 Closing Orders

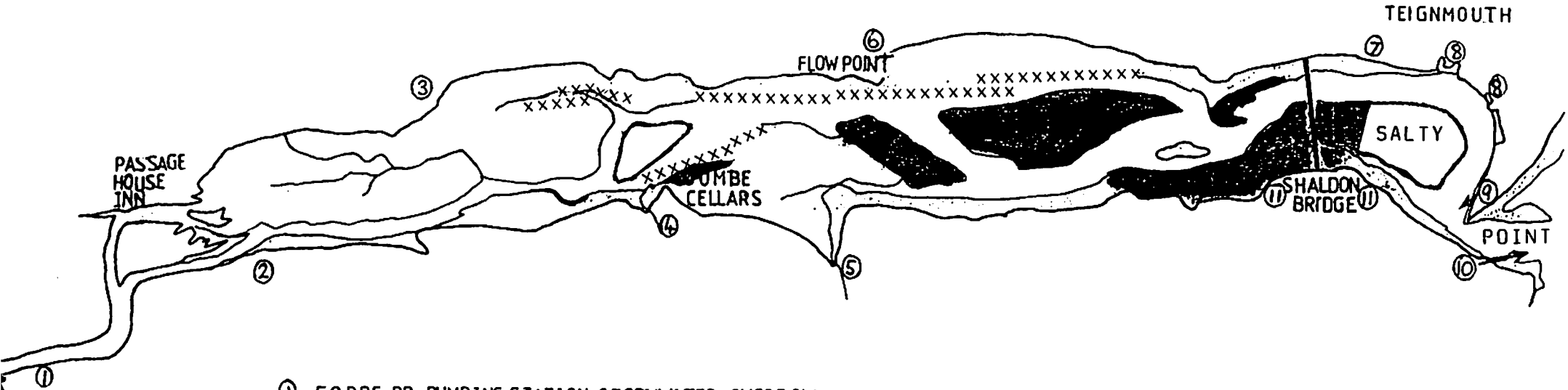
The Teign estuary has been badly affected for many years by sewage pollution and to safeguard the public a closing order - made under the Public Health (Shellfish) Regulations 1934 - was introduced by the Teignbridge District Council on 18th July, 1983.

The order covers all of the River Teign from the estuary bar in the east to Wildlands Point in the west (Figure 2).

The closing order covers oysters, clams, mussels and cockles. These shellfish must not be sold, exposed, distributed or offered for sale for human consumption unless:

(a) purified by an approved method

FIGURE 2. SEWAGE DISCHARGES AFFECTING SHELLFISH LAYINGS



① FORDE RD. PUMPING STATION STORMWATER OVERFLOW
② BUCKLAND SEWAGE TREATMENT WORKS
③ CARAVAN SITE; BIODISC UNIT
④ STREAM CARRYING RAW SEWAGE FROM COOMBEINTEIGHEAD
⑤ STREAM CARRYING DISCHARGE FROM STOKEINTEIGNHEAD SEWAGE SETTLING TANKS
⑥ BISHOPSTEIGNTON SEWAGE TREATMENT WORKS
⑦ STORMWATER OVERFLOW FROM BIODISC UNIT; NORMAL FLOW THROUGH ⑨
⑧ STORMWATER OVERFLOWS FROM ⑨
⑨ TEIGNMOUTH RAW SEWAGE OUTFALL
⑩ SHALDON RAW SEWAGE OUTFALL
⑪ STORMWATER OVERFLOWS FROM ABOVE

■ MUSSEL BEDS
xxx OYSTER LAYINGS
▨ GROUND ABOVE LOW WATER MARK

CLOSING ORDER made by Teignbridge District Council covers the area of the River Teign and its estuary from the bar beyond the Point in the east and Wildlands Point in the west.

(Supplied by Environmental Health Dept., Newton Abbot)

(b) relaid in pure water as approved by the Council

(c) subjected to a process of sterilisation by steam under pressure.

2.4 Nature conservation

So far no parts of the Teign estuary have been designated as Sites of Special Scientific Interest (SSSIs) and according to the Nature Conservancy Council there are no immediate plans to do so.

There are plans, however, to carry out a fauna and habitat study of this estuary within the next couple of years by the NCC.

3. MOLLUSC RESOURCES AND THEIR UTILISATION

The River Teign has natural stocks of mussels, cockles and periwinkles. Since the mid-1970s the estuary has also developed into one of the most important Pacific oyster cultivation sites in Britain - using hatchery seed grown in trays on racks. These molluscan resources are each considered in detail below:

3.1 Mussels

a) Background

The Teign mussel fishery was a considerable one earlier in the century. In 1921 records show that two to three thousand hundredweights were sent to traditional markets in London and the Midlands.

By 1926 mussel production had risen to 5,000 cwt. But from then on a build up of sewage contamination in the Teign led to a decline in markets and by 1950 the output

had fallen to 500 cwt. per annum. By this time very few mussels were being relaid in the Teign and the fishery was virtually dying out.

In 1953, purification tanks were built on the quay at Teignmouth based on a design recommended by MAFF which used the Conwy system of chlorination. This development resulted in new interest among the fishermen and 100-150 tons of young mussels were relaid that year. These matured in 1958 and formed the basis of a revived industry.

After the unusually dry summer of 1959 the parasitic red worm Mytilicola was found to have infected the Teign mussel beds. The whole area was affected and mussels in the upper parts of the estuary seemed to suffer badly from the infestation. Mussels nearer the sea, where there was higher salinity, seemed able to survive and maintain good condition despite heavy infestation by Mytilicola.

b) The present mussel fishery

The main mussel stocks are on the banks between Shaldon Bridge and Coombe Cellars (Figures 1&2) in the area of the Mussel Fishery Order. There are a few small natural mussel beds in this area but very little spat settlement normally takes place on the ground and production is based on simple relaying using seed collected from the seaward end of the "Salty" bank, scraped off pilings and also from yachts and moorings when they are laid up for the winter. In the past seed mussels were also brought in from the Exe estuary and

from settlements located in the Channel, but little of this activity is done nowadays.

Mussels grown in the Teign have a high meat content but because of tidal exposure (most of the beds uncover on all except the poorest neap tides and are exposed for two to three hours on spring tides) they are slow growing and take 3 to 4 years to reach marketable size (60mm). The lays also suffer from a build up of mussel mud, which not only raises the level of the mussels but also makes walking very difficult.

Under the Teign Mussel Fishery Order 1966 members of the local 'Society' have 'lays' onto which they relay any stock they can collect. Sometimes seed is brought from the River Exe but stock there is also scarce. In 1986 a local grower purchased mussel seed from the Burry Inlet in an attempt to bocst his production.

Mussels are usually gathered by hand. If they have been relaid thickly and grown in clumps of uniform-sized mussels they may be lifted with a garden fork.

In previous years the harvested mussels were taken to the purification tank at New Quay, Teignmouth, but this has now fallen into disuse and local merchants at Paignton, Totnes and Starcross have their own small purification units which can handle the present low level of production which is now less than 25 tons (Table 1).

Under the terms of the Teign Mussel Fishery Order production statistics have to be supplied to MAFF.

Figures (Table 1) show a gradual decline in mussel production from just over 100 tons a season in the early 1970s to 25-40 tons in the early 1980s. The main reason for this fall in production is the scarcity of good seed in the Teign to replenish the lays.

Cockles

Small numbers of cockles are found on the "Salty" bank and they are occasionally harvested from other areas. There are not enough cockles to support a regular fishery in the Teign.

Periwinkles

Periwinkles are also found in the Teign as far upstream as Coombe Cellars. They are gathered by hand at spring tides and provide an income for some fishermen. No records are kept of landings or sales.

Pacific oysters (Crassostrea gigas)

There was no history of oyster production in the Teign until the 1970s when hatchery-reared Pacific oysters were first tried on a semi-commercial scale under the guidance of staff from the Fisheries Experiment Station, Conwy.

Today, in the 1980s, the Teign is one of the most important Pacific oyster growing areas in England with annual production for sale in the region of 250,000-350,000 oysters, with a value of £400,000 (Table 1A).

Since this oyster does not normally reproduce in UK waters the seed is purchased from hatcheries at a size of 9mm. The small seed oysters are then held in

Table 1.

Mussel Landings by Teign Musselmen

Year	Amount
70/71	132 tons
72	143
73	96
74	125
75	100
76	84
77	48
78	30
79	22
80	31
81	26
82	44
83	43
84	36
85	25

(Supplied by Mr. Bill Hook, Teignmouth)

Table 1A.

Pacific oyster production - Teign

1970	-	Nil
1980	-	200,000 oysters
1987	-	350,000 oysters

(Source Pacific oyster growers - SAGB)

¼" plastic mesh 'pouches' laid on trestles at the low tideline. Growth in the Teign is good and most of the seed will reach a 100g size in three years. During this period they must be graded and thinned out to prevent overcrowding using the methods now developed for the culture of this fast growing species.

Oysters grown in the Teign have a good meat content and well-shaped shells. Fortunately, the growers here did not suffer the problems of organo-tin (TBT) pollution mainly because the high level of tidal exchange in the estuary reduced the effects from yacht antifouling paints using these toxic compounds and the shell thickening experienced by other British growers did not occur.

For some years production of Pacific oysters has been held back by the lack of a domestic market. Markets for Pacific oysters are gradually improving and most local growers have their own outlets. Indeed some producers admit that demand now exceeds supply.

The main problem to growers is the poor water quality in the Teign caused by sewage effluents. According to MAFF '....levels of water contamination are so high that despite purification significant quantities of molluscs from this area which enter the markets are of unacceptable quality and cause health problems'.

Such comments, and a series of illnesses associated with Teign oysters, has affected their reputation and this problem is one of the most important affecting the future development and expansion of mollusc production from this estuary.

Some growers try to overcome the sewage problem by relaying their oysters in the River Dart or Exe. Local fishermen have also agreed with the local Public Health Authorities to relay their oysters on the "Salty" - where there is a low level of pollution - for several weeks before sale. This voluntary arrangement has helped to reduce the number of outbreaks of illness from Teign oysters, especially during the winter months.

4. POTENTIAL FOR INCREASING MOLLUSC PRODUCTION

Production of bivalve molluscs from the Teign is based on the limited cultivation of mussels in the Teign Mussel Fishery Order and more developed businesses rearing hatchery-produced Pacific oysters on trestles near low tide level.

In view of the fishermen and others who rely on these fisheries for their livelihood and who have expertise, it seems logical that greater efforts are made to expand production. Add to this the steady growth in market demand for both mussels and Pacific oysters and the need to boost mollusc output from the Teign must be considered a priority.

5. WHAT ACTIONS ARE NEEDED TO BENEFIT THE LOCAL INDUSTRY?

5.1 Mariculture

Mussels

The fact that an area of 385 acres has been designated under the River Teign Mussel Fishery Order is a substantial benefit to the future of mussel production.

The main factor limiting production is a regular supply of seed.

MAFF trials in the Teign estuary showed that spat collection, using coir and synthetic tufted ropes, was likely to succeed in this estuary only during May-August when primary spat were enormously abundant (Figure 3). Subtidal ropes collected extremely large quantities of summer spat but crab predation is believed to have resulted in high losses.

Intertidal ropes had heavy settlements but losses due to dense fouling, crab predation and aerial exposure gave poor results which demonstrated that intertidal collection of summer spat is unlikely to succeed in the Teign estuary.

To overcome the problem of crab predation MAFF scientists put out collector ropes on intertidal racks inside a crab proof fence. Despite a good settlement in the summer losses occurred for some unknown reason and the problem of collecting seed in the Teign still exists.

<u>There are solutions</u>:

a) To overcome crab predation the Teign Mussel Society could relay mussels over 20mm length, which would have more chance to survive the crabs.

There are reports of offshore beds of seed mussels off Brixham, Portland and other areas of the English Channel and these areas should be located and trial relay experiments carried out. Local scallop vessels - well equipped with dredging gear - could help in this seed evaluation survey

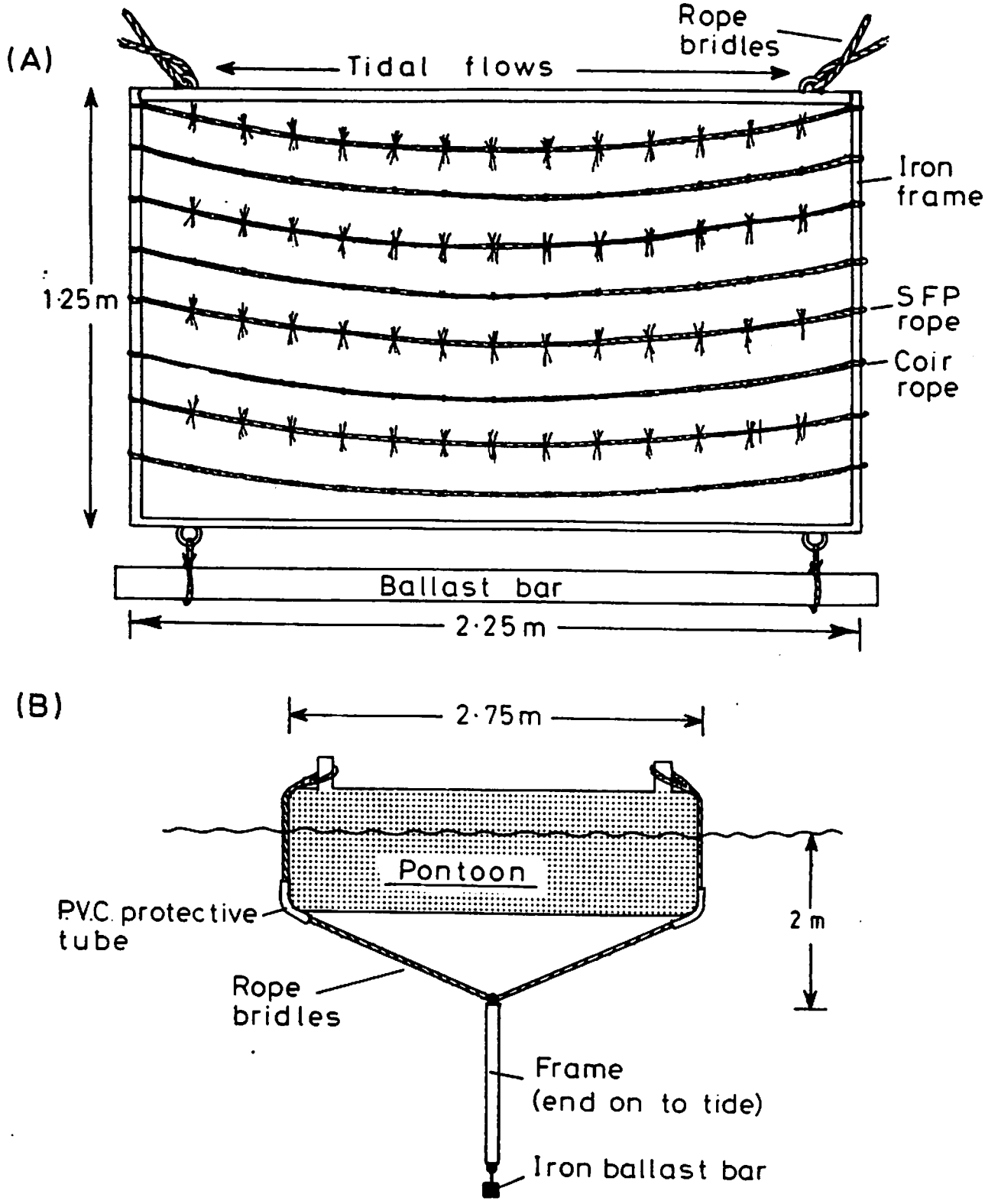


Figure 3 Diagram of the sublittoral spat collector system used under the pontoon in the Teign Estuary in 1978, showing (A) details of the frame and ropes; (B) the method of suspension. The frame held 16 m of SFP tufted ropes and 16 m of coir rope. (Source MAFF)

b) larger mussels, which just need fattening, could be purchased from other areas of the county and relayed in the Teign for a short period. Mussels over 40mm length are considered 'crab-proof' and yields could be high and boost production.

The use of crab-proof fences could be considered to reduce mortality. Tests in the Teign by MAFF during 1977-79, with 9 x 6m fibreglass fences,were successful and results gave much reduced mortality of seed inside fences leading to savings of 75-80% in weight of seed needed to be dredged and transported to the cultivation ground.

At present production of mussels in the Teign rests with the members of the Teign Musselmen's Society Ltd. There seems little incentive for the older fishermen to spend money on the fishery and little effort is being made to raise production. Many of the suitable plots lie unattended and there is pressure that more of the mussel area is used for yacht moorings which brings in a regular income. Efforts should be made to revitalise the Teign Mussel Society so that the members are more interested in development of the kinds described in this report.

Pacific Oysters

Pacific oyster production in the Teign - using hatchery grown seed - is now well established and the area is one of the most important in the country for 'gigas'.

About 14 growers are involved cultivating the oysters on trays in the gulleys near low tide level.

Four operations run by Messrs. O'Kelly, Gibbon, Lamble and Highgate account for 50% of the present production.

Growth rates this season are reported to be good and the only problem facing the future of oyster production in the Teign is the high level of sewage contamination, which has caused public health problems following the consumption of uncooked oysters which had been purified in approved plants.

Indeed, the Teign estuary is regarded as one of the most polluted areas of shellfish production in the UK and recurring incidents of gastroenteritis associated with oysters taken from the Teign have affected the image of the oyster fishery - both with the public health authorities and the Industry.

Virtually all pollution is derived from discharges subject to control by the South West Water Authority and the estuary has now been included in a priority list for improving water quality submitted by MAFF to the Department of the Environment backed by Seafish and the Shellfish Association.

5.2 Tenure

With regard to the future development of the oyster and mussel fisheries some growers believe that lack of seabed rights will not attract investment to encourage their future growth.

For example, the oyster growers operate within the Teign Mussel Order area with the agreement of the Society. There is no clash with the mussel fishery but

the growers have no defined rights of tenure.

Similarly the Society - run by a few families of fishermen would be hesitant to encourage private investment in the Teign mussel fishery and the only way forward is to try to encourage the Teign musselmen to act themselves guided by Seafish staff.

The Devon Sea Fisheries Committee understands this problem and has made moves to take over the regulation of the River Teign Mussel Fishery Order 1966. This action has been opposed by the local fishermen who fear excessive licence fees and restrictions. The Order is for a period of 40 years from 1966.

5.3 Technological research

There are several areas of R & D which if introduced into the Teign area would help the local mollusc industry. These include:

a) Water quality study

The contamination of Teign oysters which are normally eaten uncooked and the public health problems have already been described. The position seems to get worse during the winter months and there is speculation as to the possible causes and the main source of the pollution.

MAFF staff, working with the South West Water Authority and local Environmental Health Officers, have agreed to trace the flow of various discharges into the Teign in an attempt to quantify the levels of sewage contamination. This study is planned to start in 1987.

b) Shellfish depuration

Molluscan shellfish from the Teign purified in approved purification plants still give poor results - mainly due to a high level of viral contamination. Studies on the detection and elimination of viruses are only going ahead slowly. It is essential that the Industry gets a solution to this problem soon as markets for Pacific oysters and other molluscs begin to expand.

c) Mussel seed supplies

In many fisheries the irregular settlements of seed mussels are the main factor limiting production. This applies to the Teign where the local Mussel Fishery Order is in decline due to low stocks.

The application of techniques for spat collection developed by the staff at MAFF, Conwy, and by Seafish at Ardtoe should be considered.

6. GENERAL

6.1 Water quality

The South West Water Authority is responsible for the standard of water quality in the Teign estuary.

Communication with their Regional Environmental Scientists based in Exeter has provided some useful facts.

a) Estuary monitoring

The SWW monitor estuaries in their area under the Esturial Classification System in which points are awarded for chemical quality - mainly based on dissolved oxygen - biological quality (migratory and resident fish,

benthic communities and toxin levels) and aesthetic quality.

In 1985 the River Teign was merited a 'Class A', good quality classification by SWW but the assessment did not include a marine survey or any bacteriological work. Indeed the Authority admits there is a problem based on a combination of high bacterial loadings (up to 50%) from agricultural sources (manure, effluents, etc.) in river water and the numerous sewage outfalls and cess pits along the estuary banks. This makes the Teign one of the most polluted estuaries in England.

b) Effluent discharges

There are no industrial activities bordering the estuary producing aqueous effluents. Pollution is caused by both treated and crude sewage discharged into the estuary from 11 discharges (Figure 2), the largest being:

Buckland sewage works	... 19,320 cu.metres/24 hours
Wear Farm Caravan site	... 113 cu.metres/24 hours
Forde Road overflow	... 273 cu.metres/24 hours
Teignmouth raw sewage outfall	no information
Bishopsteignton sewage works	no information

At the present time the Buckland sewage works only operates at 50% of its capacity. SWW engineers are now considering whether it is feasible to direct more of the smaller crude outfalls via this treatment plant in an effort to reduce the poor water quality in the Teign estuary.

The SWW is doubtful that even a massive improvement in sewage treatment would allow the Teign to be classified as a shellfish growing water under the EC Directive.

6.2 Pests and diseases

The area is lightly infected with the red worm Mytilicola, which is found in the gut of mussels.

Under the Molluscan (Control of Deposit)(Variation) Order 1983, the Teign is designated Area 13.

Dr. Eric Edwards
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July, 1987

7.0 GENERAL READING

DARE, P.J., et al, 1983. Predation on juvenile Pacific oysters and mussels by shore crabs. Fish. Res. Tech. Rep.73, MAFF, Lowestoft.

DARE, P.J., EDWARDS, D.B. and DAVIES, G., 1983. Experimental collection and handling of spat mussels (Mytilus edulis L.) on ropes for intertidal cultivation. Fish. Res. Tech. Rep.74, MAFF, Lowestoft.

Devon Sea Fisheries Committee, reports and byelaws. Council Offices, Newton Abbot.

PARSONS, J., 1984. "Is it economic to grow Pacific oysters in the British Isles?" Proceedings of the 15th Annual Shellfish Conference 1984. Shellfish Association, London.

REYNOLDS, N., 1960. The Teign Estuary. Int. Rep., MAFF, Fisheries Expt. Station, Conwy.

South West Water Authority (1985). EC Freshwater Fish Directive - Annual Assessment of Water Quality. Internal Report. Dept. of Environmental Services, Exeter.

South West Water Authority. Annual Reports and consents list.

SPENCER, B.E., GOUGH & THOMAS, 1981. Growth and survival of hatchery-reared oysters: small-scale trials in the R.Teign, Devon, 1977-1980. Int. Rpt. MAFF, Fish.Lab. Conwy, N.Wales.

WALDOCK, M.J., THAIN & WAITE, 1987. The distribution and potential toxic effects of TBT in UK estuaries during 1986. Applied Organometallic Chemistry (1987).