SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

ESTUARY PROFILE
MENAI STRAIT, NORTH WALES

Internal Report No. 1281

March 1987

Dr. E. Edwards
Shellfish Assoc. of Gt. Britain

SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

Internal Report No. 1281 March 1987

ESTUARY PROFILE
MENAI STRAIT, NORTH WALES

SUMMARY

The Menai Strait is the channel separating Anglesey from mainland North Wales.

It is subjected to strong tidal streams from both ends which bring both advantages and disadvantages to the shell fisheries. The advantages are the constant replenishment of nutrient rich constant-salinity sea water and the disadvantages are the tidal scour, especially at the North East end. Elsewhere there are sheltered areas suitable for shellfish growing. There is little industrial waste discharged into the Strait and there are plans to improve the raw sewage treatment.

The fishery is regulated by the North Western and North Wales Sea Fisheries Committee and parts of the Strait are subjected to a Several Order which is administered by the Sea Fisheries Committee. One area covered by the Several Order is 1928 acres in area and is divided into plots for bottom culture of mussels.

There are also Closing Orders in force preventing the taking of shellfish from certain areas unless they are purified or treated in a certain way.

The Menai Strait has been proposed as a Marine Nature Reserve but as yet no definate boundaries or byelaws have been agreed. Confirmation has been given that the Several Order beds will not be affected by the MNR proposal.

There are several other users in the Strait including yachtsmen, divers, anglers and bird watchers. There are a number of small coastal ports at Port Penrhyn, Port Dinorwic and Caernarfon.

TBT has been detected but levels are low; the good exchange of water may be the main reason why the large number of yachts using toxic antifoulants are not causing problems to the shellfish.

Mussels are the main shellfish cultivated in the Strait but there is a shortage of seed mussel, and this is inhibiting the development of the fishery. If seed mussel could be provided in quantity it should be possible to increase the yield from the Several Order beds from 300 tonnes per season to about 3000-4000 tonnes. The problem is simply one of a technical method of transporting live seed mussel economically from the Morecambe Bay area where seed is abundant.

Bottom culture offers the best potential for mussels. The strong tides make raft culture or long lines impractical but bouchot culture may be possible in certain locations.

Oyster culture, using the Pacific Oyster (C. giggas) could also be expanded if more lays were used to boost production.

The area in general may be considered to have very good potential for molluscan production especially for mussels with cockles and oysters to a lesser extent.

SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

Internal Report No. 1281 March 1987

ESTUARY PROFILE
MENAI STRAIT, NORTH WALES

Contents

Contents Contd.

FIGURES:

1. GEOGRAPHICAL DESCRIPTION

1.1 Location

The Menai Strait is the channel separating the island of Anglesey from mainland North Wales. There are numerous townships on both banks; the main towns at the eastern end of the Strait (Figure 1) are Bangor, Beaumaris and Menai Bridge, with Port Dinorwic and Caernarfon at the western end (Figure 2).

The Britannia rail and road bridge to Holyhead crosses the Strait at about its centre. Between this bridge and the old Menai suspension bridge lies the middle reach of the Strait known locally as the "Swillies" - which is shallow, rock strewn and subject to fierce tidal streams and only navigable with safety for a very short period each day.

1.2 Topographical and Environmental Features

The Strait itself is a long and narrow channel, widening out at either end, and subject to strong tidal flows in either direction. Since it is sheltered by the land on both sides it does not suffer from wave action but the strength of the currents in the narrower reaches scours the bottom and prevents accumulation. In other areas, particularly at each end, there is considerable accumulation of sand (Traeth Melynog, Traeth Gwyllt) or mud in the bay near Gallows Point, Beaumaris.

...../2

The entrance to the western end of the Strait is guarded by Caernarfon Bar, an area of shallow water and mobile sandbanks. Once through the entrance, the Strait immediately widens out, although the low water channel itself remains narrow. To the north are the sandbanks of Traeth Gwyllt, near Brynsiencyn, where there are shellfish growing lays under the Menai Strait (West) Oyster, Mussel and Clam Fishery Order 1978 (see p 4). Here the Strait is at its maximum width of 1,100 metres but from this point it narrows towards Port Dinorwic and then becomes the "Swillies" (shown on the Admiralty chart as Swellies) where tides of 7-8 knots (springs) and 5 knots (neaps) are reported.

Beyond Menai Bridge the Strait gradually opens out at Bangor Pier to a width of 900 metres. In this area there are extensive mussel growing grounds leased under the Menai Strait Oyster and Mussel Fishery Orders 1962 and 1963. Beyond the Pier, the mainland shore swings away to the south east to form Bangor/Ogwen Flats and the large Lavan Sands in Conwy Bay.

1.3 Physical Features

The tidal streams in the Menai Strait are complicated - both in direction and strength - but the significance of the strong tides in view of the fisheries interest of the Strait is that they produce a set of conditions, with powerful currents and good water exchange in shallow and sheltered waters, which are ideal for mollusc cultivation. Indeed, these

...../3

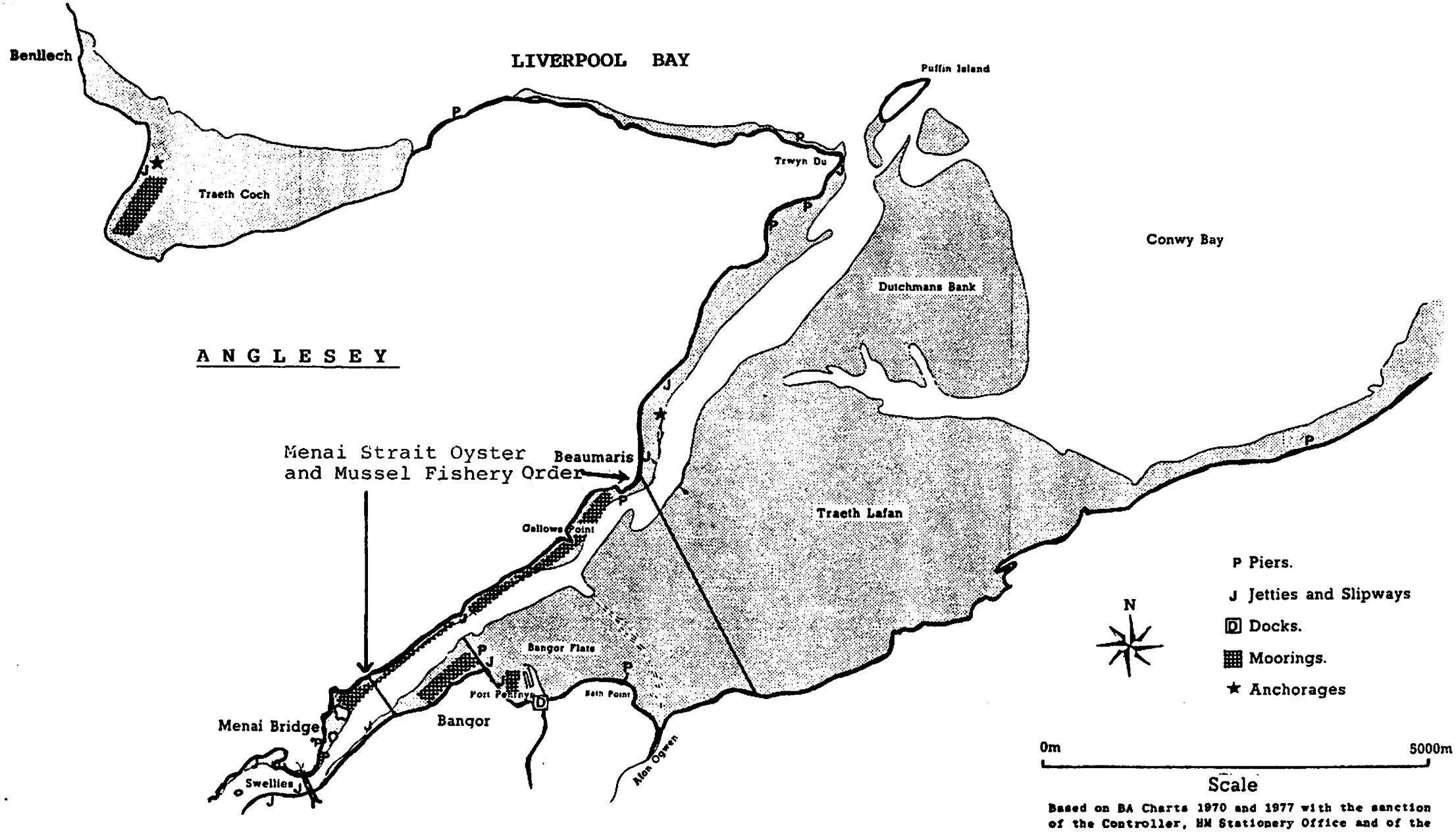


FIGURE 1. Menai Strait - eastern area

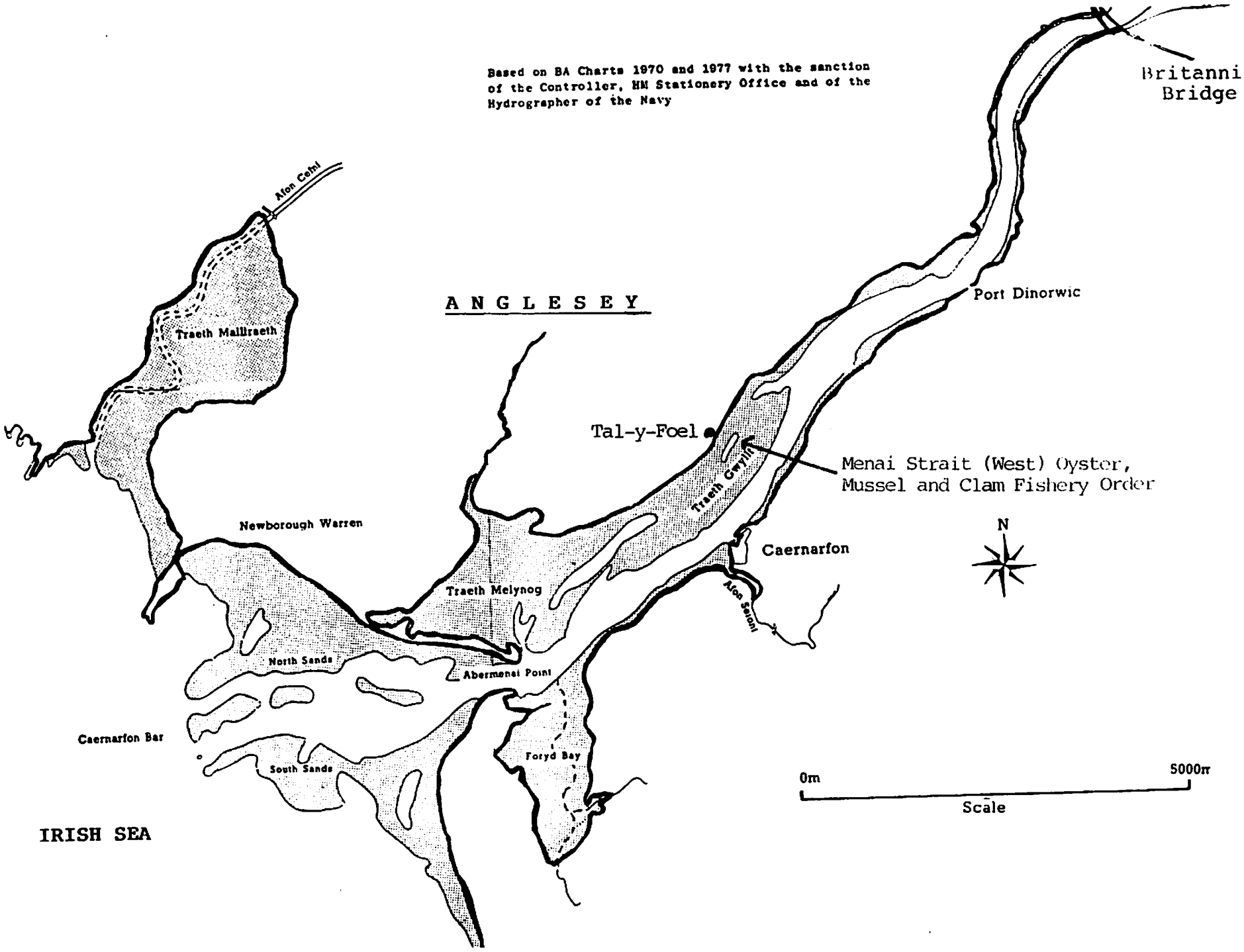


FIGURE 2. Menai Strait - western area

conditions are not reproduced exactly anwhere else around the shores of Britain.

The salinity of the water in the Strait is high and remains a fairly constant 32-34°/₀₀, rarely dropping below 20°/₀₀. A number of fresh water streams empty into the Strait, the main inflows being the River Ogwen, near Bangor, and the River Seiont at Caernarfon; they bring down nutrients which help productivity.

Water temperatures in the Strait range from 17°C (summer) and 4°C (winter), though in severe weather it can fall to 2°C.

As stated earlier the tidal streams in the Menai Strait are complicated. The in-going tidal stream runs eastwards over Caernarfon Bar but is held back by the narrowing of the channel at Abermenai Point. Meanwhile, the remainder of the stream flows around the west, north and east coasts of Anglesey to enter the Strait at its north-eastern end near Beaumaris. All this has an effect upon the direction of the tidal stream in the Strait. At one point the incoming tide from the SW entrance meets the incoming tide from the NE. This meeting point varies but is normally somewhere between Bangor Pier and Menai Bridge, near the mussel lays, causing overlapping tidal streams with nutrient rich water being brought into the Straits from the Irish Sea.

It has been reported that water on the east coast of Anglesey in the Menai Strait has a high loading of suspended matter. This turbid water might be derived from Liverpool Bay, and the Mersey, Dee and Conwy estuaries:

...../4

Studies at the University College of N.Wales, Bangor, suggests that much of the turbidity is generated locally by tidal regimes, rainfall and winds.

2. SEABED RIGHT AND MANAGEMENT REGIMES

2.1 Fisheries legislation

Shellfish stocks in the Strait are regulated by the North Western and North Wales Sea Fisheries Committee* (under the Sea Fisheries Regulation Act, 1966 as defined by the Lancashire and Western Sea Fisheries District (Variation) Order, 1980).

Parts of the Menai Strait are subject to a Several Order under the Oyster and Mussel Fishery Order 1962 (as ammended in 1963) allowing leased mussel layings between Bangor and Beaumaris (Figure 3) for a period of 60 years. This Order also includes the Ogwen mussel bed, where hand-gathering under licence is allowed.

An area near the MAFF experimental field 'oysterage' at Tal-y-Foel, near Brynsiencyn, also comes under The Menai Strait (West) Oyster, Mussel and Clam Fishery Order of 1978 for a period of 30 years (see p 9).

The Sea Fisheries Committee administers both these several order areas and has powers to enforce a

...../5

---

* The Order constituting the North Western and North Wales Sea Fisheries Committee came into operation 11th July, 1986.

number of shellfish byelaws which include:

cockles	- a 20mm gauge and restrictions on fishing methods
mussels	- 51mm (2") size limit, restrictions on digging on a mussel bed, dredges must be of an approved pattern (not applicable to several order areas or Morecambe Bay)
shellfishery	- the Committee may close any bed, or part of a bed, if so severely depleted, etc., to ensure recovery
the re-deposit	of shellfish.

2.2 Closing Orders

Both the eastern and western ends of the Menai Strait are covered by Closing Orders - under The Public Health (Shellfish) Regulations 1934 and 1948. These are:

(i) Beaumaris Port Health Authority

covers cockles and mussels taken from an area extending eastwards from the Menai Suspension Bridge to a line drawn between Gallows Point and Aber River.

(ii) Arfon Borough

covers mussels taken from an area in the western part of the Strait - includes the Fishery Order(W).

The Menai Strait has also been designated under the EEC Directive on the Quality Required of Shellfish Waters (79/923/EEC) and the Welsh Water Authority has a responsibility to ensure that seawater quality is maintained at the target levels.

2.3 Nature conservation

The whole of the Anglesey shore, down to LWMOT, is within a designated Area of Outstanding Natural Beauty (with the exception of the heavily built-up areas around Menai Bridge town).

...../6

The Menai Strait has been proposed as a Marine Nature Reserve but no definite boundaries or byelaws have yet been agreed (1 March 1987). The full consultation proceedure is underway and the Nature Conservancy Council has proposed that the whole of the Strait from Puffin Island, in the east, to Caernarfon Bar, in the west - including all sublittoral areas - form the MNR. A decision is expected soon from the Secretary of State. The NCC confirm that existing Several Order grounds will not be affected by a Statutory Reserve and any new byelaws will be discussed with the SFC.

Several intertidal areas are also included in nature conservation activities:

Newborough Warren-Ynys Llanddwyn NNR

Traeth Lafan Local Nature Reserve and SSSI
(covering the intertidal areas of these large sands)

Menai Strait shore SSSI
(covers 80 hectares)

Puffin Island SSSI
(Island and foreshore)

Friars Road shore SSSI

(Note: NNR = National Nature Reserve
SSSI = Sites of Special Scientific Interest)

2.4 Other users

The Crown Estate Commissioners have extensive interests in the area covering foreshore river bed and seabed rights.

Lessees, totalling 36, include Yacht clubs, the University College of N.Wales, Borough Councils and MAFF.

Since tourism is the biggest single industry

...../7

in North Wales the Menai Strait attracts thousands of visitors for sailing, boating, diving, angling and bird watching. Much of the Strait is full of small craft moorings, including the areas near the shellfish growing areas.

There are docks - mainly used by pleasure boats, fishing vessels and occasional small coasters - at Port Penrhyn, Port Dinorwic and Caernarfon, and a new Marina is planned for Port Penrhyn.

3. MOLLUSC RESOURCES AND THEIR UTILISATION

3.1 Species

Mussels form the basis of the shellfish industry in the Menai Strait, the main bed being off Bangor with a small stock at Tal-y-Foel. There are also irregular settlements of sublittoral seed mussels near Caernarfon Bar which, when available, are used for restocking purposes.

Pacific oysters are also grown at Tal-y-Foel on plots in the Menai Strait (west) Several Order area, using hatchery-produced seed. Manila clams are also grown at this site.

Cockles and winkles are also harvested from the area, the latter in increasing quantities.

The New Zealand oyster (Ostrea lutaria) is now established in small quantities at a subtidal site at Tal-y-Foel following its introduction by MAFF.

...../8

a) Mussels

Stocks

The area produces good quality mussels, especially those cultivated on low level intertidal grounds such as the leased mussel layings off Bangor. Unfortunately, deeper waters in the Strait support starfish populations which cause havoc to sublittoral mussel beds and cannot be used at present.

Natural beds on the Bangor/Ogwen flats are exploited by hand-picking by less than a dozen men, to whom licences are issued by the NW and NW Sea Fisheries Committee on an annual basis. Stock levels are low at present; estimated at around 385 tons (SFC survey, November '83).

As described earlier the Several Fishery Order ground off Bangor Pier has mussel layings which are leased to grantees by the SFC. Most of the ground exposes at low tides but excellent mussels can be grown here and the Several Order area has potential to produce 3,000-4,000 tons a year (Figure 3).

One laying is used by the progressive mussel firm 'Myti Mussel', run by Kim and Val Mould, for large-scale bottom culture. To boost production seed mussels are brought from Caernarfon Bar, when available, but due to scarcity seed has had to be transported from Morecambe Bay and Ireland, and the Dornoch Firth, Scotland, for relaying. This relaid stock is left to grow and/or fatten for two to four seasons before being harvested by dredging.

...../9

Another plot is leased by a group of Conwy fishermen and another to a private individual. Some layings remain unused for various reasons.

The Several Order, which has an area of 1,928 acres, has considerable potential but problems of seed supply have hampered production in recent years.

Recent figures are:

Production Menai Strait Oyster & Mussel Fishery Order

Season ending March 1986 ... 215 tons ... £25,800

" " " 1985 ... 300 tons ... £32,000

This area produces good quality mussels and it has been estimated that annual production could reach over 3,000 tons based on an extensive seed relaying programme (see p 13).

Small natural beds also occur outside the Several Fishery Order at Mountfield and Friars Bay, Beaumaris. These stocks are sometimes worked by men from Conwy.

Mussels are also harvested in the western end of the Strait at Tal-y-Foel. Conwy fishermen have a long tradition of working this bed when their local supplies are scarce. At this Several Order site one plot (covering the major portion of the natural mussel bed) is leased to the Conwy Musselmen and Boatmen Ltd., others are used to cultivate Pacific oysters and clams and a large area is used by MAFF staff from the Fisheries Experiment Station, Conwy, for mollusc growing trials. Another plot is now being used by an

...../10

individual for mussel relaying. Not all the plots available are in use.

Annual mussel production from the Fishery Order was:

1986	...	95 tons	...	£11,400
1985	...	87 tons	...	£10,800

b) Mariculture

There was a private oyster hatchery at Brynsiencyn in the 1970s but the venture collapsed and the premises are now used as the Anglesey Sea Zoo - a successful marine aquarium which also has live lobster and trout tanks run by Mona Seafoods.

A private grower at Tal-y-Foel is now growing Pacific oysters in numbers sufficient to export to the Continent.

The MAFF experimental shellfish cultivation ground has been used since the 1940s for culture trials on flat oysters, Pacific oysters, mussels and clams. This work has also included trials with French fences to reduce the predation by crabs on molluscs, especially mussels.

MAFF mussel trials in the Straits included hanging culture experiments - using spatted ropes taken from Morecambe Bay. Trials using spatted ropes hung from a raft near Menai Bridge had problems; although the spat survived well, and a year later reached a density of 9-17 Kg/m on many ropes and had lengths of 40-45mm, a high proportion of mussels were lost from the ropes due to tidal turbulence (max. tidal speeds = 1½-1¾ knots). It was concluded that if floating

...../11

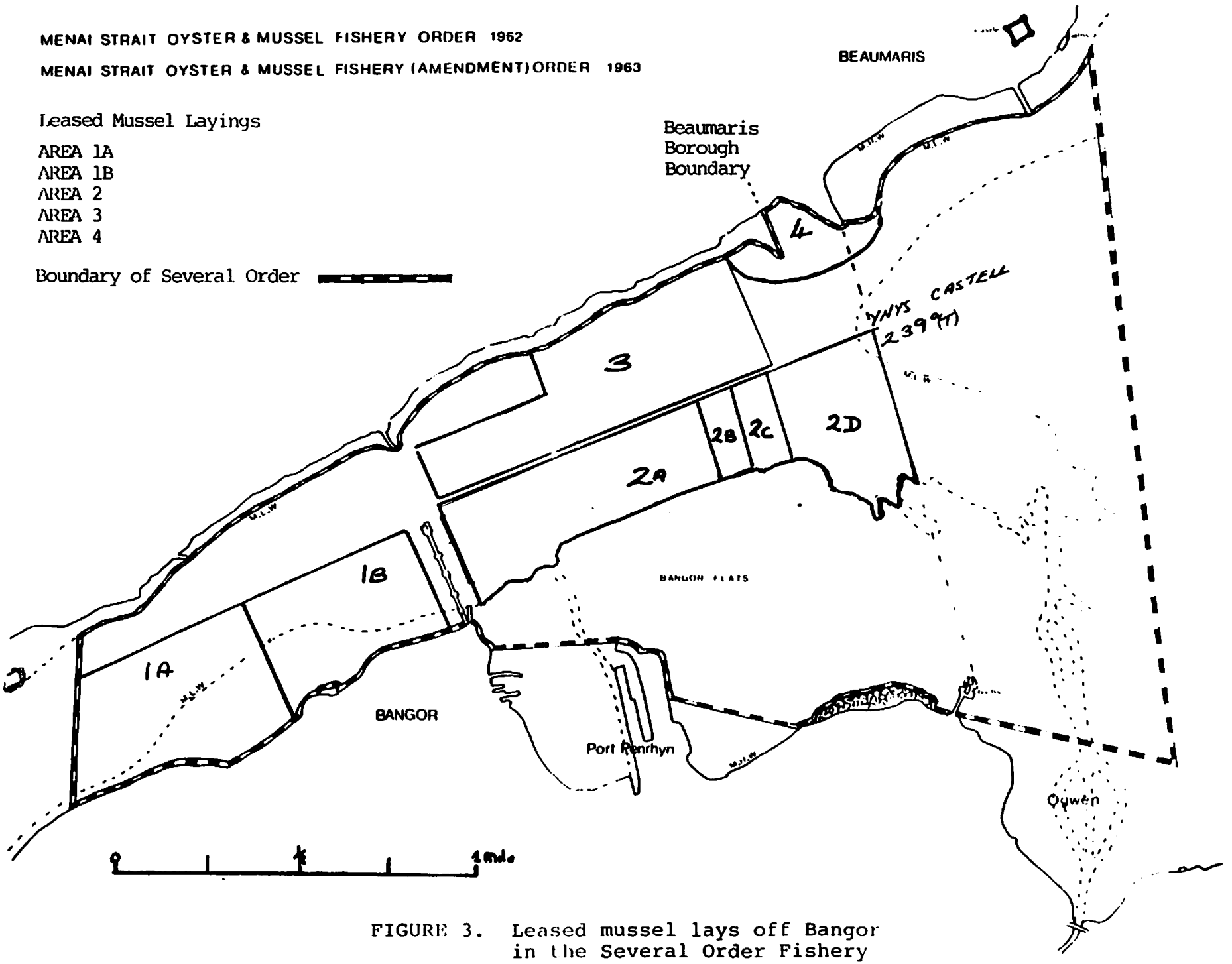


FIGURE 3. Leased mussel lays off Bangor in the Several Order Fishery

culture was to work under the difficult hydrographic conditions found in the Straits, overcrowding and rope collisions would have to be prevented.

All these MAFF trials confirmed, however, that the area can grow good mussels quickly but there can be problems of crab predation with smaller-sized seed.

GROWTH, SURVIVAL AND YIELDS IN A YEAR OF 27mm SEED MUSSELS RELAID ONTO THE GROUND AND INTO A FLOATING NET, MENAI STRAIT

Culture method	$\bar{L}$ mm	Survival %	Yield of mussels per Kg of seed
Floating net	56.2	47	x3.5
Caged plot	45.7	67	x2.6
Open plot	50.3	23	x1.3

Source MAFF

c) Scientific research and education

The Menai Strait is one of the outstanding locations in Britain, if not Europe, for scientific research and education.

The University College at Bangor has taken a growing interest in the marine fauna around the area and establishment of the Marine Science Laboratories at Menai Bridge ensures that the

...../12

Straits are studied and monitored on many biological aspects. A proposal to set up an MSc course in Shellfish Biology, Fisheries and Culture at the School of Ocean Sciences, University College of N.Wales could all help local shellfish development.

The NW and NW Sea Fisheries Committee also has a small lobster hatchery at the Marine Science Laboratories.

The presence of the nearby MAFF Fisheries Laboratory, at Conwy, now being expanded by extra staff, has also been of value to the area for a number of years providing advice on mariculture, etc.

4. POTENTIAL FOR INCREASING PRODUCTION

Mussels

The Menai Strait offers considerable potential to increase mussel production using the existing Several Fishery Order areas.

Bottom culture - on a large scale - seems to offer the best potential; bouchot culture could be tried on a small scale at discrete, sheltered sites, but the extensive boating activities - especially with the demand for anchorages and moorings - makes raft culture or mussel long-lines impractical. The strong tidal regime would also hamper hanging culture.

Bearing in mind the growing demand for good quality mussels, the Menai Straits could produce over 5,000 tons a year resulting in a £1 million industry. Such potential depends on large-scale bottom culture

...../13

based on a regular and reliable source of seed. These will have to be dredged from Caernarfon Bar, when available, or brought from other areas under licence (i.e. Molluscan Control of Deposit Order).

A regular supply of suitable seed is the key to the development and expansion of the N.Wales* mussel industry.

Oysters

Production of Pacific oysters could be expanded if the other lays available are used for tray culture and if markets can be expanded further.

The possibility of harvesting O.lutea, which has a similar appearance to the native flat oyster, may develop in the future.

Trials are also going ahead with the American oyster C.virginica at Tal-y-Foel but growth rates have not been impressive.

Cockles

There has been some cockle gathering in the past at Traeth Melynog and the Lavan Sands. No doubt some are harvested on a casual basis but commercial exploitation has died out. The growing demand for the species may warrant more interest in the future.

...../14

---

*Note - a supply of seed will also be needed to replenish and revitalise the Conwy mussel fishery once the A55 Tunnel scheme has been completed (see Estuary Profile, Internal Report 1280)

5. WHAT ACTIONS ARE NEEDED TO BENEFIT THE LOCAL INDUSTRY

5.1 Mariculture

Greater efforts are needed to support the growth of the Menai Strait mussel industry.

Increased production relies on the relaying, by dredger, of mussel seed which may have to be brought some distance when local supplies fail. This will require:

a) better knowledge of sublittoral seed beds in the Irish Sea or Liverpool and Morecambe Bays and their potential for relaying

b) support by SFIA on the design and funding of a shallow dredger which will be approved by the Department of Trade and Industry

c) technical support in the application of spatted ropes for bouchot pole culture at suitable sites in the Straits

d) evaluation of the starfish population in the mussel areas, predation rates, and consider whether control measures would be effective(MAFF)

d) efforts to develop shellfish production in the Straits must not be hindered by the NCC once the Marine Nature Reserve is established.

5.2 Technological research

(i) Without a properly-designed mussel dredger, similar to those used in the massive Dutch mussel fishery, large-scale mussel production will never be realised in N.Wales.

Staff at the I.D.U., Hull, should be involved in this problem in the hope that a suitable vessel

...../15

can be modified to pass the strict DTI rules on stability or a new purpose-built vessel designed for the job.

(ii) All mussels taken from the Straits have to be purified or cooked. At present the only operational/approved purification tanks are run by 'Myti Mussel' at Port Penrhyn. These can handle around 60 tons every 48-hours but with the expected expansion in the live trade some modernisation using a containerized system could help speed handling and reduce labour costs.

(iii) SFIA involvement in mussel cooking proceedures should be progressed involving N.Wales companies interested in the future potential of processed mussels. This technology will be required if production can be raised over the 3,000 ton mark.

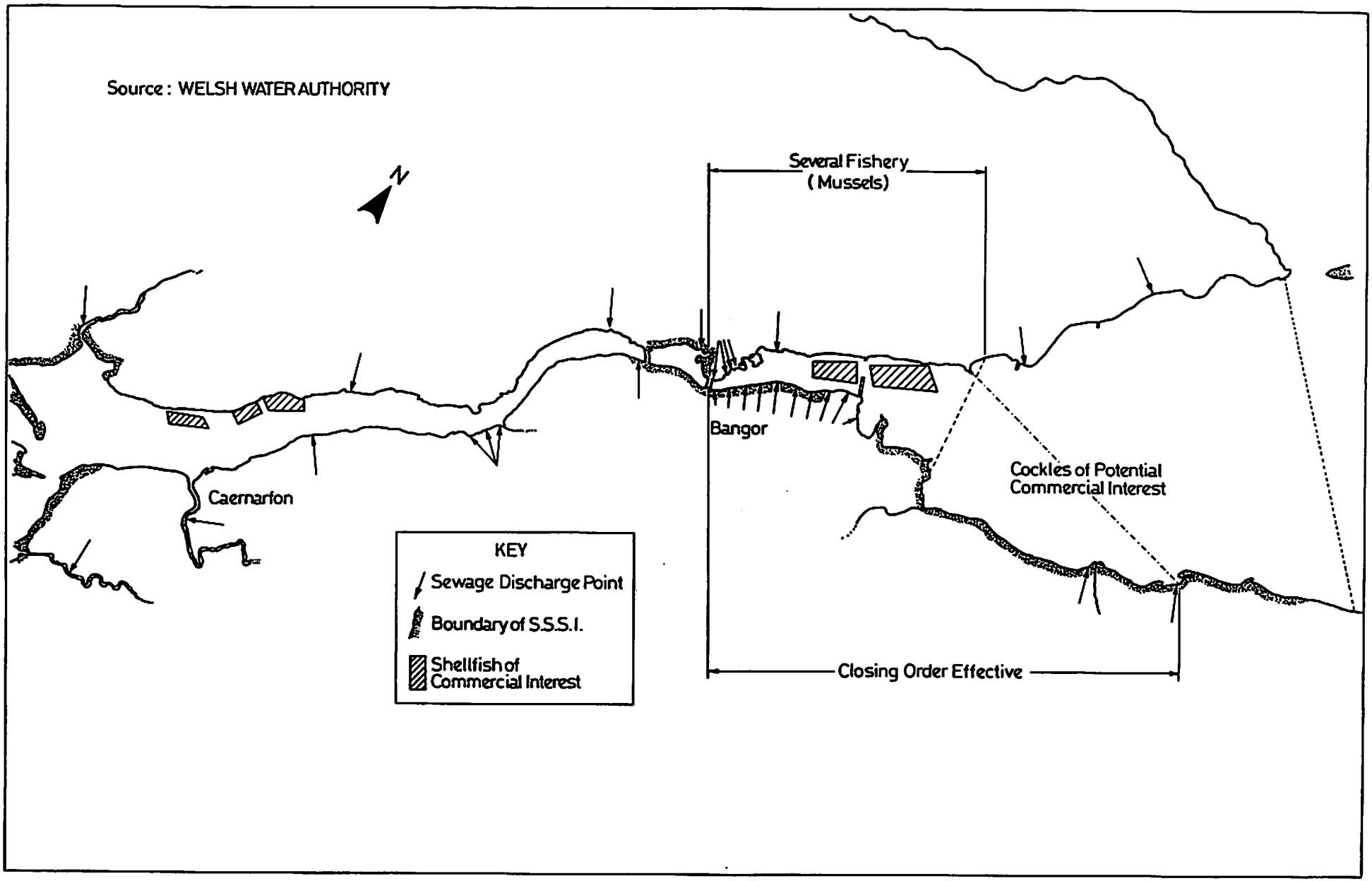
5.3 Marketing

The Seafish marketing section must continue to promote mussels - both live and processed - as a tasty, cheap, nutritious seafood.

Efforts must be made to promote UK mussels so that imports - especially from Holland - are kept at a low level.

The idea of a Welsh Mussel Festival organised in conjunction with the Wales Tourist Board may be an interesting possibility.

...../16



Menai Strait

Fig.4

6. GENERAL

6.1 Water quality

The Welsh Water Authority is responsible for the standard of water quality in the Menai Strait, which is included in the list of areas designated under EC Directive (79/923/EEC) on the quality of shellfish growing waters.

The Directive sets limiting values corresponding to certain parameters including:

> suspended solids, dissolved oxygen saturation, petroleum hydrocarbons, faecal coliforms, a range of different metals and substances affecting the taste of shellfish.

A recent letter from the WWA to the Shellfish Association (dated 4 March 1987) reports "Results of routine monitoring of water in the Strait show compliance with all parameters specified in the EC Directive 79/923/EEC.

The Strait is not in the DOE estuary classification system but there are data available on effluent discharges from the WWA.

a) effluent discharges

Little in the way of industrial effluent is discharged directly into the Menai Strait. The only factory of any size is the Ferodo factory, on the mainland near Caernarfon, from which any trade discharges are closely monitored.

There is, however, a relatively large amount of untreated sewage - discharged from 16 small

...../17

outfalls along the Strait (Figure 4). One of the largest, at Bangor, is undergoing modernisation and extension and is one of the largest outfalls in the area with a design capacity of 4,000 cu.ml. per day. Another large outfall at Menai Bridge was constructed in 1982 emptying by the suspension bridge. Figures from the WWA give an 'actual' total discharge into the Menai Strait of 6,291 cu.ml/day and, at present, this meets the target set by the EC Directive.

b) Dumping

It has been suggested that the dumping of large quantities of domestic and industrial wastes in Liverpool Bay may also affect the Menai Strait. Figures available suggest over 70,000 dry tonnes of refuse wastes are dumped per annum, including sewage sludge. Work is going ahead at the Marine Science Laboratories to check whether there are any links affecting water quality in the Strait.

c) Anti-fouling pollution

Toxicity studies at the Marine Science Laboratories, Menai Bridge, show that tributyl tin (TBT) compounds used in yacht paints are toxic to mussel larvae at minute concentrations. The growth and condition of Pacific oysters is also known to be affected by TBT. Although the Strait is not known to be badly polluted by TBT (probably due to the good water exchange) the growing number of moored yachts and pleasure boats may be causing some problems.

...../18

The recent announcement by the DOE that the use of TBT in yacht anti-fouling paints is to be banned in 1987 reduces this threat and could benefit shellfish culture in the area.

6.2 Pests and diseases

The area is free of shellfish pests and diseases apart from the predatory starfish (Asterias). Despite the introduction of mussels from Morecambe Bay and other areas there are no established populations of the red worm Mytilicola, which is a parasite of mussels.

Under the Molluscan (Control of Deposit) Order 1974 (As Varied) the Menai Strait is designated as Area 20, Braich-y-Pwll to St.Ormes Head.

7. RECOMMENDATION

This estuary profile identifies the Menai Strait as an area which has considerable potential for bivalve mollusc cultivation - especially for mussels and, to a lesser extent, Pacific oysters.

In view of cuts in the staffing of the North Western and North Wales SFC, with lower budgets, there is likely to be less emphasis on shellfish development work in their District in the future. The Sea Fish Industry Authority should, therefore, become more involved in promoting shellfish projects in N.Wales - also involving the scientific staff at the MAFF Fisheries Laboratory, Conwy and the SFC. Specialist consultants should also be used when appropriate.

...../19

The possibility of setting up a Shellfish Development Group which would bring together Industry representatives, scientists and other experts should be considered. This group could identify projects in the Menai Strait/Conwy area, collate the available information, initiate R & D, and help stimulate new shellfish developments which would be to the overall benefit of the Industry in North Wales.

March 1987

Dr. Eric Edwards
Shellfish Association of Great Britain
Fishmongers' Hall,
London, EC4R 9EL

GENERAL READING

BEAUMONT, A.R. and BUDD, M.D., 1984. High Mortality of the larvae of the common mussel at low concentrations of tributyl tin. Mar. Pol. Bul.15, 402-405.

Coastal Sewage Pollution in Wales, 1985, Vol.2, First Rpt. from the Committee on Welsh affairs.

DARE, P.J., 1980. Mussel cultivation in England and Wales. MAFF Laboratory Leaflet No.50.

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

DAVIES, G., DARE, P.J. and EDWARDS, D.B., 1980. Fenced enclosures for the protection of seed mussels (Mytilus edulis) from predation by shore crabs (Carcinus maenas). Fish.Res.Tech.Rep. 56, MAFF, Lowestoft.

Menai Strait Proposed Marine Reserve. 1984. Preliminary draft management plan. NCC.

MOULD, K., 1984. Restructuring the UK mussel industry. Proceedings of the Fifteenth Annual Shellfish Conference 15-16 May 1984, 40-46. Shellfish Association London.

Reports of the Superintendent, North Western and N.Wales Sea Fisheries Committee, University of Lancaster.

Welsh Water Authority, 1985/6 Annual Report.