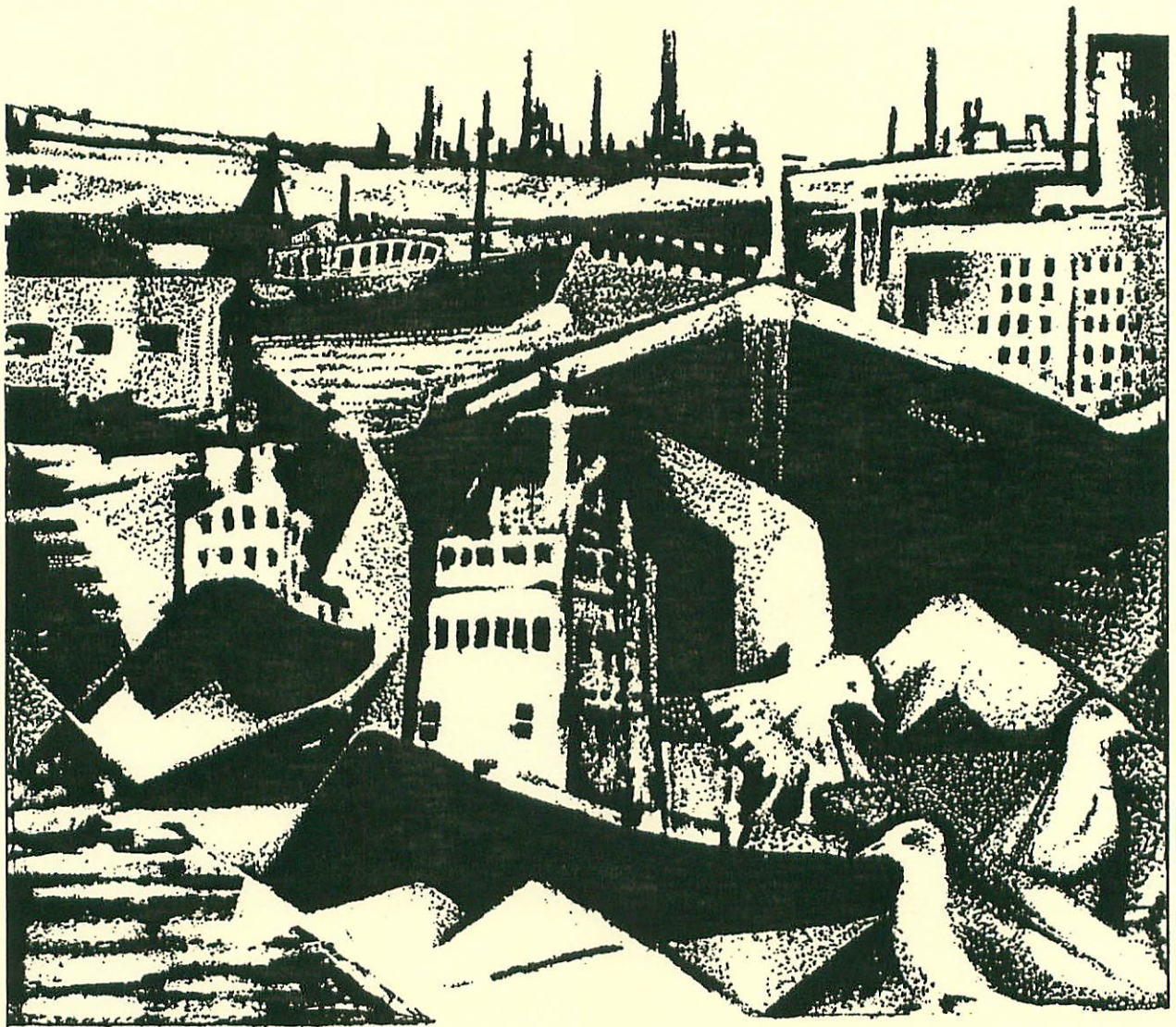


*Report of the
MILFORD HAVEN WATERWAY
ENVIRONMENTAL MONITORING
STEERING GROUP*



MHWEMSG

1993/4

CONTENTS

	page(s)
Acknowledgements	1
Introduction	3 & 4
Financial Summary	5
Water Quality Monitoring 1993	7
Seabed Sediment Chemistry 1993	9
Seabed Sediment Biology 1993	9
Winter Wildfowl & Wader Counts 1993/4	11 & 12
Annual Shelduck Census 1993	13 & 14
Bait Digging	15 - 18
Shellfish Sampling	19 & 20

ACKNOWLEDGEMENTS

In order for the Milford Haven Waterway Environmental Monitoring Steering Group (MHWEMSG) to continue with its agreed long term programme it has to be well resourced. These resources are threefold:-

- Financial donations which allow the Group to initiate contracts associated with the programme.
- Provision of manpower, equipment and facilities by Group members.
- Commitment and expertise brought to the Group by its members.

Presently the contributors to the Group are as follows:-

Countryside Council for Wales
Dwr Cymru Welsh Water
Elf Oil Refinery
Gulf Oil Refinery
Dyfed County Council
Field Studies Council
Milford Haven Port Authority
Milford Port Health Authority
National Power
National Rivers Authority
Pembrokeshire Coast National Park
Preseli Pembrokeshire District Council
South Pembrokeshire District Council
Texaco Refinery

The report cover graphic is reproduced by courtesy of Pembrokeshire Coast National Park.

THIS PAGE IS INTENTIONALLY BLANK

INTRODUCTION

This is the second report produced by the Milford Haven Waterway Environmental Monitoring Steering Group (MHWEMSG) since its inception in 1991.

Initially it was necessary to gather and collate all the available data which already existed about the condition of the waterway. Once this task was completed an on-going monitoring programme was developed and contracts initiated to meet the requirements of the programme. It is the intention of the Group to present its report at the beginning of the financial period in future years.

All the initial work conducted by the Group was accomplished under the chairmanship of Nic Wheeler, National Park Officer, Dyfed County Council. The Group would wish to record its thanks to Nic for leading it through its inception and infancy to be handed to its present chairman as a viable and vibrant concern.

Over the period covered by this report the major tasks undertaken by the Group have been:-

- Water Quality Monitoring
- Seabed Sediment Chemistry
- Seabed Sediment Biology

These had been previously identified as crucial activities allowing both currently available information to be updated and to fill gaps in existing knowledge pertaining to the Milford Haven Waterway.

It has been possible to achieve value for money and successfully carry out a substantial amount of survey work at minimal costs in 1993/4. This has been achieved, in no small part, by Group members providing expertise, resources and financial assistance to the projects.

Most of the results are presently available as raw data or in draft form. Final reports will be prepared during this summer. A more complete picture of the status of the overall environmental quality of the Milford Haven Waterway should then be possible.

During the period 1994/5 the most important areas of work for the Group will be:

- Continuation of the existing water quality monitoring. This will be at a reduced frequency following the completion of the data review and will continue on a collaborative basis.
- The extension of the sediment chemistry and biology to include the important soft sediment inter-tidal areas throughout the Haven. This will be done under contract and tender specifications are currently being prepared by the Projects sub-group of MHWEMSG. It is proposed to phase this work over two years with the fieldwork and analysis only being completed in 1994/5. This approach is more cost-effective and has the advantage of minimising the numbers of chemical analyses which can be better targeted once the biological results are known.

It is important to emphasise that the work of the Group is associated with "environmental monitoring" which not only includes the condition of the Cleddau but its environment and the eco-systems it supports. So studying shelduck numbers and shell-fish quality is inexorably linked to water quality.

The methods of making available details and results of the Group's work is threefold:-

- MHWEMSG Yearly Report containing an overview of the Group's work and executive summaries of the various projects either completed or on-going. This document is circulated to all the Group members in appropriate numbers and would be made available to the public on request.
- Project Reports can be supplied to any outside body or individual at a price which ensured no cost to the Group. The price to be charged will include printing, handling and distribution costs.
- The requirement by an outside agency for Raw Data will firstly have to be discussed with the appropriate project manager of the Group. Whether the data was to be provided in processed form or not, the price charged will ensure there was no cost to the Group.

TREVOR D. LLOYD
Chairman MHWEMSG
3rd June 1994

FINANCIAL SUMMARY

It should be appreciated that unlike a fixed yearly budget the operating balance of the Milford Haven Waterway Environmental Monitoring Steering Group (MHWEMSG) varies continuously for two important reasons:-

- The receipt of contributions and other income is seldom congruent with the demand for phased expenditure on major project work
- The rolling programme of work is not compatible with a fixed yearly accounting period

Below is found a statement of accounts which indicates that the cost of work being undertaken is consistent with the funds available.

Brought forward from 1992/3	£15,908 – 22	
Contributions 1993/4	£39,500 – 00	
Other income	£106 – 50	

Total credit	£55,514 – 72	£55,514 – 72

Payments 1993/4	£22,112 – 83	
Commitments	£32,624 – 15	

Total debit	£54,736 – 98	£54,736 – 98

Account balance 1993/4		£777 – 74

THIS PAGE IS INTENTIONALLY BLANK

WATER QUALITY MONITORING 1993

The monitoring programme was designed to provide an assessment of the background water quality at mid-channel sites throughout the Haven. This was undertaken at nine sites within the Waterway, a "control" at Skomer, and the two main freshwater inputs to the estuary on the Eastern and Western Cleddau rivers.

With the exception of the river points the remainder of the sites have been sampled at surface, sub-surface and depth over neap and spring tides at a frequency of twelve times per annum. The analysis included salinity, suspended sediment, oil, nutrients and bacteriological quality.

The Oil Pollution Research Unit of the Field Studies Council at Fort Popton are presenting a report of the monitoring results on behalf of the Group. A critical review of the present programme is to be done once the results are available, expected in June. This will include examining those site/depth combinations where monitoring may be reduced as well as providing an interpretation of the data.

The provision of survey vessels by the Milford Port Health Authority (MPHA) and the Countryside Council for Wales (CCW) and assistance with manpower and analysis at cost by the National Rivers Authority (NRA) has enabled this programme to continue at minimal cost.

THIS PAGE IS INTENTIONALLY BLANK

SEABED SEDIMENT CHEMISTRY 1993

During 1993 grab-sampling of sediments was undertaken at 86 sites within the waterway together with the Skomer "control". The sites were chosen to provide an assessment of the variation in seabed sediment metals levels throughout the Haven.

Some 20 sites were unsuitable for sampling due to the nature of the sediment, tidal constraints, or the presence of rock making grab-sampling impossible. The analysis undertaken was for a suite of 14 metals at each site.

The Field Studies Council are also collating, presenting and interpreting these results on behalf of the Group. This report is expected during June. The results will be related to the soft seabed sediment biology identified from the programme described below.

As with the water quality monitoring, collaboration by Group members in the fieldwork and analysis resulted in minimal costs for this work which was successfully completed in 1993. As a second stage it may be possible to investigate any "hotspots" identified from this initial survey in a future programme of work.

SEABED SEDIMENT BIOLOGY 1993

The objective of this programme was to sample and describe the soft seabed sediment biology at locations throughout the Haven.

Forty sites for which the Group already had sediment metals results were selected. The work was put out to contract due to the highly specialised and time consuming nature of the biological analysis and identification to be undertaken. Such work is outside the resources of Group members alone.

Bids were invited from several organisations who were considered to have the required expertise for this work. The contract was awarded to the Field Studies Council (FSC) at Fort Popton as the lowest bid which complied with the Group's specifications.

A total of 36 sites were successfully sampled quantitatively for biological and sedimentological samples. Metals and hydrocarbon samples were also obtained at these points although analysis is not presently proposed. These samples have been preserved by freezing for future reference if required once the biological results are known.

Due to the large quantity of material to be processed the work involved in sorting and identification of the biological samples was greater than originally anticipated by FSC. However the report is still expected to be available by the end of June 1994, within the original timescale.

The reporting conditions of the contract include the requirement to address the variation in results found to the sediment chemistry data previously collected and other environmental factors.

THIS PAGE IS INTENTIONALLY BLANK

Daugleddau Estuary & Milford Haven Waterway

WINTER WILDFOWL & WADER COUNTS 1993/4

1. Introduction and Methods

The Daugleddau Estuary and Milford Haven Waterway hold Nationally Important numbers of Shelduck, Teal, Curlew and Redshank during the winter months. Monthly counts of wildfowl and waders on the Cleddau Estuary are carried out throughout the winter as part of the national Wetland Bird Survey (WeBS). The counts have now also been incorporated into the rolling programme of the research and survey initiated by the Milford Haven Waterway Environmental Monitoring Steering Group (MHWEMSG). The date of the counts are determined by WeBS to coincide with high spring tides. The estuary is divided into fifteen count sites and is counted by a team of observers. Counts normally take place within two hours either side of high tide when most species are assembled in high tide roosts. Sites are counted by a combination of walking the shore and counting from fixed points depending on the accessibility of each site. In recent years counts have taken place between November and February. In October 1993 it was decided to revert to counting throughout the winter so that it is now possible to present fuller data than was originally planned for 1993/4. All sites were covered for all counts from October to March.

2. Results

During the period November 1993 to February 1994 mean monthly totals of 4225 wildfowl and 6037 waders were present. The peak monthly count for wildfowl was 5137 in January, and for waders 6718 in February.

National Importance is determined by WeBS as representing 1% of the national totals for a species. On the Cleddau, Nationally Important numbers of Teal and Shelduck are present, with Wigeon falling only slightly short of the total required. The most numerous diving duck was Goldeneye. A total of eleven duck species was counted with one swan (Mute) and two goose species (Canada and Brent). Also included under the heading of wildfowl for count purposes are five other bird families: divers, grebes, cormorants and shags, herons and moorhens and coot. As well as regular species (Little Grebe, Cormorant and Grey Heron) some unusual ones also occurred – Red-throated and Great Northern Divers, and Slavonian Grebe. Little Egrets, once a rarity, are now a small but regular feature of the Cleddau.

Of the waders, Redshank (peak 872) and Curlew (peak 1321) achieved National Importance, while Dunlin (4160) almost did so. A total of 21 species of wader was recorded. These include Oystercatcher (424), Snipe (166) and Turnstone (127). Lapwing and Golden Plover are both primary species of agricultural land using the estuary for only a part of their daily cycle. Due to a mild winter, counts of these two species were rather low.

3. Discussion

The timing of the peak counts for the various species of both wildfowl and waders reflects a number of different patterns of use of the Cleddau by birds. Some species use it throughout the winter, eg. Mallard and Oystercatcher, while some build up to a peak in late winter as birds arrive from other parts of the United Kingdom, eg. Dunlin. Others use it principally or exclusively in autumn and/or spring, eg. Curlew, Sandpiper and Whimbrel.

The strategic importance of the estuary nationally from the birds' point of view is considerable. The division of the estuary into count sites enables the important of different areas for different species to be determined. Some species, eg. Curlew, are widely distributed, while others eg. Snipe, are much more particular in their requirements.

4. Future Monitoring

Monthly counts will continue throughout 1994/5. It is hoped to produce a report based on analysis of the accumulated Cleddau Estuary counts in the course of the next year.

**Annie Poole & Richard Ellis
Pembrokeshire Ornithological Research Committee
April 1994**

Daugleddau Estuary & Milford Haven Waterway

ANNUAL SHELDUCK CENSUS - 1993

1. Introduction and Methods

The Daugleddau Estuary and Milford Haven Waterway hold nationally important numbers of shelducks during the winter months, and a small summer population. The numbers of breeding shelducks have been assessed at various times during the 1960s and 1970s, and full surveys were carried out in 1991 and 1992. In 1993, the summer survey was repeated, using the National Park Water Ranger's boat. This annual survey has been incorporated into a rolling programme of research and survey initiated by the Milford Haven Waterway Environmental Monitoring Steering Group (MHWEMSG). In addition to numbers and distribution of shelducks in the estuary system, information on the species and numbers of other wildfowl and waders was collected. The survey was carried out in two phases, in June and early August. All major pills, tributaries and embayments were surveyed from the boat on high spring tides.

2. Results

Shelducks: In June 1993, 8 pairs of shelducks with broods of ducklings were located, on the Eastern and Western Cleddau, Carew, Cresswell and Pembroke Rivers, and in Angle Bay. There were 139 adults, 99 of which were assumed to be non-breeding birds, and 67 ducklings. In early August, there were 8 adults attending 5 broods, and a crèche (a group of two or more broods "shepherded" by two adult females) present. All the other adults had departed for the moulting grounds. There was a net loss of 14 ducklings between phase I in June and phase II in August, and only one new brood came onto the water between June and August (in Cosheston Pill).

Other estuary birds: During the first phase of the survey, a total of 704 estuary birds were present - with 8 species represented. The most numerous birds were curlews, Canada geese (the resident group at Little Milford) and mallards, with smaller numbers of oystercatchers and redshanks. By early August, numbers had increased to 3480, 2177 of which were curlews (nationally important numbers). Many of the curlews were probably migrating south for the winter. Other passage migrants included whimbrels. The majority of these birds were found at high tide roosts (fringing saltmarsh and shingle ridges) on the Western Cleddau, Carew, Cresswell and Pembroke Rivers, and in Angle Bay.

3. Discussion of Results

Generally, the 1993 results for breeding shelducks were poorer than in 1992, with fewer and smaller broods. Several factors may account for these results, such as cold, wet weather in May (a critical period for nesting shelducks), predation by ground predators such as foxes and mink, and disturbance. Detailed examination of the results strongly suggests predation as a major factor, possibly exacerbated by disturbance and by bad weather. The results highlight the need for annual monitoring of breeding shelducks in the estuary system, and suggest that there is little room for complacency.

4. Future monitoring

The survey will be repeated in 1994 as part of the annual monitoring programme for the estuary system which is administered by the MHWEMSG.

A detailed account of the 1993 survey is contained in an unpublished report to the MHWEMSG and the Dyfed Wildlife Trust's Ornithological Research Committee.

**Jane Hodges
Pembrokeshire Coast National Park
August 1993**

BAIT DIGGING

During August 1993, Miss Teleri Palmer, a student at Bangor University College, undertook research work into bait digging and its effects in the estuary. This work was carried out in conjunction with the Milford Port Health Authority and the Field Studies Council Research Centre at Fort Popton, Angle. In her summary, Miss Palmer findings are reported thus:-

Overview

"...General observation of the Gann Flat, Dale was conducted throughout the month of August at low tide for approximately two hours. During that time the number of bait diggers and their position on the beach was recorded.

As a result three parallel transects DA, DB & DC were set up on three separate occasions. These transects ran from the houses at Dale Fort, at a bearing of 140°, each 50 paces apart.

A count of the number of NEREIS (ragworm) and ARENICOLA (lugworm) dug up within a 0.25m² quadrant was recorded and a sand sample collected at each station (at intervals of 40 paces) along each transect beginning at the low water mark (LWM) and proceeding to the high water mark (HWM).

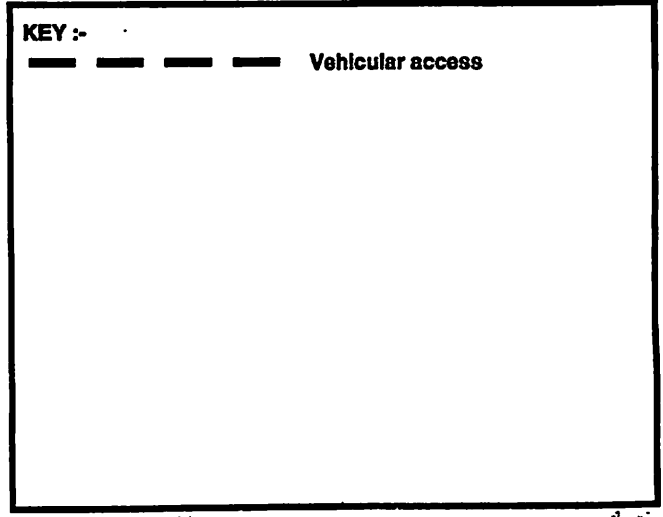
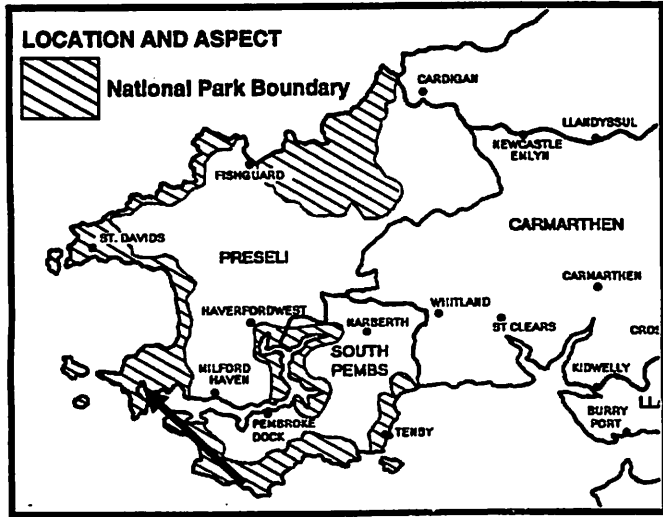
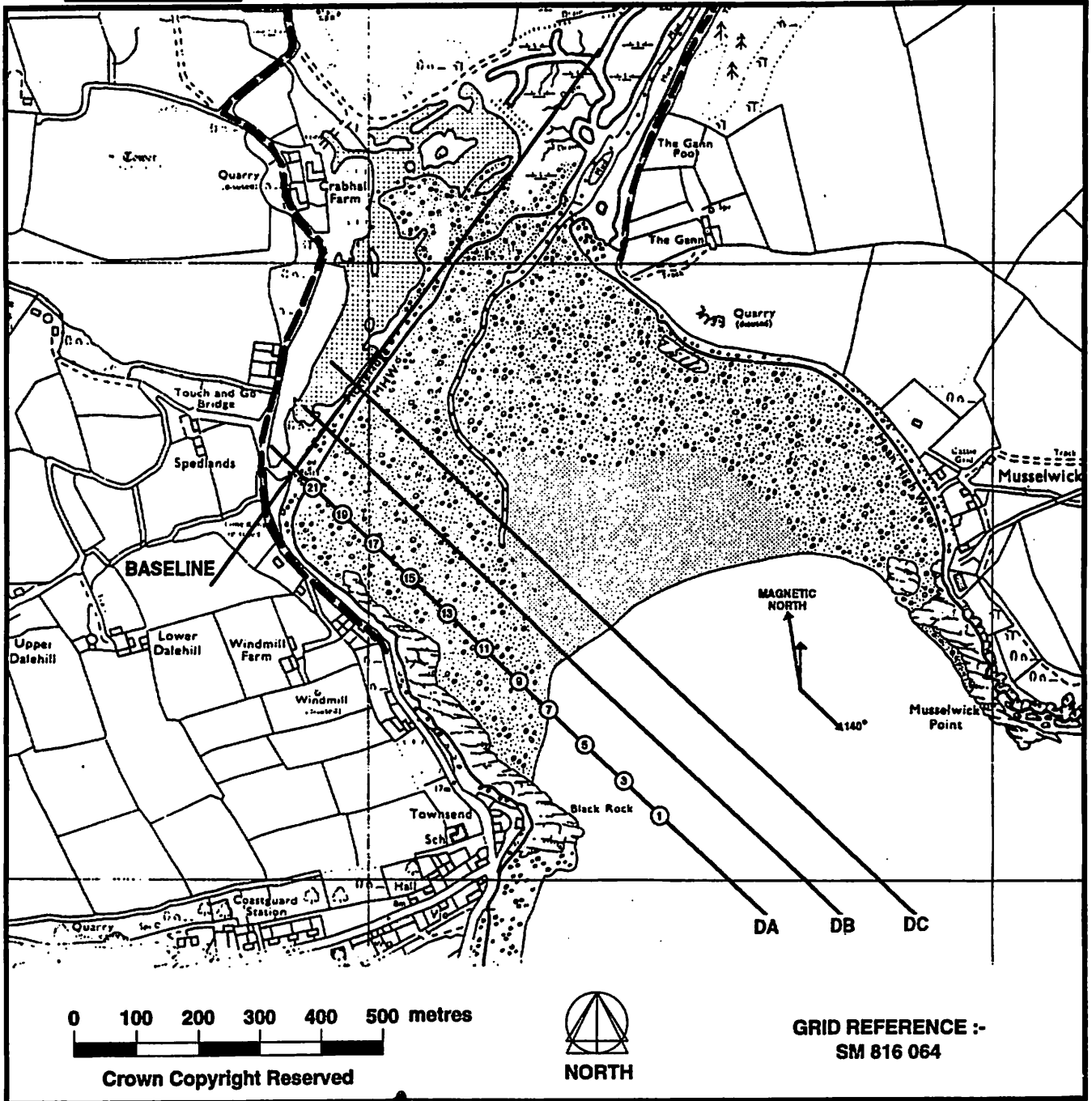
The number of bait diggers during this period varied greatly. Although the minimum number was one this contrasted with as many as fifteen, which was the highest number recorded during any one period. No commercial diggers were seen during the period of observation. No observations were made at weekends.

The bait diggers interviewed were mainly from the locality ie. Dale, Marloes, Milford Haven, Neyland and Haverfordwest - with the occasional tourist from further afield. On average the bait diggers frequent the beach approximately twice a week, however the number taken by individual bait diggers differed widely. This ranged from as little as 20-30 worms once or twice a week to as many as 150 three times weekly. The majority of bait diggers, 83.3%, were searching for Nereis and only a small percentage expressed interest in Arenicola. It was suggested that Sandyhaven and Gelliswick were more suitable for digging for lugworm.

Approximately 66% of the local bait diggers were concerned by the level of digging on the beach. A large majority objected to commercial bait diggers. Equally, concern was expressed about the number of worms being taken was in excess of fishing needs. The majority of those interviewed were prepared to accept some form of restriction on the amount of digging permitted on the beach. Permits with patrolling and/or zonation controls of the beach was suggested. There was some disagreement concerning the number of worms on the Gann, most of those questioned reported a noticeable decline in the number of worms over recent years. However, one said there were "*plenty of worms*", another suggested there had been an increase in the number of ragworms since last year and yet another commented on the decline in the condition of the beach.

The diggers showed no preference for a particular area of the beach and showed a wide distribution over the whole of the area (see map). Some expressed a preference for the low tide area. However, it was agreed that Nereis was most likely to be found in regions of black mud".

Gann Flat, Dale



Abiotic Results

The sand samples were processed in accordance with the recommendations of the Field Studies Council (FSC) Research Centre to match previous work carried out in 1986.

"... Analysis of surface sand samples taken from every other station along each transect revealed a varied and patchy substrata of mixed sediments (fine sand, mud and gravel) The content of each sample varying greatly from one station to the next... Calculation of the average phi mean (average particle size) and the average percentage mud for the 30 stations sampled in August 1993 revealed the following results:-

average phi mean = 0.068
 % mud = 14.114

The same calculations were made for data collected from 44 stations chosen at random by FSC Research Centre, Fort Popton, Angle in August 1986.

average phi mean = 1.521
 % mud = 7.773

These results show that during the past seven years the average phi mean was approximately halved whereas the % mud has more or less doubled.

STATION	DA		DB		DC	
	17.8.93		19.8.93		23.8.93	
	NEREIS	ARENICOLA	NEREIS	ARENICOLA	NEREIS	ARENICOLA
1	1	1				
2	3	3				
3	2	3	2	7		
4	2	5	3	4		
5	1	3	0	1		
6	0	4	0	3	0	5
7	2	5	0	1	1	5
8	6	4	2	5	2	4
9	0	3	2	7	0	0
10	2	3	0	6	1	0
11	1	3	2	2	1	0
12	2	0	2	1	2	0
13	1	0	0	2	2	0
14	5	2	0	3	1	0
15	0	5	3	0	0	0
16	3	3	0	0	2	0
17	1	0	0	0	1	0
18	0	2	0	0	1	0
19	1	1	2	0	1	0
20	1	0	7	0	1	0
21	1	0	15	0	3	0
22	0	2	1	1	1	0

Biotic Results

The total number of *Nereis* and *Arenicola* recorded along each transect was not dissimilar. However their relative distributions were quite different.

Nereis showed relatively even distribution along with all three transects; the highest density recorded at stations DB18 & DB19, seven and fifteen ragworms respectively. Stations DB18 & DB19 also incidentally showed the highest percentage mud for transect DB, 14.366% & 22.639%.

Arenicola was noticeably absent from 26 of the 59 stations sampled. The highest densities of *Arenicola* were recorded nearest to the LWM ie. DB1 = 7 & DB1 = 5 lugworms. This trend can be seen in transects DB and DC where *Arenicola* was absent from stations DB13-19 and DC4-10.

The strong link between *Arenicola* and tidal level is supported by the findings of Bassindale and Clarke 1960.

"Lugworms are distributed over almost the whole beach and in the Gann estuary, but the greatest numbers occur around the periphery of the Flat at about Low Water Neap Tide (LWNT)."

At the present time however, distribution of *Arenicola* appears to be considerably less widespread. The report, "The Gann Flat, Dale: Thirty Years On", carried out in August 1988 similarly supports this observation.

"The most striking changes have been a decline of... *Arenicola marina*, and a dramatic increase in the abundance of *Neanthes (Nereis) virens*".

We can conclude from the wide distribution of *Nereis* that it is readily adaptable to a variety of conditions including physically disturbed environments such as that at Dale. It is difficult to ascertain whether the intensity of digging in recent years has changed the nature of the sediment which in turn made it more susceptible for colonisation by *Nereis*, or whether the change in the sediment enabled it to outbid the competitor *Arenicola* whose numbers have drastically declined and which is rarely found in areas with a high percentage mud. Our results show that the average percentage mud has doubled from 7.7% in 1986 to 14.1% in 1993. The earlier report, "The Gann Flat, Dale: Thirty Years On" suggest that the digging of deep holes for bait such as *Nereis* results in an increase in the gravel content of the surface sediment as the finer particles form the spoil are winnowed away by the incoming tide, resulting in "pockets of fine sediment surrounded by gravel". This certainly appears to be the case and might explain the patchy substrata showing wide variation in the average particle size and percentage mud along the transects.

SHELLFISH SAMPLING

The Food Safety (Live Bivalve Molluscs) Regulations (enacting European Council Directives) required that all waters, from which bivalve molluscs are taken for human consumption, have to be classified by the Ministry of Agriculture, Fisheries and Food (MAFF) following sampling carried out by the Port Health or Local Authority.

The samples of live shellfish are submitted to the Public Health Laboratory Service (locally in Carmarthen) for bacteriological examination. The classification is as follows:-

CLASSIFICATION OF HARVESTING AREAS

category A	< 230 E.coli/100g flesh } < 300 faecal coliforms }	} may go for direct } human consumption
category B	< 4,600 E.coli } < 6,000 faecal coliforms } (in 90% of samples)	} must be depurated, heat treated } or relaid to meet category A
category C	< 60,000 faecal coliforms } }	} must be relaid for a long period } (2 month) to category A or B } (may also be heat treated by approved method)
category D	above 60,000 or at the } discretion of Member State	} prohibited

SAMPLING DURING 1993

	1993	1992 for comparison
number of sampling dates	24	60
number of sampling points	50	53
number of samples taken	217	502
results - Grade A	30	114
Grade B	147	312
Grade C	44	76

Accordingly, the latest classification of Milford Haven, Cleddau and Carew rivers is as follows:-

PRODUCTION AREA - Milford Haven			
BED NAME	SPECIES	CLASS	COMMENT
Beggars Reach & above Black Mixon, Mount Pleasant, Warrior Berth & Sandy Haven Pill	Mussels	C	
Four Ashes, Benton Castle, Herbrandston Jetty, Musselwick & Castle Beach Bay	Mussels	B	
Ferny Pits	Mussels O. edulis	C	
Carew River (areas 1 & 2)	C. gigas	C	* Provisional Classification
Carew River (area 3)	C. gigas	B	
All beds (except Angle Bay & Dale Flats)	Cockles	C	
All beds (except Ferny Pits)	O. edulis C. gigas	B	
Angle Bay & Dale Flats	Mussels Cockles	B	

* Insufficient sample results to fully assess impact of changes in water quality, eg new sewerage and sewage treatment schemes, tourism factors etc.