

NRA WESSEX REGION

EEC SHELLFISH DIRECTIVE

**Analysis of Bacteriological contamination and accumulation of
metals and organics in the mussel (*Mytilus edulis*)**



Biology Unit
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NRA WESSEX REGION
EEC SHELLFISH DIRECTIVE

ANALYSIS FOR BACTERIOLOGICAL CONTAMINATION AND
ACCUMULATION OF METALS AND ORGANICS IN THE MUSSEL
(*Mytilus edulis*)

There are two designated Shellfish Waters in the Wessex NRA Region at Poole Harbour and Portland Harbour. Samples have been collected since 1983 from the commercial shellfish beds in Poole Harbour, and wild mussels from a permanent floating structure in Portland Harbour. Within the last two years a significant commercial oyster fishery has been developed in the Fleet, and samples are now being taken from this site. Intravalvular tissue samples are routinely analysed for faecal coliforms as required by the Directive, and bioaccumulated metals and organohalogenated substances were recently analysed by the NRA according to the recommended list of determinands in the NRA Uniform Scheme for Monitoring Shellfish Waters (Table 1).

During 1989 an experiment was carried out in order to investigate differences in faecal coliform and bioaccumulation of metals and organics at various sites within the harbour and these results are included in this report.

The results and histograms refer only to data where concentrations of substances are above the limit of detection at any particular site or date of sampling, therefore only significant levels of substances are reported.

Metals and Organics/PCB,s

Poole Harbour

Mercury & Arsenic (Fig 1)

Levels of mercury are generally low being well below the JMP Guideline levels of 0.1 - 0.3 mg/kg. Arsenic was only above the limit of detection on one sampling occasion in 1989.

Zinc (Fig 2)

Tissue levels of zinc are low compared with 'expected' values for molluscs which can be in the range in excess of 100mg/kg.



Dieldrin & Pentachlorophenol (Fig 3)

Concentrations only exceeded the limit of detection on three occasions with slightly elevated levels of dieldrin present in autumn 1990, however the levels of both substances are very low when compared with the expected values of 0.1 - 0.3mg/kg.

Poole Harbour 'Caged Mussels Experiment'

Mature mussels were obtained from the commercial beds in South Deep and 30 individuals were placed into 'shellfish bags' and suspended from buoys at 11 sites in the harbour. After approximately 6 months the cages were removed and samples were taken for faecal coliform and metals/organics bioaccumulation.

Mercury (Fig 4)

Levels were generally consistently low except for slightly elevated concentrations at the Wareham Channel site, which however is still below JMP Guideline levels.

Zinc (Fig 5)

All sites appear show consistently low levels of zinc.

Gamma HCH & Dieldrin (Fig 6)

All sites were below the codex alimentarius of 2 mg/kg and 0.2mg/kg respectively; there was no evidence of substantial contamination at any site.

Pentachlorophenol (Fig 7)

Only two sites had levels slightly above the limit of detection.

Portland Harbour

Mercury & Arsenic (Fig 8)

Levels of these two chemicals in mussel tissue were of a similar order of magnitude to those of Poole Harbour.

Copper & Zinc (Fig 9)

Copper levels are low compared with the Food Standards Committee recommended maximum level of 20mg/kg. Zinc levels are also low when compared with expected values for shellfish.

Organics & PCB's (Fig 10)

Overall, levels of organics were low, however, levels of PCB's exceeded the JMP lower and medium level guidelines.

Faecal Coliforms

Fig 11 tabulates the results for samples taken since 1987 for both Poole and Portland Harbours. The EEC Shellfish Directive limit is 300 Faecal Coliforms per 100ml, and out of the 13 sampling occasions this level was exceeded in Poole Harbour 4 times; and out of 10 sampling occasions in Portland harbour, this level was exceeded once.

The 'Cage Mussel Experiment' in 1989 indicated relatively higher levels of total Coliforms at the Poole Bridge site resulting from the influence of discharges from Holes Bay (Fig 12).

Conclusions

Levels of metals, organics and PCB's are generally low in mussels taken from Poole and Portland Harbour, the only exception being elevated levels of PCB's in Portland Harbour since sampling began in 1985.

Faecal Coliform levels do exceed the EEC Limit (300/100ml) on occasions in Poole Harbour; Portland only failing once.

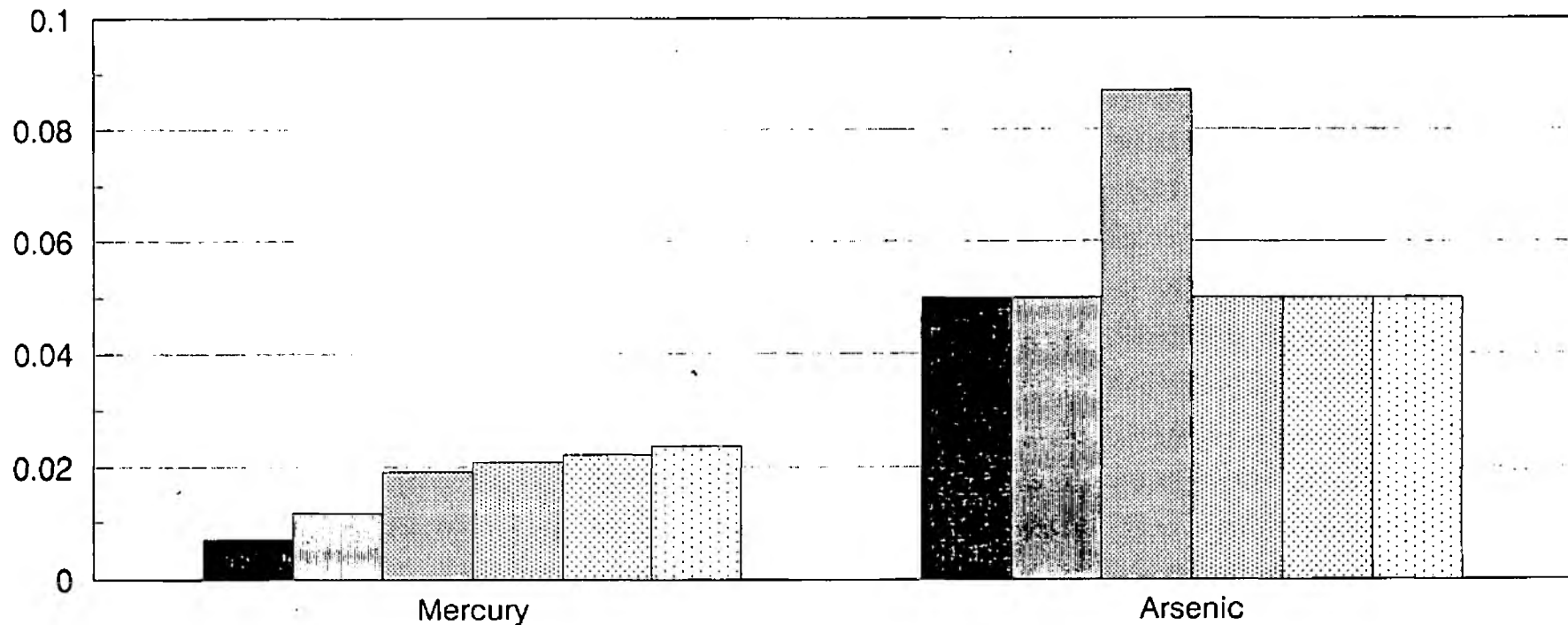
Table 1

List of determinands for Shellfish tissues from designated EEC
Shellfish Waters

Cadmium	HCH - Alpha
Mercury	HCH - Beta
Arsenic	HCH - Gamma
Silver	HCH - Delta
Chromium	HCH - Epsilon
Copper	pp - DDE
Nickel	pp - TDE
Zinc	pp - DDT
Lead	op - DDE
	op - TDE
	Aldrin
	Dieldrin
	Endrin
	Heptachlor
	Heptachlor epoxide
	Endosulphan - A & B
	Hexachlorobenzene
	Hexachlorobutadiene
	Chlordane
	Trichloromethane
	Pentachlorophenol
	Carbon Tetrachloride
	PCB as Arochlor 1254
	Isodrin

Bioaccumulation in Shellfish - EEC Directive Poole Harbour METALS: MERCURY & ARSENIC

Concentration (mg/kg wet wt)



1983 1985 1989 (Spring) 1989 (Autumn) 1990 (Spring) 1990 (Autumn)

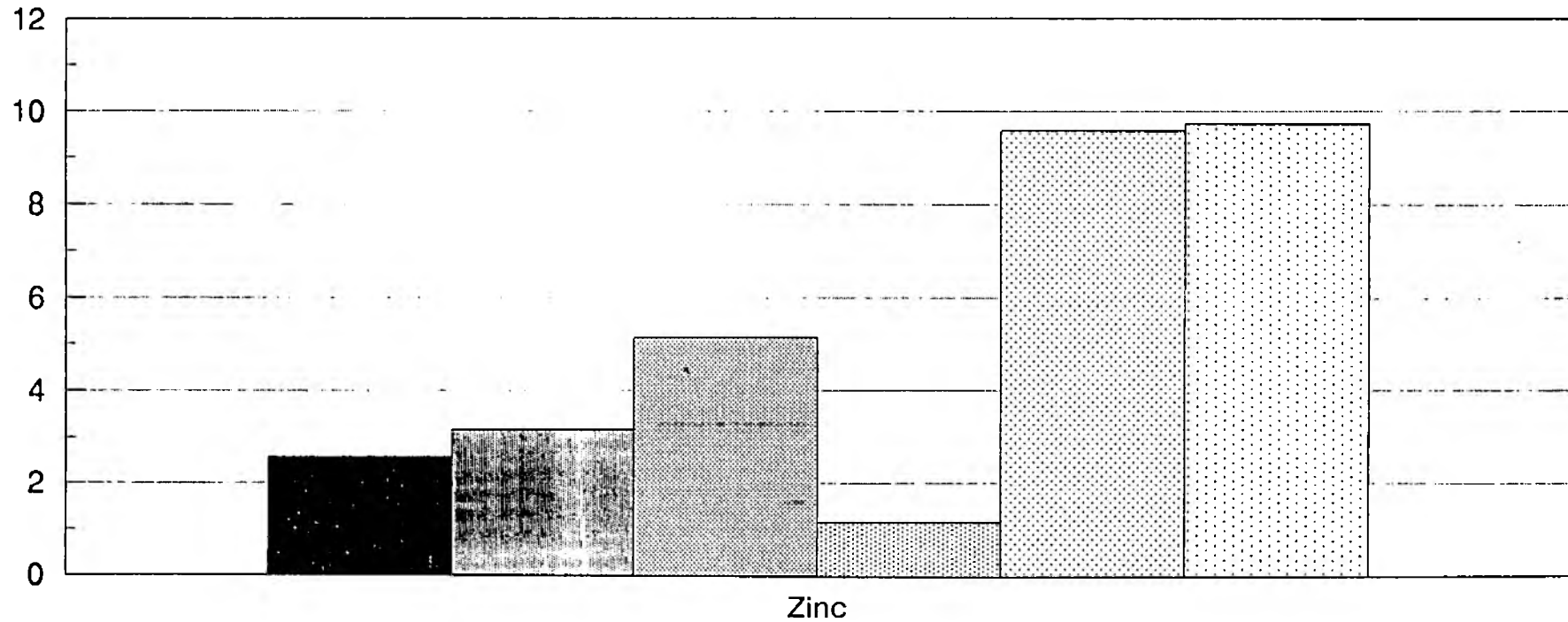
Limit of detection for Arsenic=0.05 mg/kg

Fig 1



Bioaccumulation in Shellfish - EEC Directive
Poole Harbour
METALS : ZINC

Concentration (mg/kg wet wt)



1983 1985 1989 (Spring) 1989 (Autumn) 1990 (Spring) 1990 (Autumn)

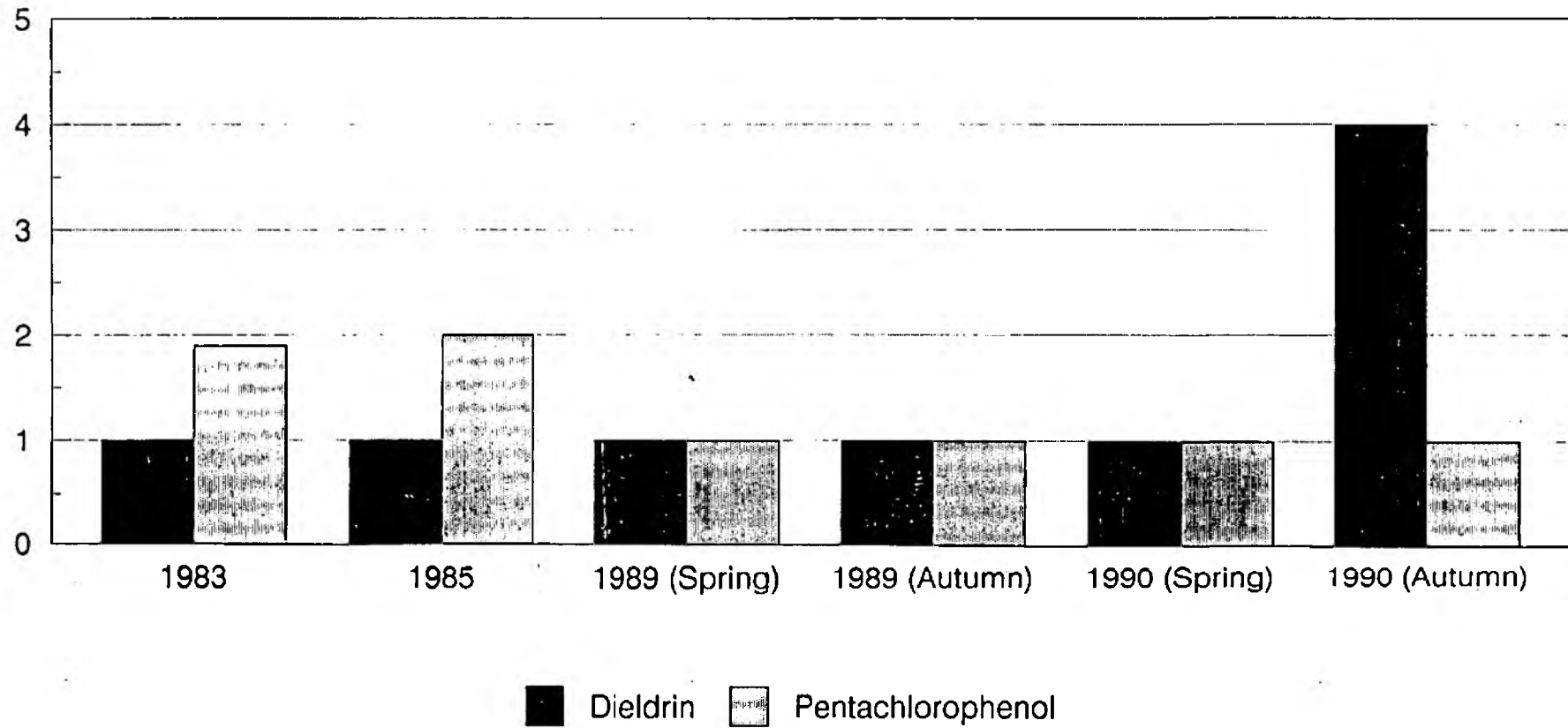
Fig 2

Bioaccumulation in Shellfish - EEC Directive

Poole Harbour - Mussels

ORGANICS

Concentration (micrograms/kg wet wt)

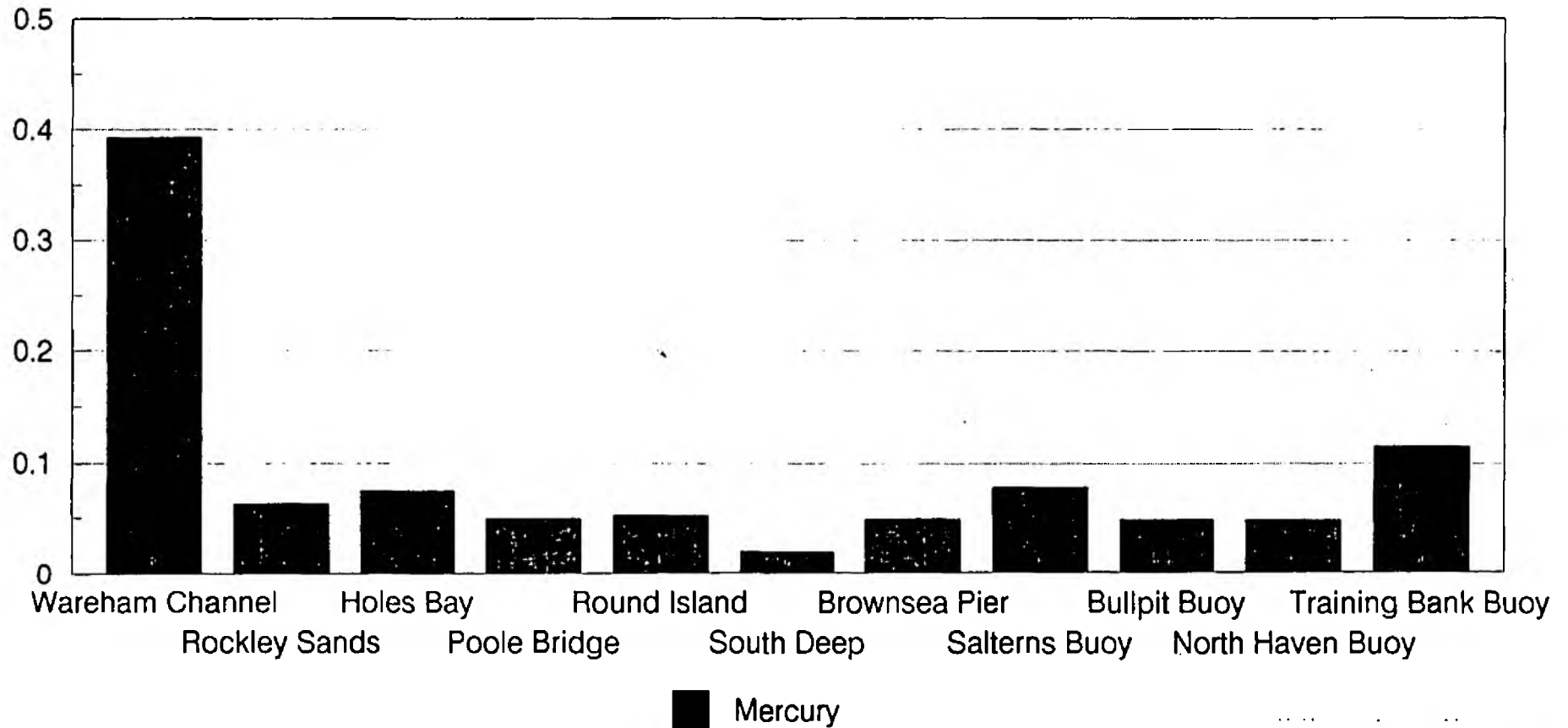


Limit of detection = 1 microgram/kg

Fig 3

Bioaccumulation in Shellfish
Poole Harbour - Caged Mussel Experiment 1989
METALS : MERCURY

Concentration (mg/kg wet wt)



Limit of detection=0.05mg/kg

Bioaccumulation in Shellfish
Poole Harbour - Caged Mussel Experiment 1989
METALS : ZINC

Concentration (mg/kg wet wt)

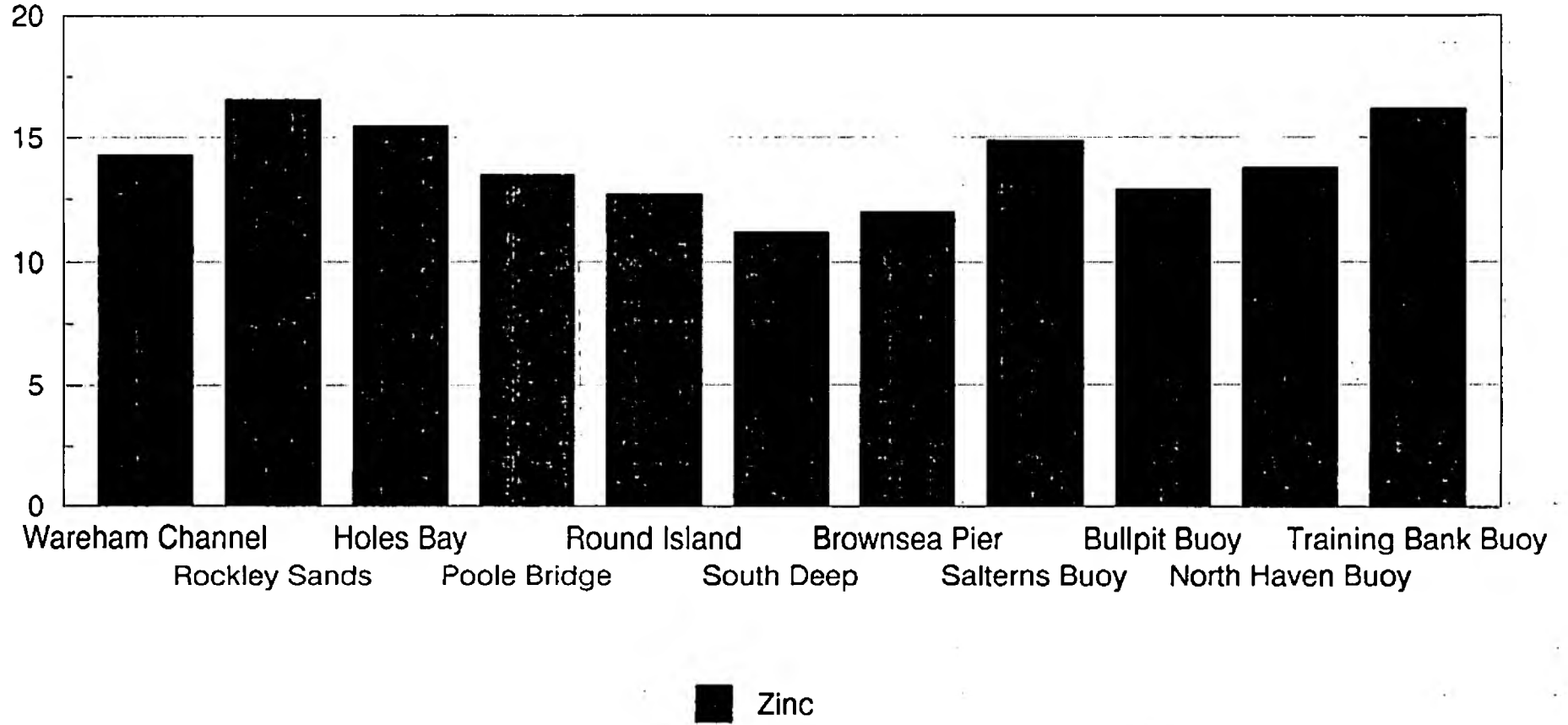
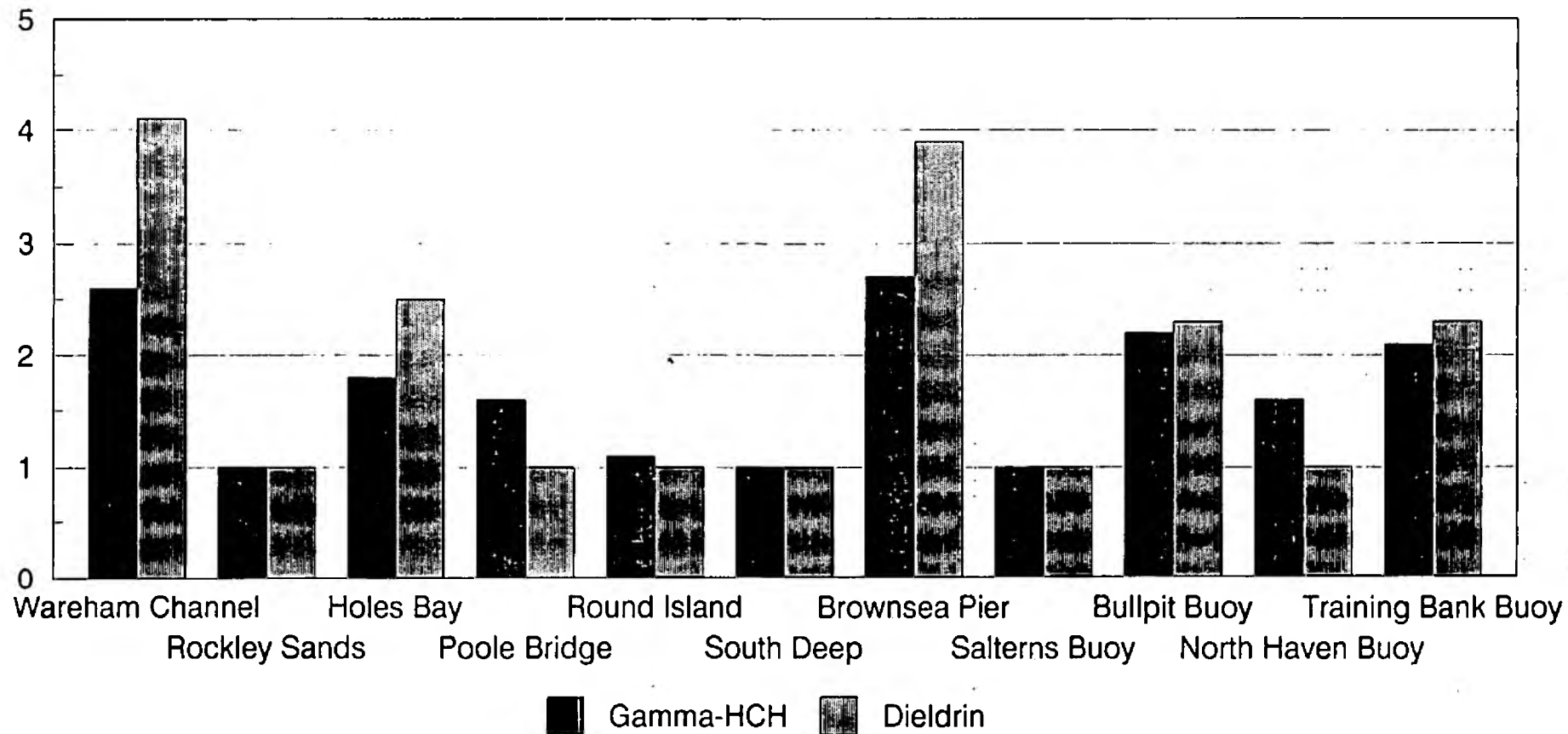


Fig 5

Bioaccumulation in Shellfish Poole Harbour - Caged Mussel Experiment 1989 GAMMA-HCH & DIELDRIN

Concentration (micrograms/kg wet wt)

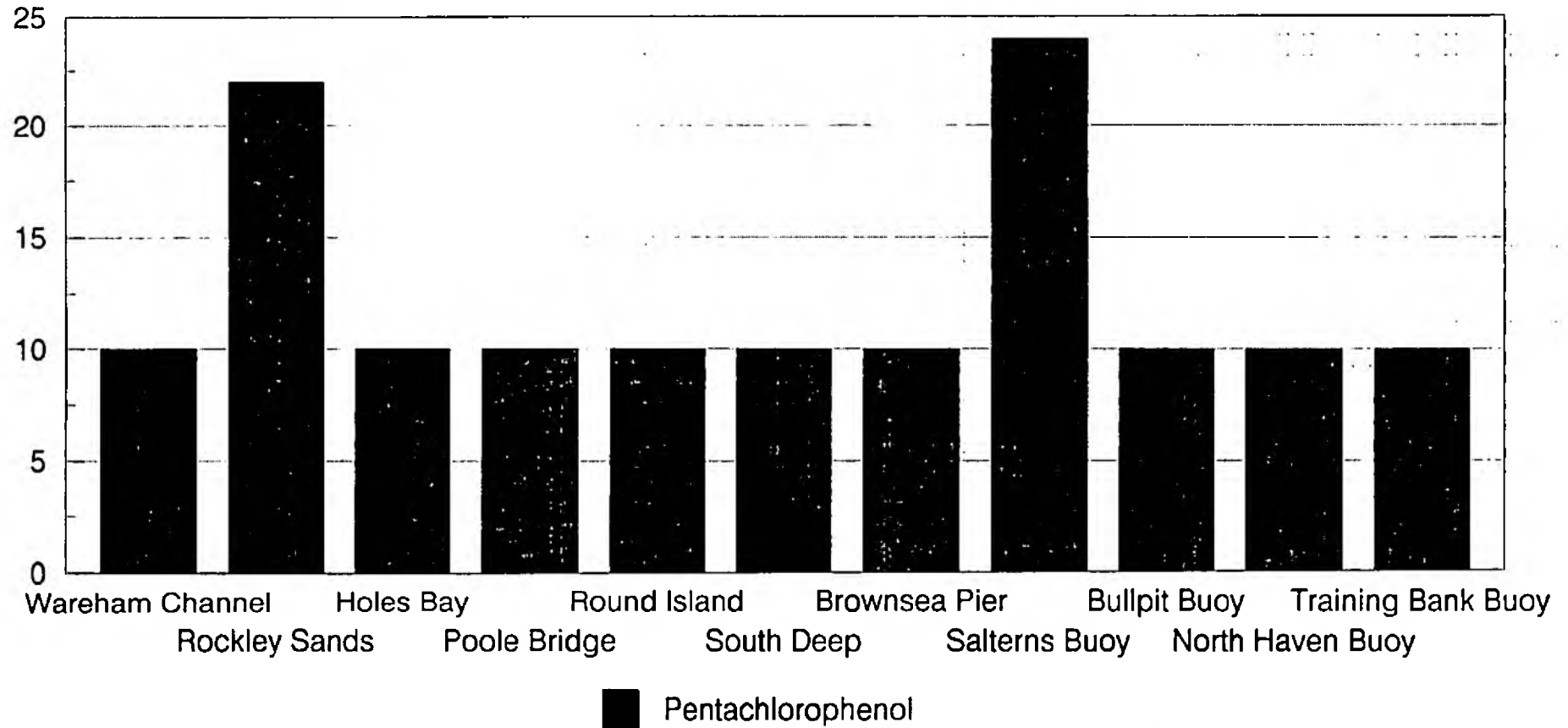


Limit of detection = 1 microgram/kg

Fig 6

**Bioaccumulation in Shellfish
Poole Harbour - Caged Mussel Experiment 1989
PENTACHLOROPHENOL**

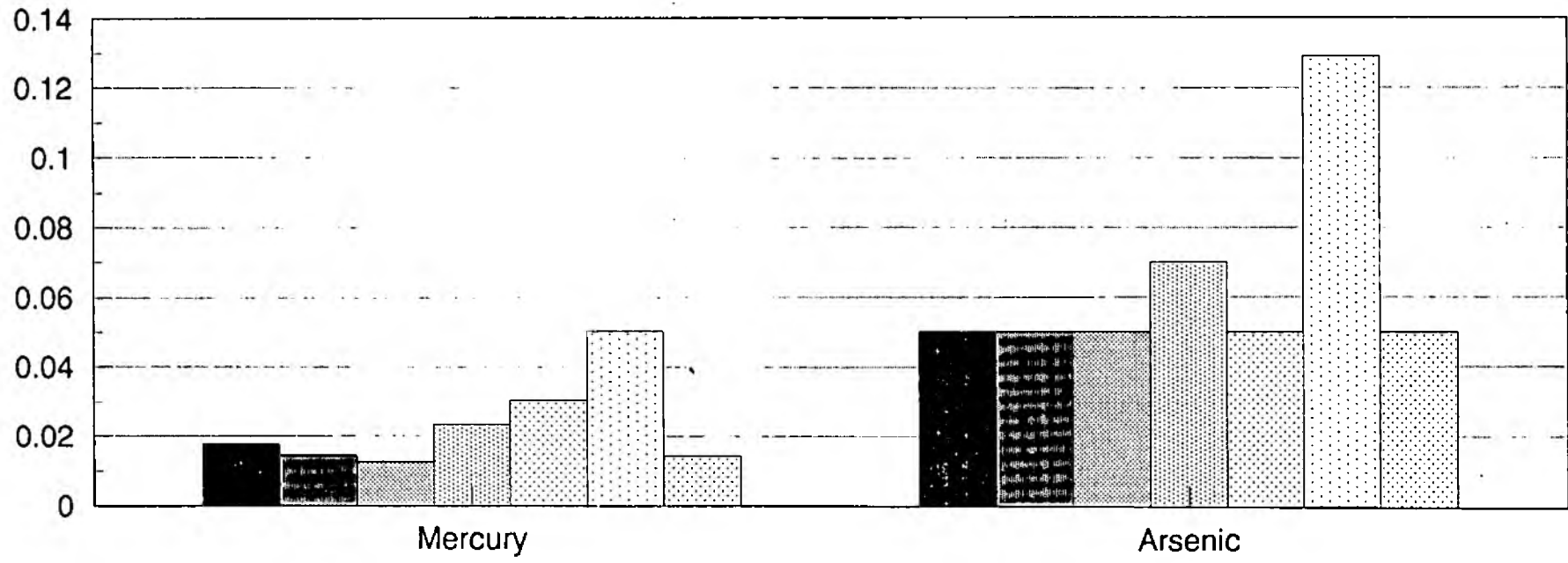
Concentration (micrograms/kg wet wt)



Limit of detection = 10 microgram/kg

Bioaccumulation in Shellfish - EEC Directive Portland Harbour - Mussels METALS: MERCURY & ARSENIC

Concentration (mg/kg wet wt)

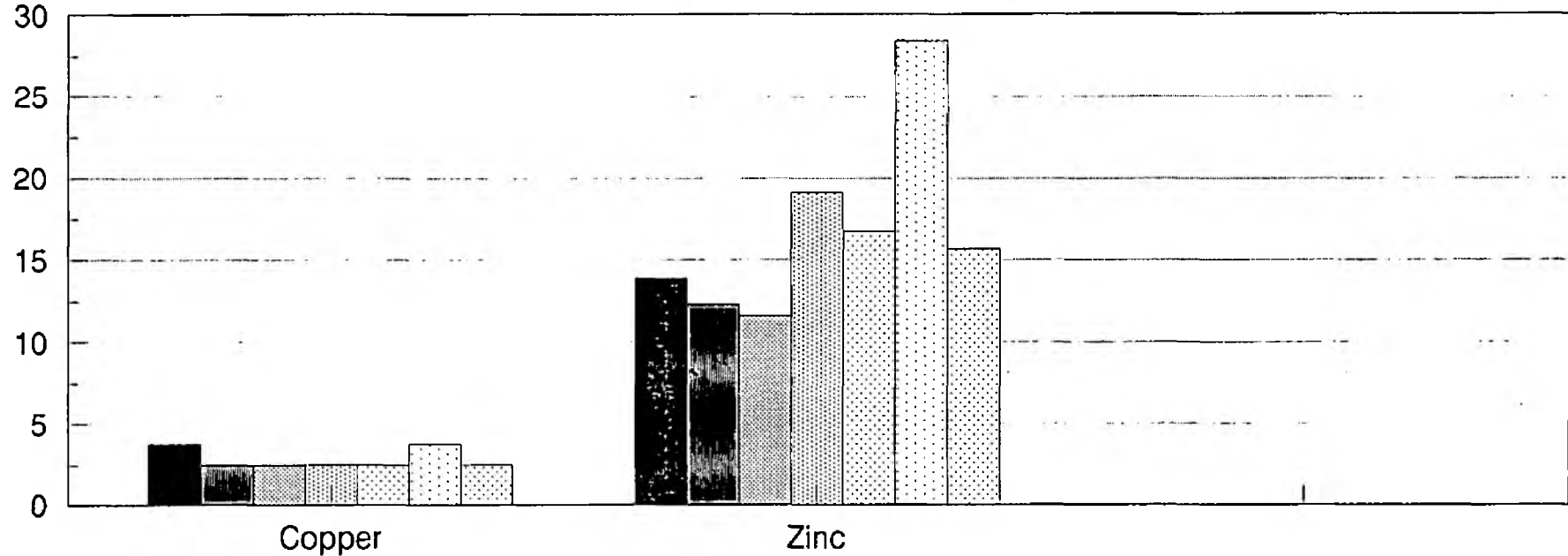


- 1985
- 1988 (Spring)
- 1988 (Autumn)
- 1989 (Spring)
- 1989 (Autumn)
- 1990 (Spring)
- 1990 (Autumn)

Limit of detection for Arsenic=0.05 mg/kg

**Bioaccumulation in Shellfish - EEC Directive
 Portland Harbour - Mussels
 METALS: COPPER & ZINC**

Concentration (mg/kg wet wt)



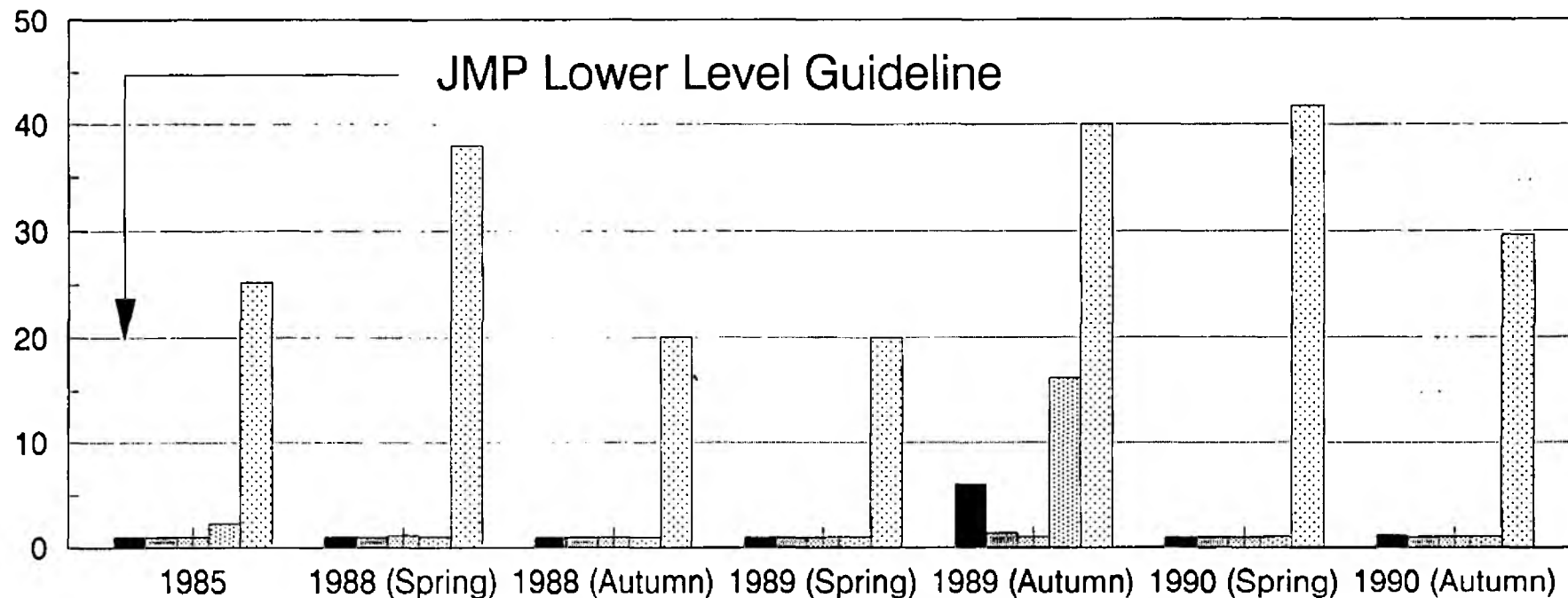
1985
 1988 (Spring)
 1988 (Autumn)
 1989 (Spring)

1989 (Autumn)
 1990 (Spring)
 1990 (Autumn)

Limit of detection for copper=2.5 mg/kg

Bioaccumulation in Shellfish - EEC Directive Portland Harbour - Mussels ORGANICS

Concentration (micrograms/kg wet wt)



Gamma HCH
 OP TDE
 Dieldrin
 Pentachlorophenol
 PCB Arochlor

Limit of detection for PCB=20 micrograms/kg
 All other compounds=1 microgram/kg

Fig 11

NRA WESSEX REGION - EEC SHELLFISH DIRECTIVE
INTRAVALVULAR FLUID/TISSUE BACTERIOLOGICAL ANALYSIS

(Coliforms per 100 ml.)

N.B. EEC Limit - 300 Faecal Coliforms per 100 ml.

PORTLAND HARBOUR - (NGR SY 680750)

Mussels

<u>DATE</u>	<u>FAECAL COLIFORMS</u>	<u>TOTAL COLIFORMS</u>
10-2-88	87	-
13-6-88	12	-
31-1-89	10-100	10-3,200
15-9-89	1800	3800
5-10-89	20	20
13-3-90	50	50
14-8-90	10	10
05-2-91	35	700
02-7-91	10	10
19-11-91	50	50

POOLE HARBOUR - (NGR SZ 030873)

Mussels

28-10-87	350	-
09-12-87	143	-
03-6-88	95	-
27-1-89	<10-10300	200-19400
27-2-89	200-400	500-1400
22-5-89	<10-100*	20-700*
05-10-89	140	300
20-2-90	2900	3200
20-3-90	50	50
09-8-90	<100	<100
04-2-91	40	5600
06-6-91	140	220
28-10-91	30	30

*Special Survey of caged mussels at 10 sites in Harbour.

POOLE HARBOUR MUSSEL CAGE EXPERIMENT 22:5:89

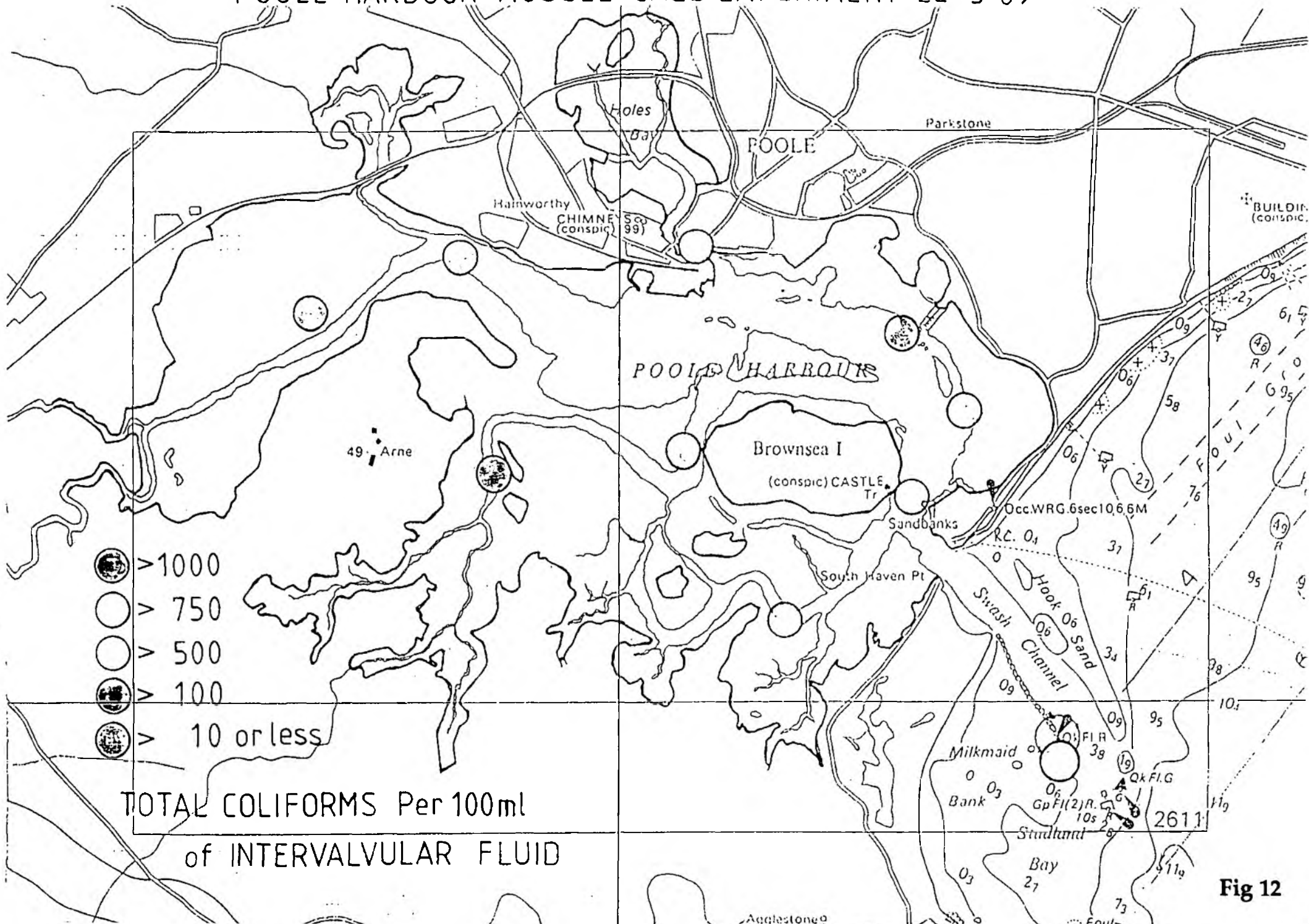


Fig 12